Journal of Sustainable Finance & Investment

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/tsfi20

Sustainable performance during the COVID-19 pandemic: a comparative analysis of Islamic and conventional banks

Miroslav Mateev, Kiran Nair & Golam Mostafa Khan

To cite this article: Miroslav Mateev, Kiran Nair & Golam Mostafa Khan (26 Mar 2024): Sustainable performance during the COVID-19 pandemic: a comparative analysis of Islamic and conventional banks, Journal of Sustainable Finance & Investment, DOI: 10.1080/20430795.2024.2334252

To link to this article: https://doi.org/10.1080/20430795.2024.2334252

JOURNAL OF SUSTAINABLE FINANCE & INVESTMENT
https://doi.org/10.1080/20430795.2024.2334252

Sustainable performance during the COVID-19 pandemic: a comparative analysis of Islamic and conventional banks

Miroslav Mateev[a], Kiran Nair[b] and Golam Mostafa Khan[a]

[a]Professor of Finance and Director of Research, Abu Dhabi School of Management, Abu Dhabi, UAE; [b]College of Business, Abu Dhabi University, Abu Dhabi, UAE

ABSTRACT

This study examines the role of market competition and efficiency in explaining banks' stability during the COVID-19 pandemic. Using a sample of 575 banks in 20 countries in the Middle East and North Africa (MENA) region for the period 2006-2021, we investigate the individual and joint effects of competition and efficiency on bank profitability and risk during the COVID-19 pandemic. The results indicate that both market power and efficiency are strong determinants of bank performance and stability in the MENA region, and these effects are similar across different types of banking systems (conventional and Islamic) in the pre-COVID-19 period. The analysis of bank performance during the pandemic period (2020-2021) shows that efficient banks exhibit better profitability and cost-effectiveness if they operate in a more competitive environment and are Islamic. Regarding the interaction effect, our results indicate that market competition seems to reinforce the positive effect of efficiency on Islamic banks 'stability during the recent financial crisis.

ARTICLE HISTORY
Received 23 May 2023
Accepted 17 March 2024

KEYWORDS
Competition; efficiency; profitability; COVID-19 pandemic; stability

1. Introduction

The coronavirus disease (COVID-19) pandemic has negatively affected the global economy. Governments have also imposed social distancing and lockdowns. These measures have affected the operations of banking systems themselves directly, but also their performance indirectly by affecting households' income and businesses' revenue' (Le et al. 2022, 1). The effect of COVID-19 on financial systems across countries has been widely documented in numerous studies (Ashraf 2020; Alfaro et al. 2020; Al-Awadhi et al. 2020; Hasan et al. 2021; Demirgüç-Kunt, Pedraza, and Ruiz-Ortega 2021; Borri and Di Giorgio 2021; Abdulla and Ebrahim 2022; Ashraf, Tabash, and Hassan 2022; Viphindrartin, Wilantari, and Bawono 2022; Mateev, Tariq, and Sahyouni 2023; EL-Chaarani et al. 2023). The consequences of the crisis on Islamic and conventional banking systems have also been examined. Specifically, the question of whether Islamic banks (IBs) perform better than conventional banks (CBs) during the COVID-19 outbreak has attracted the attention of many researchers (Grassa et al. 2022; Fakhri and Darmawan 2021; El-Chaarani et al. 2022). However, very few studies have examined

CONTACT Miroslav Mateev m.mateev@adsm.ac.ae Professor of Finance and Director of Research, Abu Dhabi School of Management, Abu Dhabi, UAE

the financial stability of Islamic banking during the COVID-19 pandemic and the main drivers of the performance disparities between these two groups of banks (see e.g. Mirzaei, Saad, and Emrouznejad 2024; El-Chaarani et al. 2022). Therefore, we structured this study to identify the factors that need further investigation to address the main research question: Are Islamic banking institutions more resilient to COVID-19 than their conventional peers? Specifically, what factors may explain the performance disparities between IBs and CBs during the pandemic crisis?

COVID-19 has had a significant impact on the economies of Middle East and North Africa (MENA) region, leading to a substantial fall in oil production, hospitality, and tourism, and a significant decline in Gross Domestic Product (GDP) per capita income. Disruptions in the global supply chain have affected domestic production, demand, and supply. According to a recent study 'the oil exporting economies will be the biggest hit due to fall in crude oil prices, creating a fiscal ripple effect by reducing the private consumption expenditure and reduction in energy investments' (Hassan, Rabbani, and Abdulla 2021, 53). Islamic finance and banking are a significant part of the development agendas of countries in the MENA region. Islamic finance has several financial services, *Qardh-Al-Hasan, Zakat, Waqf* and *Social Sukuk,* which are tailored for crises and pandemic-like situations (Syed et al. 2020). Therefore, -one may expect that the negative impact of the COVID-19 pandemic on IBs is less pronounced than in their conventional counterparts due to their unique financial structures (Mirzaei, Saad, and Emrouznejad 2024; Viphindrartin, Wilantari, and Bawono 2022). For example, IBs typically have a more diversified funding base and are less reliant on short-term wholesale funding than are CBs. Islamic banking institutions tend to have lower levels of leverage, which can make them less vulnerable to market fluctuations. The principles of Islamic finance, which emphasize risk-sharing and asset-backing, helped IBs mitigate the impact of the double shock (caused by the pandemic and oil price drop) on their loan portfolios. However, this is not a universal truth, as the performance of IBs can vary depending on the country and specific bank response, especially during the COVID-19 (El-Chaarani et al. 2022).

The recent financial crisis has also affected the conventional banking system because the pandemic has had a strong negative effect on the real economy and capital markets as a whole (Carletti et al. 2020; Alfaro et al. 2020). In fact, both IBs and CBs faced regulations and supervision that established incentives to either change their focus or diversify. In this context, supervisors encourage banks to increase their diversification to reduce risk and enhance profitability. For example, Li et al.(2021) showed that revenue diversification may enhance bank profitability during a pandemic. According to the authors, the reason is that 'non-interest revenue sources are positively related to performance but inversely related to risk' (Li et al. 2021, 1). Their findings are also 'consistent with a beneficial diversification effect during the pandemic from banks expanding beyond traditional lending sources of revenue' (Li et al. 2021, 1). Moreover, the prior research reported that 'regulatory measures of the banking sector, for instance, easing capital buffers and relaxing the handling of non-performing loans, have been located to alleviate the COVID-19 negative effects on the financial system stability' (Xie et al. 2021, 4805). All these measures have had a positive impact on banking system stability in both developed and emerging economies. However, the performance and risk-taking behavior of IBs during the COVID-19 pandemic vis-à-vis their conventional

peers require more consideration. Therefore, -this research is focused on the main factors of performance disparities, such as market competition and efficiency, which may explain why these two types of banks performed differently during the pandemic. Using a data set of 575 banks in 20 countries in the Middle East and North Africa (MENA) region during the period 2006-2021, we find that both individually and jointly market competition and efficiency are important determinants of bank profitability and risk, and their impact is more pronounced during the pandemic only in the group of IBs.

The motivation for this study is twofold. *First*, studying the role of market competition and efficiency in bank performance during the COVID-19 pandemic enables bank managers and policymakers in MENA countries to analyze the adverse effects of the pandemic on bank stability and apply appropriate strategies to avoid further losses. Therefore, it is important to understand the influence of competition and efficiency on bank performance. Such an analysis requires a deep investigation of the 'competition-efficiency-stability' paradigm, which states that, in general, market power and efficiency increase bank profitability and financial stability. However, only a few studies examine the relationship between efficiency and bank default risk (see e.g. Saeed and Izzeldin 2016) or the impact of bank competition on systemic stability (see e.g. Mateev et al. 2022) in a comparative setting that includes IBs. Therefore, our motivation is to contribute to the existing literature on the competition-efficiency-stability paradigm by investigating how efficiency and market competition, both individually and jointly, affect IBs performance. *Second*, based on the predictions of 'efficient structure' hypothesis that more efficient banks obtain both higher profitability and market share, we may assume that efficiency would play a significant role in explaining profitability and risk-taking behavior of our banks. However, no prior study has examined this effect during the COVID-19 pandemic in the context of Islamic banking in the MENA region. To fill this gap, our study focuses on efficiency as an important factor driving profitability and risk-taking behavior of IBs, together with market competition as a complementary factor. Specifically, we investigate whether market competition reinforces the positive impact of efficiency on bank performance during the pandemic, and whether this effect is more pronounced for Islamic banking institutions.

The contributions of this study can be summarized as follows: *First*, the majority of existing studies examined the individual effects of efficiency (and competition) on bank performance during financial crises (Assaf et al. 2019; Mirzaei, Saad, and Emrouznejad 2024; Mateev, Sahyouni, and Al-Masaeid 2024; Mateev, Tariq, and Sahyouni 2023). However, the role of efficiency and market competition in banking system stability during the recent global crisis remain unclear. Our contribution lies in the investigation of how efficiency and market competition, both jointly and individually, affect bank performance in the MENA region. Our analysis reveals that market competition and efficiency are substantial drivers of bank performance (profitability and risk) during the pandemic. However, these effects are significant only in the sample of IBs, indicating the important role of Islamic institutions in the banking system stability in the MENA region. *Second*, several previous studies (Demirgüç-Kunt, Pedraza, and Ruiz-Ortega 2021; Mirzaei, Saad, and Emrouznejad 2024) have evaluated bank performance during the COVID-19 outbreak using market indicators (e.g. stock returns) and reported a significant influence on bank performance. In this study, we investigate bank performance

using both individual (accounting-based) and aggregate (stability- and risk-adjusted) performance measures. This approach allows us to obtain a more precise evaluation of bank profitability and risk-taking behavior compared with previous studies. For our sample of MENA banks, we find that in the pre-COVID-19 period, efficient banks were more profitable and stable when they operate in less competitive markets. However, during the COVID-19 period, market competition seemed to reinforce the positive effect of efficiency on bank performance, and this effect was stronger in the IB group.

Third, a growing number of articles have specifically addressed the stability of Islamic banking during the COVID-19 outbreak (Ashraf, Tabash, and Hassan 2022; Abdulla and Ebrahim 2022; El-Chaarani et al. 2022). We extend their findings on the role of efficiency (and market competition) in explaining bank stability in the MENA region by focusing on the pandemic period (2020–2021). This allows us to further analyze the determinants of the financial stability of IBs during the recent financial crisis and address the following question: Are Islamic banking institutions more resilient to COVID-19 than their conventional peers? Our main finding is that the more efficient the IBs are, the more profitable and stable they are during the pandemic. Additionally, we answer the question of whether the same factors (e.g. competition, efficiency, and bank-specific characteristics) explain the observed disparities between the two groups of banks before and during the pandemic. *Finally*, our study aims to explain the role of banking market structure and efficiency in improving bank performance during the pandemic and provides useful guidance for regulators and bank managers. For example, well-designed policies that best suit the level of market competition in each country and require a more disciplined approach to lending decisions would improve the financial stability of banking institutions in the MENA region in times of crisis. Since efficiency further enhances the financial stability and soundness of banks, IB managers should follow strategies that improve operational efficiency and risk management practices to minimize the adverse effects of the pandemic.

The remainder of this paper is organized as follows. Section 2 summarizes the outcomes of existing literature and presents the main hypotheses based on this analysis. Section 3 describes the methodology, including samples, variables, and model specifications. Section 4 presents the results and interpretation. Section 5 includes the robustness tests and their outcomes. Finally, Section 6 presents the conclusions, including policy implications and research limitations.

2. Background and hypotheses development

2.1. Bank performance and stability in the MENA region: pre-pandemic context

Islamic banks (IBs) operate in highly regulated environments guided by Sharia's principles (Shawtari, Ariff, and Razak 2019). As interest is prohibited in Sharia's law, IBs achieve their earnings through transactional and intermediation contracts (El-Hawary, Grais, and Iqbal 2013). Since IBs are strictly banned from charging interest, they offer alternative financial services and products fulfilling Sharia's principles, which permit profit and loss sharing (PLS), such as *Musharaka* and *Mudarabah*. Moreover, the relationships between IBs and their customers are based on mutual trust strengthened

by shared religious beliefs. These banks 'offer products in accordance with *Fiqh Al Muamalet* that encourage trading and productive investment' (Hamza and Kachtouli 2014, 30). Thus, the theoretical model of Islamic banking differs from that of conventional banking.[1]

Simultaneously, the uniqueness of Islamic banking generates outstanding challenges in terms of its efficiency and stability. Research by Yılmaz (2009) and Hasan and Dridi (2010) proposed that the strict governance principles imposed by Sharia's law represent one of the main reasons IBs were not as adversely affected by the 2007–2008 financial crisis as most CBs were. In addition, prior studies 'demonstrated that IBs had relatively high efficiency and profitability during periods of financial uncertainty' (Mateev, Sahyouni, and Al-Masaeid 2024, 2). However, Belanès, Ftiti, and Regaïeg (2015) reported a negative impact of the global financial crisis of 2007/08 on the efficiency of IBs in the Gulf Cooperation Council (GCC) region, similar to their conventional peers worldwide. By comparing the two banking systems, prior research found that 'CBs grant a higher percentage of loans than their benchmark peers and are more profitable in the pre-, during-, and post-crisis periods. Additionally, in the post-crisis period, IBs held more liquidity and experienced a slower recovery. However, their profitability gap with CBs is narrowing' (Abu-Alkheil, Khan, and Khartabiel 2017, 1). Another group of studies claims that the two types of banks are not significantly different. For example, the researchers argue that 'since all banks operate in the same competitive environment and are regulated in the same way in most countries, it is possible that Islamic and conventional banks have similar behavior and hence adopt similar strategies' (Khediri, Charfeddine, and Youssef 2105, 76). Chong and Liu (2009) also contend that, in practice, IBs are not different from CBs and suggest that the rapid growth of Islamic banking is not due to the principals of Sharia-compliant banking, but rather to Islamic resurgence worldwide. Therefore, IBs are subject to risks that are common to CBs and other risks that are specific to Islamic financial institutions (Louati, Abida, and Boujelbene 2015).

Empirical literature has also investigated different factors that may explain the performance disparities among different types of banking systems (Islamic and conventional). For example, using unbalanced annual panel data covering 2006 - 2012, Rashid and Jabeen (2016) analyzed different factors that influence bank performance in Pakistan and compared them between IBs and CBs. Their study reported 'that operating efficiency, reserves, and overheads are significant determinants of conventional banks' performance, whereas operating efficiency, deposits, and market concentration are significant in explaining the performance of Islamic banks' (Rashid and Jabeen 2016, 92). Other studies have focused on the relationship between efficiency and banks' risk-taking behavior of different banking systems. For example, Saeed and Izzeldin's paper 'was the first study to consider the efficiency-default risk paradigm in a comparative setup that includes IBs' (Saeed and Izzeldin 2016, 127). The authors found 'that the relationship between profit efficiency and default risk [of] banks across the sample, for CBs, and for the GCC is such that a decrease in default risk is associated with lower efficiency levels' (Saeed and Izzeldin 2016, 127). Prior research has also reported different factors that explain the IBs efficiency in comparison with their conventional peers. For example, Kablan and Yousfi's paper has analyzed 'IBs efficiency over the period 2001–2008 and found that they were efficient at 78.9%, but the level of efficiency varies according to the region' (Kablan and Yousfi 2017, 1). This research

also reported that 'market power and profitability negatively impact the efficiency of Islamic banks. In addition, the subprime crisis did not impact Islamic banks, as evidenced by the dummy variable' (Kablan and Yousfi 2017, 1).

Finally, several empirical studies have attempted to relate efficiency to capital-to-bank stability. For example, Bitar, Saad, and Benlemlih (2016) examine the impact of various regulatory capital ratios on bank performance using a sample of 168 banks in 17 MENA countries. The findings suggest that compliance with the Basel II capital requirements improves bank efficiency and enhances bank protection against risk. However, their analysis does not differentiate between Islamic and conventional banking in the MENA region. More recently, a similar study investigated 'the relationship between bank capital, efficiency, and risk in Islamic banks' (Isnurhadi et al. 2021, 841). The results confirm 'the previous findings that bank capital positively affects bank stability (natural logarithm of Z-Score) and negatively affects credit risk (loan loss provision to total liabilities). The findings also show that efficiency has the same effect' (Isnurhadi et al. 2021, 841). However, other studies (Abedifar, Molyneux, and Tarazi 2013; Louati, Abida, and Boujelbene 2015) claimed that prudential regulations have no significant effect on the risk-taking behavior and capitalization level of IBs because these institutions have strong capital ratios that are considerably higher than their conventional peers. Therefore, the evidence on different factors that explain the performance disparities between conventional and Islamic banking systems is inconclusive. To fill this gap, we take a step further and investigate the factors that impacted bank stability in the MENA region before and during the pandemic by testing several hypotheses presented in Section 2.3.

2.2. The Islamic banks performance vis-a-vis conventional banks during COVID-19

The financial stability and soundness of banking systems during the COVID-19 pandemic have attracted the attention of a growing number of researchers. Some have also investigated the COVID-19 effect on bank performance and stability of Islamic banks (IBs) vis-à-vis their conventional peers. The results were mixed.

For instance , Elnahass, Trinh, and Li (2021) examined the impact of the COVID-19 pandemic on global banking stability. The authors reported 'that, in the global banking sector, the Covid-19 outbreak has had detrimental impacts on financial performance across various indicators of financial performance (i.e. accounting-based and market-based performance measures) and financial stability (i.e. high-risk indicators including default risk, liquidity risk, and asset risk)' (Elnahass, Trinh, and Li 2021, 1). This study also shows a strong differential effect of COVID-19 on the Islamic banking system. Abdelsalam et al.'s paper has used a unique sample of international banks located in 21 countries to investigate 'the impact of asset securitization on the performance and financial stability of banks in a dual banking system (Islamic and conventional)' (Abdelsalam et al. 2022, 1). The authors reported that 'these two models of asset securitization show differential effects on bank stability. Unlike conventional securitization, which is marked by significantly low bank stability, an issuance of Islamic securitization leads to lower bank risk' (Abdelsalam et al. 2022, 1). Finally, prior research examined 'the effect of the COVID-19 pandemic on Islamic and conventional stock markets from a

global perspective' (Hasan et al. 2021, 1). The study reported that 'the pandemic created identical volatility in both stock markets [..]. However, the Shariah screening process fails to provide immunity to Islamic stock markets against financial crises' (Hasan et al. 2021, 1).

In the context of banking systems in the MENA region, a recent research reported that 'Islamic banks are not as profitable and resilient in the COVID-19 pandemic as in the global financial crisis (2007-2008)' (Grassa et al. 2022, 251). Moreover, 'Islamic banks in GCC countries have gained experience and become more efficient and stable over time' (Grassa et al. 2022, 251). Similarly, El-Chaarani et al. (2022) analyzed and compared financial performance of Islamic and conventional banks in the Gulf Cooperative Council (GCC) countries before and during the COVID-19 pandemic. The results of this study 'reveal that there is a significant difference between Islamic banks and conventional banks during the crisis of COVID-19, where the conventional banks have presented a higher level of financial performance and financial liquidity than their Islamic counterparts' (El-Chaarani et al. 2022, 1). Fakhri and Darmawan (2021) investigated the impact of the COVID-19 pandemic on financial performance factors in both Islamic and conventional banking in Indonesia. The authors found that 'Islamic banking is more vulnerable than conventional banking in facing financial crises' (Fakhri and Darmawan 2021, 19). Prior studies have reported that increased credit losses in the form of non-performing loans (NPLs) during the COVID-19 pandemic have threatened the soundness of these banks (i.e. IBs) and the stability of the entire banking sector. For instance, using a sample of 200 banks across 15 countries in the Middle East and Africa (MEA) region over the period 2018–2021, Ahmed, El-Halaby, and Soliman (2022) confirmed the negative association between NPLs and the financial performance of both Islamic and conventional banks. Their study 'reveals that COVID-19 partially mediated the association between NPLs and financial performance in the case of the whole sample and separated sample of CBs while not in case of IBs' (Ahmed, El-Halaby, and Soliman 2022, 1).[2]

Evidence of the superior stock performance of IBs during the COVID-19 crisis is also inconclusive. For example, research on Islamic banking market in the GCC member states reported that 'stock market investors have not assessed Islamic banks as superior to conventional ones during the Covid-19 market meltdown. Interestingly, the adverse impact of social distancing policies is stronger on Islamic banks due to their inherent higher cost structure' (Ashraf, Tabash, and Hassan 2022¸ 1). A similar study examined the impact of the pandemic on 'the co-movement between Islamic and conventional banks' stock prices during the period from March 3, 2019, to January 30, 2021, in six GCC countries' (Aliani, Al-kayed, and Boujlil 2022, 1). The study reported 'that Islamic and conventional banks' stock returns moved in the same direction during the pandemic, but the fluctuations of Islamic banks' returns were less volatile compared to their conventional counterparts' (Aliani, Al-kayed, and Boujlil 2022, 1). Mirzaei, Saad, and Emrouznejad (2024) investigated the stock price performance of IBs in 48 countries across the world during the COVID-19 outbreak. Their study found that 'the observed higher stock returns for IBs relative to their conventional counterparts can be explained by their pre-crisis levels of efficiency' (Mirzaei, Saad, and Emrouznejad 2024, 1). Finally, Boubaker, Le, and Ngo (2022) evaluated the performance and efficiency of 49 IBs across 10 countries during the 2019–2020 period in order to 'explore how these banks can

preserve their performance and remain resilient in the aftermath of the COVID-19 pandemic'. The research reported that 'because of reductions in their outputs, 31 out of the 49 banks studied would need to reduce their inputs so that their efficiency can remain unchanged' (Boubaker, Le, and Ngo 2022, 1).

Based on our analysis of prior research, we may conclude that although the COVID-19 pandemic was found to have a strong negative impact on different banking systems in the MENA region, the question of why IBs are more resilient during the COVID-19 pandemic remains unanswered. Moreover, there is limited evidence on the importance of different factors, such as market competition and efficiency, which may explain the performance disparities between the two banking systems. To fill this gap, in the next section, we test several hypotheses using a large dataset of 575 banks (104 Islamic and 471 conventional banks) operating in 20 MENA countries.

2.3. Hypotheses development

As mentioned in section 1, our main research question is: Are Islamic banking institutions more resilient to COVID-19 than their conventional peers? Specifically, what factors may explain the performance disparities between Islamic and conventional banks during the pandemic? To address these questions, we refer to existing concepts and theories that explain the relationships between and the impact of market competition and efficiency on bank performance.

Prior research reported that 'competition in the banking industry, as well as operating efficiency, are frequently mentioned as the main determining factors of bank performance' (Mateev, Sahyouni, and Al-Masaeid 2024, 7). This finding can be expalined with the assumprions of either the structure-conduct-performance (SCP) theory or the efficient-structure (ES) hypothesis. On the one hand, 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, 746). The empirical literature tests the SCP theory by 'examining the relationship between profitability and market concentration with a positive relationship indicating non-competitive behavior in concentrated markets' (Goldberga and Rai 1996, 746). On the contrary, the ES hypothesis claims that 'efficient firms increase in size and market share because of their ability to generate higher profits, which usually leads to higher market concentration. Thus, the positive relationship between profits and concentration is explained by lower costs achieved through either superior management or production processes' (Goldberga and Rai 1996, 746). Therefore, if concentrated markets are associated with less competition, non-competitive behavior is related to high profitability.

However, existing studies provide inconclusive evidence on the influence of banking market structure and/or efficiency on the performance of banking institutions. For example, Cristian, Leonarsan, and Kim (2020) investigated 'the effects of competition, efficiency, and risk on bank performance in Indonesia'. The study found that 'competition of non-interest income market influence negatively on bank performance. Cost and revenue efficiency do not affect bank performance. Profit efficiency positively affects net interest margin, but not return on assets' (Cristian, Leonarsan, and Kim 2020, 407). However, a study on developing economies reported that a 'greater

concentration of the banking market and less aggressive competition motivate banks to invest in gathering soft information on customers and credit monitoring measures' (Kozak and Wierzbowska 2021, 40). This improves the quality of the loan portfolio and increases efficiency and bank profitability. In the context of the MENA region, Mateev, Tariq, and Sahyouni (2023) examined the impact of concentration and efficiency on different banking systems that coexist in this region. Their study reported that 'the market concentration effect is more pronounced when the banking institution is Islamic and during the COVID-19 outbreak' (Mateev, Tariq, and Sahyouni 2023, 1).

Based on the prediction of efficient-structure (ES) hypothesis, we may assume that efficient banks operating in concentrated markets (banks with high market power) would be more profitable. Therefore, efficiency and market power are expected to positively relate to bank performance. If we assume that Islamic banking institutions are more efficient and liquid than their conventional peers, as Saâdaoui and Khalfi (2022) claim, one may expect these effects to be stronger in the group of IBs, particularly during the COVID-19 pandemic. To test the validity of these assumptions, we formulate the following hypotheses:

> Hypothesis 1a: Market power and efficiency are positively associated with bank profitability and this effect is similar across the two banking systems.

> Hypothesis 1b: The positive effect of market power and efficiency during the COVID-19 pandemic is more pronounced only for Islamic banks.

Although previous studies have investigated efficiency and financial stability individually, only a few of them have provided evidence on the efficiency-stability paradigm (Koutsomanoli-Filippaki and Mamatzakis 2009; Saeed and Izzeldin 2016). Moreover, Saeed and Izzeldin (2016) were the first to explore the 'efficiency-default risk' paradigm in a comparative setup that includes IBs. Their analysis shows that 'the relationship between profit efficiency and default risk of banks across the sample, for CBs and the GCC, is such that a decrease in default risk is associated with lower efficiency levels' (Saeed and Izzeldin 2016, 127). A similar study reported that 'the interaction test of bank capital and efficiency shows that efficiency encourages banks to reduce risk, including when bank capital is relatively lower' (Isnurhadi et al. 2021, 841). Prior research has also focused on the impact of market structure on bank stability, but the reported results are mixed. For example, González et al. (2017) claimed a negative relationship between competition (measured by H-statistics) and bank stability (measured by Z-Score) in Gulf countries but an opposite effect in non-Gulf countries. Mateev et al. (2022) report a positive and nonlinear association between market competition and banks' insolvency risk. Finally, Anginer, Demirguc-Kunt, and Zhu (2014) analyzed 'the impact of bank competition on systemic stability' and provided 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, Demirguc-Kunt, and Zhu 2014, 25).

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 the banking sector encourages banks to diversify their risk and become financially stable.

We expect this effect to be stronger during the COVID-19 pandemic. However, the differential impact of COVID-19 on financial stability of IBs remains unclear. To fill this gap, we tested the following hypothesis:

> Hypothesis 2a: Market competition and efficiency are positively associated with bank stability and this effect is similar across the two banking systems.

> Hypothesis 2b: The positive effect of competition and efficiency during the COVID-19 pandemic is more pronounced only for Islamic banks.

Regarding the MENA region, González et al. (2017) claimed 'that in less-competitive markets, increased competition may favor the risk-shifting effect and help improve efficiency, which in turn improves financial stability' (592). However, the positive effects of efficiency on bank performance and stability depend on the level of competitiveness of the banking industry. Moreover, prior research on MENA banking systems found 'that in highly competitive markets, banks will be willing to pursue risky strategies when they face the need to raise their capitalization levels' (Mateev et al. 2022, 41). This effect is much stronger for CBs , while in the case of IBs, 'the evidence shows that market competitiveness has a limited impact on the relationship between the capital adequacy ratio and credit risk' (Mateev et al. 2022, 41). However, no prior study has investigated the impact of market competition on the relationship among efficiency, bank performance, and stability during the recent financial crisis. In line with the complementarity hypothesis,[3] we expect that market competition will reinforce the positive effect of efficiency on bank performance, and this effect will be stronger during the COVID-19 pandemic, when the banking system is more fragile and vulnerable to financial shocks. To test the validity of this proposition, we formulated the following hypothesis:

> Hypothesis 3:There is a significant moderating effect of market competition on the relationship between efficiency and bank performance. This effect is significant during the COVID-19 pandemic only for Islamic banks.

3. Research design

This study aimed to bridge the research gap related to the role of market competition and efficiency in banking system stability during the COVID-19 pandemic. Specifically, the objective of this section is to study the individual and joint effects of market competition and efficiency on bank performance and compare them across different banking systems in the MENA region. On this basis, we consider different indicators of bank performance (profitability and risk) commonly used in the literature. For example, we use the return on average assets and return on average equity to measure bank profitability. Next, we set the distance to default (Z-score) and two aggregate performance measures as the dependent variables, which are explained by bank efficiency, market competition, and the interaction between efficiency and competition, while controlling for bank- or country-specific determinants of bank performance. Moving forward, we study two types of banks (conventional and Islamic) and choose an appropriate research design to obtain accurate results on this important topic in the context of the recent financial crisis. To achieve the proposed objective, a hypothesis-based, deductive method approach was

applied by performing a set of tests using data for the MENA banking sector. In this specific analysis, 'longitudinal samples' from MENA banks covering the period from 2006 to 2021 and different parametric and non-parametric methodologies were utilized. Finally, panel data models were employed to test the research hypotheses formulated based on the arguments of the existing theoretical and empirical studies discussed in the previous section.

3.1. Sample selection and data

Data were collected from the Bankscope and Banksfocus (Bureau van Dijk) databases and World Bank Development Indicators. In addition to the Bankscope and Bankfocus information, this study extracted data from the annual reports of banks and central bank websites to build a comprehensive database for banks in our sample. The final sample was obtained from unbalanced panel data of 5020 year-observations from 2006 to 2021. The period of this study was selected based on yearly data availability and the need to cover the periods before and during the COVID-19 pandemic. This allows for a deeper understanding of the effects of the pandemic crisis on the factors determining bank performance and stability. We selected all banks that are labeled as conventional and Islamic, and banks with missing accounting and financial information for any year during the observation period were excluded from the list. Our sample was diverse in terms of income group and geographical area. The number of banks in our dataset varies by country and type (Table 1). Of the 525, 104 banks are labeled Islamic, while the remaining 471 are conventional. Following the literature on IBs, we include banks that are either (fully fledged) Islamic banks, banks based on Sharia compliance or Islamic window-based banks. To address potential estimation biases, the bank-level explanatory variables were winsorized, limiting them to the 1st and 99th percentiles.

3.2. Measures of bank performance

Following previous research, we used different performance indicators based on both market and accounting information. Specifically, various accounting variables have been considered, such as the Return on Asset (ROA) ratio, which is 'a commonly used performance measure, defined by the ratio of net income over total assets' (da Silva Neto 2021, 60), and Return on Equity (ROE) ratio, which evaluates the return on the shareholder's equity. Following previous empirical studies, we used 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, Saad, and Benlemlih 2016, 5). We also employ an alternative (market-based) proxy of bank performance – Tobin's Q (Abdallah and Ismail 2017). Prior research reports that the effective performance of banking institutions can 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, Kil, and Idzik 2021, 10). Therefore, in addition to traditional accounting ratios, we introduce three aggregate performance measures: Z-score or distance to default, Multilevel Performance Score (MLPS), and Financial Stability Indicator (FSI). The aggregate performance measures (MLPS and FSI) were computed according to the methodology

Table 1. Sample composition of banks by country and type.

Country/ Banks	Total	Number of Conventional Banks	Number of Islamic Banks	Observations (Conventional)	Observations (Islamic)	Observations (All bank)
United Arab Emirates	39	27	12	288	131	419
Bahrain	51	36	15	277	129	406
Egypt	54	51	3	504	33	537
Israel	14	14	0	151	0	151
Jordan	32	28	4	275	32	307
Kuwait	44	34	10	340	106	446
Lebanon	41	38	3	284	16	300
Oman	24	22	2	213	16	229
Qatar	19	12	7	115	73	188
Saudi Arabia	30	23	7	218	53	271
Iran	33	20	13	113	107	220
Morocco	23	23	0	211	0	211
Algeria	18	18	0	153	0	153
Iraq	53	35	18	257	131	388
Malta*	17	17	0	97	0	97
Palestine	12	10	2	82	23	105
Syria	16	13	3	123	33	156
Tunisia	37	35	2	332	19	351
Yemen	8	6	2	26	10	36
Libya	10	9	1	46	3	49
Total	**575**	**471**	**104**	**4105**	**915**	**5020**

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 shows the total number of banks, the number of conventional banks (CBs) and Islamic banks (IBs) per county, and the number of observations per bank type. The last column represents the total number of observations per country.

Note: There are two reasons for including 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 for the entire sample period.

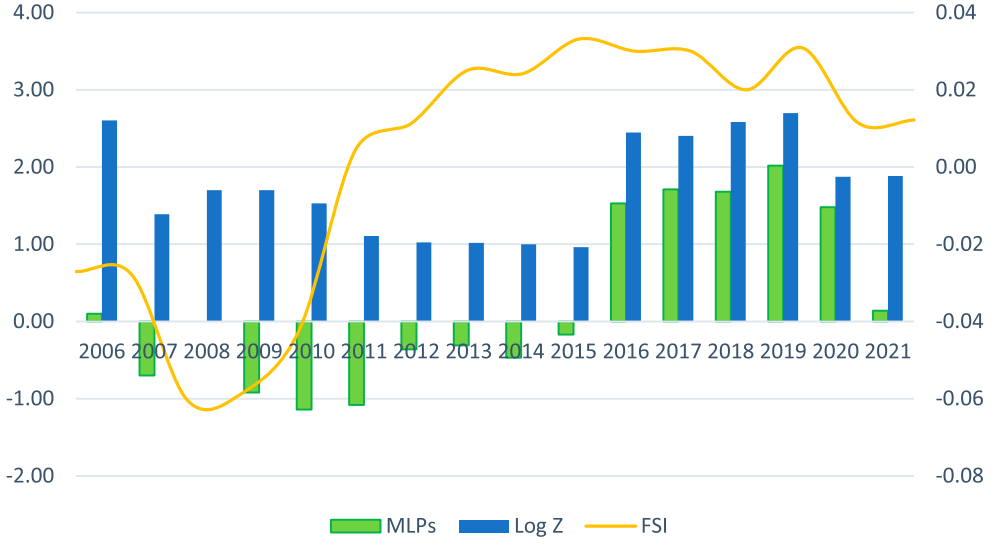

Figure 1. Bank stability (Z-score) and aggregate performance (MLPS and FSI) indicators (2006-2021).

proposed by Miklaszewska, Kil, and Idzik (2021). Figure 1 illustrates the computed values of our performance measures and their dynamics over the analyzed period (2006-2021). We observe a strong positive trend in the overall performance of MENA banks until 2019 but a deteriorating performance in 2020 and 2021 as witnessed by the negative trends of MLPS and FSI indicators, owing to the adverse effects of the COVID-19 pandemic. Appendix A presents the definitions of accounting and aggregate performance measures and the data sources (Table A-1).

3.3. Measures of efficiency and market competition

To investigate the hypotheses that describe the predicted relationship between the variables of main interest (competition and efficiency) and bank performance, we need to measure bank efficiency and the level of market competition. To do this, we follow a methodological approach 'that allows us to obtain results more robust and reliable than the techniques traditionally used in this line of research' (da Silva Neto 2021, 8). Our choices are guided by both existing theoretical frameworks and empirical results obtained by previous studies in the same area of research.

Since the pioneering work of Charnes, Cooper, and Rhodes (1978), Data Envelopment Analysis (DEA) has removed the limitation of efficiency measurement research. Moreover, it has been extensively used as an effective technique to 'estimate the production frontier and calculate the efficiency score of a DMU (Decision Making Unit) to homogeneous entities' (da Silva Neto 2021, 95). As one of the most commonly used methods for analyzing organizational efficiency, multiple inputs are applied to produce multiple outputs, and many theoretical developments and practical applications have been reported. In its traditional format, the DEA used to evaluate bank efficiency can go through a single stage of estimation computation (the stage model of DEA analysis). As traditional DEA studies ignore the fact that the bank itself is a more complex operating system than the inputs and outputs, multi-stage DEA models have been introduced to consider the complex internal structure of banks and achieve more convincing results for efficiency. Examples include two-stage DEA (Seiford and Zhu 1999) and dynamic network DEA models (Tone and Tsutsui 2014). In this research, to compute the efficiency scores, we followed the intermediation approach proposed by Chaffai and Hassan (2019). Appendix C (Table C-1) details the intermediation approach for the inputs and outputs used to compute the efficiency scores. Specifically, we employed three models (CRS, VRS, and SCALE) as per Mateev, Tariq, and Sahyouni (2023), and the average efficiency score from each model was used as a proxy for the overall efficiency measure. According to prior research (see e.g. Mirzaei, Saad, and Emrouznejad 2024; Mateev, Tariq, and Sahyouni 2023), we should expect a positive association between efficiency and bank performance.

Guided by previous studies that find market competition in the banking industry to be a significant determinant of bank performance and stability, we include market power as a proxy for market competition. The so-called 'new empirical industrial organization' approach is widely used to measure market competition. This pioneering framework uses measures to gauge market power directly, instead of deducing the competitive conduct of banks from the analysis of market structure. The Lerner index is one of the most useful and popular indicators of bank competition (Maudos and de

Guevara 2004; Fungáčová, Pessarossi, and Weill 2013; Liu, Molyneux, and Wilson 2013; Louati, Abida, and Boujelbene 2015; Tan, Floros, and Anchor 2017; Clark, Radić, and Sharipova 2018). The Lerner indexis is 'a direct measure of competition through the distance between the price and the marginal cost' (Hamza and Kachtouli 2014, 37). This indicator ranges between 0 and 1, with the index taking a value of 0 in the case of perfect competition (firms have no market power) and 1 in the case of monopoly (firms exercise high market power). Since the Lerner index is an inverse measure of competition, a low Lerner value indicates low market power (high competition) and a high Lerner value indicates high market power (low competition). Appendix C (Table C-2) presents the inputs for calculating the Lerner index.[4] Prior research has reported inconclusive results regarding the relationship between market power and bank profitability. For example, Mateev, Sahyouni, and Al-Masaeid (2024) reported a positive association between market power and bank performance, whereas Tan, Floros, and Anchor (2017) found that 'Chinese commercial banks with higher levels of market power (lower level of competition) have lower profitability'. Furthermore, a significant and positive relationship between the Lerner index and bank credit risk (measured by non-performing loans) has been reported, while the link with bank stability (measured by the Z-score) was found negative (Mateev, Sahyouni, and Al-Masaeid 2024). These results imply that banks with high market power are more profitable, but less stable. Based on the findings of previous studies, we expect a positive (negative) association between market power and bank profitability (stability).

3.4. Control variables

To ensure that market power and efficiency do not replace the known effects of other variables on bank profitability and risk, we consider a set of control variables previously identified in empirical literature as relevant determinants of bank performance. These control variables can be divided into two main categories: bank-specific and country-wide.

In the first category, we include bank size measured by the natural logarithm of total assets (Belasri, Gomes, and Pijourle 2020). Most previous studies (Ali and Puah 2019; Kevser 2020; Miklaszewska, Kil, and Idzik 2021) found that bank size has a positive impact on bank profitability, which can be explained by the fact that large banks tend to be more profitable because they gain advantages from economies of scale. Therefore, we expect a positive relationship between bank size and profitability. Following previous research in the banking area, we employ 'the revenue diversification, measured by the ratio of non-interest income over total operating revenues, the liquidity, measured by the liquid assets over total assets' (da Silva Neto 2021, 105). Guided by previous studies focusing on bank performance in the MENA region and other developing countries, we assume that both revenue diversification and liquidity ratio have a positive impact on bank profitability (Čihák and Hesse 2010; Ammar and Boughrara 2019; Li et al. 2021).[5] Following Mateev, Tariq, and Sahyouni (2023) 'the leverage ratio (equity to total assets) is included to control for differences in the risk preferences across banks'. Based on this and similar studies, we expect leverage to have a positive (negative) influence on bank profitability (default risk).

To measure credit risk, we calculate the non-performing loans tototal loans ratio (Cristian, Leonarsan, and Kim 2020; Khan, Siddique, and Sarwar 2020). Since any increase in the size of the non-performing loans deteriorates a bank's profitability and hampers its financial stability, we expect a negative association with bank performance.[6] Other control variables used in the analysis are deposit growth (expected positive association with bank performance) and non-financial loan growth (negative association with bank performance). Next, we use capital adequacy ratio as a measure of a bank's capital strength or insolvency risk. Capital adequacy is expected to have a positive influence on bank stability because it reflects the long-term solvency of banks (Kasman et al. 2010) but at the same time, a higher capital base is an opportunity cost to banks that decreases bank profit. Therefore, the explicit sign of this variable is unclear. Finally, we compute an index of the overall institutional quality of a host country, which is the mean value of six governance indicators, as per Kaufmann, Kraay, and Mastruzzi (2008) methodology (see Appendix A). The better quality of the institutions in the host country is associated with enhanced bank performance.

Empirical literature on banking sector performance suggests that the macroeconomic environment in which banks operate may affect their behavior. Following previous studies (Miklaszewska, Kil, and Idzik 2021; Mateev, Tariq, and Sahyouni 2023), we included gross domestic product (GDP) growth, inflation rate, and domestic credit to the private sector as a % of GDP as country-specific variables, to control for the effect of macroeconomic differences between countriesin our sample. We assume that GDP dynamics have a positive and significant impact on bank profitability and that inflation is expected to be negatively associated with profitability. However, we must be cautious because previous empirical studies have reported opposite results for GDP growth (Mateev, Sahyouni, and Al-Masaeid 2024) and inflation (Wasiuzzaman and Tarmizi 2010).

3.5. Empirical specification

To explore the relationship between market competition, efficiency, and bank performance/stability, we employ the following estimation model.

$$BP_{it}/BR_{it} = \alpha_0 + \beta_1 Competition_{it} + \beta_2 Efficiency_{it} + \beta_3 Competition_{it} * COVID - 19 + \beta_4 Efficiency_{it} \times COVID - 19 + \nu X_{it-1} + \beta_5 GCC_t + \nu_{it} \quad (1)$$

$$BP_{it}/BR_{it} = \alpha_0 + \beta_1 Competition_{it} + \beta_2 Efficiency_{it} + \beta_3 Efficiency_{it} * Competition_{it} + \beta_4 Efficiency_{it} * CAR + \nu X_{it-} + \beta_5 GCC_{t1} + \nu_{it} \quad (2)$$

In this model, BP_{it} is the measure of the financial profitability of bank i in year t; similarly, *and* BR_{it} is the measure of the risk level of bank i in year t. We used several alternative measures of bank profitability (ROA, ROE, and C/I) in each regression. In addition to the bank stability measure (Z-score), we employ two comprehensive aggregate measures of bank performance and stability (MLPS and FSI) as per Miklaszewska, Kil, and Idzik (2021). The level of banking market competition is proxied by the Lerner index, and efficiency is measured by the average efficiency score. In addition to the traditional measure of a bank's market power, we used the efficiency-adjusted Lerner index (Koetter,

Kolari, and Spierdijk 2012) in our robustness tests. The bank capitalization level is proxied by the capital adequacy ratio (CAR). Following Mateev, Tariq, and Sahyouni (2023), X_{it-1} is defined 'as a vector of bank-specific (or country-specific) variables that are identified as important determinants of bank efficiency' (p. 25). The GCC dummy is an indicator variable that takes the value of 1 if a bank belongs to a GCC member state and 0 otherwise, while COVID-19 is a crisis dummy indicative of a systematic crisis, in our case, the COVID-19 pandemic.

Following previous studies (Abedifar, Molyneux, and Tarazi 2013; González et al. 2017; Mateev et al. 2022) dealing with panel data, we employ fixed effect/random effect specifications that include time- and country-fixed effects, and perform a Hausman test, where the null hypothesis is that the preferred model is random effects versus alternative fixed effects. The choice between the random- and fixed-effects specification depends on Prob>chi^2 being greater or less than 5% (if Prob > chi2 is < 0.05 use fixed effects).[7] Note that, in the panel data framework, Eq. (1) and (2) specify the dynamic structures. Therefore, problems related to endogeneity, autocorrelation, and heteroscedasticity, may occur. To account for such potential issues, we employ the dynamic panel data Generalized Method of Moments (GMM) approach proposed by Arellano and Bover (1995) and Blundell and Bond (1998), which provides more accurate and robust results (García-Herrero, Gavilá, and Santabárbara 2009). According to prior research, methods based on the system GMM estimator are 'particularly useful for models including endogenous or predetermined explanatory variables' (Miklaszewska, Kil, and Idzik 2021, 12). For robustness purposes, we also estimate our baseline models using the two-stage least squares (2SlS) approach and report its diagnostic tests in Appendix E (see also section 5).[8]

According to similar studies on panel data analysis, 'Pearson correlation test is used to assess the collinearity among the independent variables: if collinearity is rejected, then, in order to assess the determinants affecting performance of banks, Fixed Effect Model (FEM) Ordinary Least Square (OLS) is applied' (Sun, Mohamad, and Ariff 2017, 199). Therefore, we first estimated the level of correlation between efficiency, market competition, and other important variables used in our models (see Eq. 1 and Eq. 2) to Identify any multicollinearity problems. No significant correlation between efficiency and market competition measures, or between efficiency/competition indicators and other variables, was observed in the model. Therefore, the correlation matrix (not presented here to preserve space) suggests that our estimation results do not appear to suffer from multicollinearity. The VIF analysis shows that the values of VIF for each variable did not exceed the threshold of 10. This result 'indicates that variables are said not to be highly collinear, leading to the same conclusion as that of the correlation matrix' (Sahyouni and Wang 2019, 10). Since the collinearity is rejected, we proceed to study the main relationships descrived in our model using Fixed effect/Random effect specifications and the system GMM estimator.

4. Empirical results and discussions

4.1. The descriptive statistics and univariate analysis

Table 2 presents descriptive statistics of the main variables included in the analysis. First, we show the performance ratios of banks in the MENA region using the following major

Table 2. Descriptive statistics of banks.

	Conventional banks					Islamic banks					Mean test
	# obs	*Min*	*Max*	*Mean*	*SD*	*# obs*	*Min*	*Max*	*Mean*	*SD*	*P-value*
Stability measures											
Z-Score	2576	−0.93	6.43	2.53	1.17	730	−1.59	6.73	2.84	1.33	0.000***
Multi-Level Performance Index (MLPS)	3897	−25.00	23.00	0.83	9.35	936	−25.00	23.00	1.69	10.37	0.000***
Financial Stability Indicator (FSI)	3908	−0.40	0.60	0.01	0.17	955	−0.40	0.60	−0.02	0.15	0.325
Performance measures											
Return on Assets	3396	0.00%	91.3%	2.2%	3.8%	792	0.00%	34.8%	1.9%	2.6%	0.002***
Return on Equity	3406	0.00%	83.9%	11.5%	9.1%	801	0.01%	94.0%	11.4%	11.3%	0.000***
Cost-to-Income Ratio	3758	26.0%	94.5%	53.5%	21.4%	921	26.0%	94.5%	59.3%	23.8%	0.000***
Efficiency measures											
ES (Average)	4037	0.01	1.00	0.82	0.24	976	0.02	1.00	0.81	0.24	0.000***
Market Concentration											
Lerner index	4037	−0.08	0.71	0.35	0.20	976	−0.08	0.71	0.37	0.24	0.190
Adjusted Lerner index	3797	−0.16	0.99	0.58	0.23	891	−0.08	0.99	0.55	0.25	0.000***
Bank-level characteristics											
Deposit Growth	1687	0.00%	99.0%	17.1%	17.0%	490	0.10%	97.0%	20.6%	18.5%	0.000***
Loans/Total Assets	3827	0.01%	98.7%	46.0%	26.4%	938	0.01%	98.5%	47.6%	25.4%	0.282
Non-interest income/ Total revenues	3115	0.08%	99.0%	36.1%	25.1%	754	0.03%	99.0%	37.4%	24.1%	0.035**
Size	3929	2.91	11.87	8.50	1.64	956	4.17	11.35	8.54	1.61	0.000***
Non-financial Loan Growth	1741	0.00%	96.8%	18.0%	17.6%	484	0.04%	98.5%	20.9%	18.3%	0.000***
Liquid Assets	3169	0.01%	99.0%	44.0%	23.2%	766	0.82%	97.6%	34.9%	17.8%	0.000***
Equity/ Total Assets	3166	0.69%	98.9%	26.0%	25.2%	767	0.69%	98.8%	27.3%	25.7%	0.000***
Capital Adequacy Ratio	3454	0.02%	99.0%	21.4%	22.5%	866	0.92%	98.9%	25.1%	24.5%	0.007***
Credit risk measures											
Non-performing loans	2335	0.02%	97.98%	11.18%	15.52%	566	0.03%	96.30%	9.78%	13.99%	0.514
Regulation and institution											
Institution	3823	−2.01	0.88	−0.32	0.70	949	−2.01	0.88	−0.30	0.72	0.012**
Macroeconomic variables											
GDP Growth	300	−28.0%	32.5%	2.1%	5.6%	240	−28.0%	31.4%	1.8%	5.9%	0.000***
Inflation	300	−4.9%	98.8%	4.9%	10.3%	240	−4.9%	98.8%	5.0%	8.9%	0.006***

The sample includes 575 banks in 20 countries in the MENA region. The sample is divided into two sub-samples: conventional banks and Islamic banks. As measures of bank profitability, we use Return on Assets (ROA) and Return on Equity (ROE), and for the level of cost efficiency – Cost-to-Income ratio (C/I). To measure bank risk and stability, we use Z-Score, Multi-Level Performance Index (MLPS) and Financial Stability Indicator (FSI). Bank efficiency was measured as the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market competition was proxied by the Lerner index and the efficiency-adjusted Lerner index. All the variables except market competition and institutions are in percentage. Bank characteristics for different groups of banks are computed using data for the period 2006-2021. Bank-level characteristics, regulation, and macroeconomic variables are described in Appendix A.

indicators: ROA, ROE, and the C/I ratio. Stability ratios are represented by the distance to default (Z-score) and two comprehensive aggregate measures (MLPS and FSI). The performance and stability ratios of Islamic and conventional banks have been compared. Next, we present sample statistics for our explanatory and control variables related to bank performance. The data analysis in Table 2 highlights interesting facts regarding the performance of each group of banks (CBs and IBs).

First, CBs exhibit higher profitability during the entire observation period (2006-2021); and both ROA and ROE exceed the profitability levels of IBs. Moreover, IBs are less cost-effective; the C/I ratio significantly exceeds the cost inefficiency level of CBs (59.3% vs. 53.5%). Regarding aggregate performance indicators, the higher value of the composite measure MLPS shows a better assessment of bank performance for IBs than for CBs (1.69 vs. 0.83). However, the composite measure of financial stability (FSI) takes a negative value for IBs (mean of −0.02), indicating the relatively weak short-term stability of Islamic banking institutions.[9] Next, we observed that the CBs in our sample have slightly higher efficiency levels (on average) than the IBs (0.82 vs. 0.81), and the difference in means is strongly significant at the 1% level. Regarding the financial stability of different banking systems (measured by the Z-score), we notice that CBs are riskier than IBs (2.53 vs. 2.84). Additional analysis of bank riskiness before and during the COVID-19 pandemic indicates that the main reason for this result is the better financial stability of IBs during the pandemic period (2020-2021) as indicated by the higher Z-score (3.13 vs. 2.80). In addition, the average level of market competition (measured by the Lerner index) for the two samples (IBs and CBs) is 0.37 and 0.35 respectively, and ranges from −0.08 to 0.71 across the samples, indicating that the degree of market power is quite different across the countries in our sample.

Second, Table 2 shows that the mean values of capital adequacy ratio (CAR) for the whole sample is around 21%. However, IBs are much better capitalized than CBs (25.1% vs. 21.4%). The analysis also indicates that IBs have similar loan-to-total assets and non-interest income-to-revenue ratios, and both types of banks share similar growth in customer deposits, although they are slightly higher for IBs (20.6% vs. 17.1). Regarding liquidity, CBs have a high percentage of liquid assets (44.0% vs. 34.9%), whereas the level of leverage measured by the equity-to-total assets ratio seems similar across the two samples. In addition, non-financial (corporate) loan growth, which shows changes in the demand and supply of loans to non-financial institutions, is approximately 20% in both samples. We also present market competition estimates proxied by the efficiency-adjusted Lerner index. The average adjusted Lerner index is slightly higher for CBs than for IBs (0.58 vs. 0.55), and the mean difference between the two samples is significant at the 1% level. Finally, CBs have a higher level of non-performing loans (as a percentage of total loans) than IBs do (11.18% vs. 9.78%). In conclusion, the analysis indicates that IBs exhibit better performance, higher stability, and lower credit risk than their conventional peers do. Moreover, Islamic banking institutions seem to have higher market power, although the efficiency-adjusted Lerner index shows the opposite. The 'institution' index that proxies for the quality of institutional environment in each country has negative values for both samples of banks.

Table 3. Panel regressions of bank performance (CB vs. IB, 2006-2021).

	Conventional banks			Islamic banks		
Performance measures:	ROA	ROE	C/I	ROA	ROE	C/I
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	−0.003	0.031	0.233***	−0.010	−0.113	0.285*
	(0.748)	(0.310)	(0.000)	(0.764)	(0.233)	(0.059)
Efficiency	0.006	0.028**	−0.101***	0.015*	0.030**	−0.317***
	(0.133)	(0.042)	(0.000)	(0.102)	(0.015)	(0.000)
Lerner	0.011	0.028*	−0.182***	0.016*	0.114***	−0.179*
	(0.141)	(0.084)	(0.000)	(0.101)	(0.000)	(0.100)
Efficiency COVID-19*	−0.027***	−0.070***	0.104***	−0.003	−0.010	0.022
	(0.000)	(0.001)	(0.005)	(0.776)	(0.848)	(0.791)
Lerner COVID-19*	−0.013*	−0.007	0.011	−0.005*	−0.084*	0.221***
	(0.076)	(0.718)	(0.753)	(0.068)	(0.081)	(0.004)
Institutions	−0.000	−0.005	−0.001	0.001	−0.008	0.009
	(0.971)	(0.101)	(0.856)	(0.570)	(0.299)	(0.265)
Deposit Growth	0.006**	0.023***	0.039***	0.005	0.017	0.024
	(0.036)	(0.003)	(0.006)	(0.342)	(0.308)	(0.361)
Loan/Total Assets	−0.004	0.007	0.014	0.022***	0.026	−0.007
	(0.146)	(0.352)	(0.308)	(0.003)	(0.210)	(0.816)
Non-interest income	0.043***	0.102***	0.183***	0.029***	0.071**	0.079**
	(0.000)	(0.000)	(0.000)	(0.004)	(0.011)	(0.073)
Size	0.001**	0.010***	0.033***	0.002**	0.016***	0.024***
	(0.020)	(0.000)	(0.000)	(0.048)	(0.000)	(0.000)
(Non-financial) Loan growth	0.005*	0.040***	−0.028**	0.022***	0.032*	−0.018
	(0.086)	(0.000)	(0.064)	(0.001)	(0.108)	(0.573)
Liquid Assets	−0.003	0.031***	0.049**	0.004	0.029*	0.069*
	(0.209)	(0.000)	(0.001)	(0.673)	(0.073)	(0.098)
Equity/TA	0.007**	0.024***	0.126***	0.008	0.019	0.167***
	(0.031)	(0.007)	(0.000)	(0.280)	(0.391)	(0.000)
CAR	−0.011***	−0.068***	0.052***	−0.002*	−0.087***	0.033
	(0.002)	(0.000)	(0.004)	(0.074)	(0.000)	(0.356)
GDP Growth	−0.016	−0.043	−0.042	−0.041	−0.257***	0.339**
	(0.297)	(0.317)	(0.584)	(0.222)	(0.008)	(0.028)
Inflation	−0.006	−0.015	−0.047	−0.043	−0.035	−0.044
	(0.425)	(0.478)	(0.233)	(0.101)	(0.632)	(0.707)
GCC	−0.003*	−0.030	−0.136***	−0.011	0.016	0.114
	(0.104)	(0.253)	(0.004)	(0.734)	(0.857)	(0.422)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	4037	4037	4037	969	969	969
R-squared (Overall)	0.0468	0.1023	0.1034	0.0823	0.1579	0.1878

This table reports the results estimating the relationship between market competition, efficiency, and bank performance from 2006 to 2021, while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. To measure bank profitability, we use Return on Assets (ROA) and Return on Equity (ROE). Cost efficiency is proxied by the Cost to income (C/I) ratio. Bank efficiency was computed as the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market competition was proxied by the Lerner index and the efficiency-adjusted Lerner index. 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. Bank-level characteristics, institutions, and macroeconomic variables are described in Appendix A.

4.2. The effect of competition and efficiency on bank profitability

In this section, we present the results of bank performance tests using the model specifications determined in Eq. (1) and (2), respectively: In each regression, we used the Lerner index to proxy for the level of market competition, and the DEA average score to measure the efficiency level. Table 3 presents the results for different banking systems (CBs and IBs) for the entire period (2006-2021).

In support of our first hypothesis (H1a), market power significantly influences IBs profitability, and the positive sign of the estimated coefficients indicates that banks with high market power have better profitability (ROA and ROE). Furthermore, the coefficient of the competition variable (the Lerner index) is negatively associated with bank cost efficiency, indicating that banks with high market power also have better operational efficiency. Our results are consistent with those of Tan, Floros, and Anchor (2017) and Sun, Mohamad, and Ariff (2017). Moreover, these effects are similar across the two samples of banks (except for ROA). Consistent with prior research findings, we may conclude that by increasing their market power, 'banks could have flexibility in setting interest/profit rates to their customers. Banks may charge higher loan and profit rates while offering lower deposit and borrowing rates in order to maximize intermediation margins' (Sun, Mohamad, and Ariff 2017, 201).As a consequence of the increased consolidation in the banking sectors in the MENA region due to a merger or takeover of smaller banks by larger ones, banks have seen an increased level of concentration and market share. Regarding Islamic banking institutions, this finding suggests 'that IBs exhibit more concentration in providing quality financial products/services while showing a higher degree of market power' (Sun, Mohamad, and Ariff 2017, 201). The impact of market power on bank profitability (measured by ROA and ROE) is not only statistically significant, but also economically relevant.[10]

Similarly, efficiency is positively correlated with bank profitability in both samples (CBs and IBs), supporting our first hypothesis (H1a). This result aligns with the findings of previous studies, which suggest that efficiency is an important determinant of bank performance (Cristian, Leonarsan, and Kim 2020; Mateev, Sahyouni, and Al-Masaeid 2024). Therefore, increased market power and better efficiency seem to play positive roles in improving bank performance in the MENA region. We also assessed whether these effects were more pronounced during the COVID-19 pandemic. As expected, the new global financial crisis mitigates the positive influence of marker power (for IBs) and efficiency (for CBs) on bank profitability (the estimated coefficients of the two interaction terms are all significant and negative). While the moderating effect of the COVID-19 pandemic is significant in both samples, the differential impact of the crisis on IBs performance in terms of increased competition indicates that the measures to be taken by policymakers must be prioritized based on the IB's specific short-term response to the pandemic, the country's economic condition, and the government support initiatives.

The results for the control variables lead to the following conclusions: (i) the positive and significant coefficient of bank size indicates that larger banks have higher levels of profitability, (ii) banks with higher non-interest income exhibit better profitability, (iii) banks with higher capitalization levels are less profitable, (iv) banks that are more liquid and have a larger percentage of equity in the capital structure exhibit higher profitability levels, (v) banks with higher deposit growth are also more profitable, and (vi) the higher the percentage change (growth) in non-financial loans, the more profitable the bank is. These results indicate that although CBs and IBs operate under different business models, their profitability levels are driven by important bank characteristics such as deposit growth, non-interest income, size, leverage, and capital adequacy. Regarding the impact of macroeconomic conditions in different countries, economies that have seen economic and inflationary expansion are generally characterized by more profitable banking sectors; however, in our case,

Table 4. Panel regressions of bank performance (CB vs. IB, 2006-2019).

	Conventional banks			Islamic banks		
Performance measures:	ROA	ROE	C/I	ROA	ROE	C/I
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.007	0.031	0.549***	−0.033	0.147	0.750***
	(0.492)	(0.292)	(0.000)	(0.532)	(0.380)	(0.003)
Efficiency	0.004	0.012	−0.012*	0.033	0.031	−0.181**
	(0.657)	(0.637)	(0.082)	(0.167)	(0.655)	(0.018)
Lerner	−0.007	−0.036	0.384***	−0.008	−0.008	0.175*
	(0.634)	(0.375)	(0.000)	(0.810)	(0.993)	(0.058)
Efficiency Lerner*	0.002	0.065**	−0.260***	0.013	0.126**	−0.290*
	(0.852)	(0.013)	(0.001)	(0.714)	(0.019)	(0.082)
Efficiency CAR*	−0.000	−0.096***	0.095*	−0.043	−0.050	0.099
	(0.998)	(0.003)	(0.101)	(0.151)	(0.219)	(0.484)
Institutions	0.003***	0.008**	−0.008**	0.002	0.002	−0.001
	(0.003)	(0.010)	(0.032)	(0.366)	(0.741)	(0.484)
Deposit Growth	0.001	−0.005	0.024	−0.003	0.017	0.031
	(0.559)	(0.518)	(0.096)	(0.648)	(0.402)	(0.334)
Loan/Total Assets	−0.003	0.006	0.008	0.020***	0.011	−0.003
	(0.279)	(0.440)	(0.956)	(0.008)	(0.600)	(0.921)
Non-interest income	0.041***	0.098***	0.150***	0.033***	0.071***	0.032**
	(0.000)	(0.000)	(0.000)	(0.001)	(0.008)	(0.056)
Size	0.004	0.002	−0.009***	0.003*	0.004	−0.029***
	(0.497)	(0.135)	(0.004)	(0.077)	(0.565)	(0.000)
(Non-financial) Loan growth	0.003	0.024***	−0.040***	0.007*	−0.018	0.003
	(0.270)	(0.004)	(0.009)	(0.093)	(0.411)	(0.993)
Liquid Assets	−0.006**	−0.029**	0.067***	0.004	0.029	0.034
	(0.039)	(0.001)	(0.000)	(0.664)	(0.300)	(0.465)
Equity/TA	−0.001	0.003	−0.027	0.003	−0.001	−0.033
	(0.755)	(0.696)	(0.091)	(0.634)	(0.954)	(0.370)
CAR	−0.004	−0.037	0.053	0.034	0.072	−0.001
	(0.639)	(0.175)	(0.294)	(0.199)	(0.348)	(0.993)
GDP Growth	−0.033**	−0.011	0.091	−0.078**	−0.235**	0.374**
	(0.043)	(0.799)	(0.272)	(0.032)	(0.030)	(0.028)
Inflation	−0.016	−0.052	−0.134*	−0.071**	−0.008	0.068
	(0.252)	(0.178)	(0.062)	(0.022)	(0.929)	(0.635)
GCC dummy	0.001**	0.041**	−0.159***	−0.023	−0.206	0.061
	(0.021)	(0.019)	(0.000)	(0.648)	(0.163)	(0.796)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	3328	3328	3328	793	793	793
R-squared (Overall)	0.0568	0.1305	0.1923	0.1047	0.1877	0.2711

This table reports the results estimating the relationship between market competition, efficiency, and bank performance for the period 2006-2019, while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. To measure bank profitability, we use Return on Assets (ROA) and Return on Equity (ROE). Cost efficiency is proxied by the Cost to income (C/I) ratio. Bank efficiency was computed as the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market competition was proxied by the Lerner index and the efficiency-adjusted Lerner index. 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. Bank-level characteristics, institutions, and macroeconomic variables are described in Appendix A.

the estimated relationships are insignificant. Finally, conventional banks located in non-GCC member states seem to be more profitable and cost-efficient. However, in the case of IBs, this effect is insignificant across different regions.

The next two tables report the results for bank profitability in the pre-COVID-19 (Table 4) and COVID-19 periods (Table 5). Regarding our main variables of interest, the coefficients of the competition variable (the Lerner index) and the efficiency variable (the DEA average score) are statistically insignificant in the pre-COVID-19 period in both samples, indicating that increased market power and better efficiency are not

Table 5. Panel regressions of bank performance (CB vs IB, 2020-2021).

	Conventional banks			Islamic banks		
Performance measures:	ROA	ROE	C/I	ROA	ROE	C/I
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	−0.008	0.070	−0.062	0.122	0.147	0.238
	(0.878)	(0.562)	(0.768)	(0.471)	(0.380)	(0.226)
Efficiency	0.014	0.037	−0.122**	0.002	0.234*	−0.497***
	(0.470)	(0.419)	(0.023)	(0.966)	(0.100)	(0.004)
Lerner	−0.046	−0.025	0.166*	−0.014	−0.403*	0.246*
	(0.385)	(0.836)	(0.093)	(0.911)	(0.101)	(0.075)
Efficiency Lerner*	−0.060	−0.033	0.042	−0.014	−0.319**	0.584**
	(0.059)	(0.653)	(0.743)	(0.886)	(0.049)	(0.023)
Efficiency CAR*	−0.003	−0.041	0.130	0.050	0.070*	−0.994**
	(0.952)	(0.734)	(0.540)	(0.787)	(0.064)	(0.040)
Institutions	−0.004	−0.080	0.047	0.020	0.396	−0.063
	(0.941)	(0.595)	(0.855)	(0.906)	(0.298)	(0.277)
Deposit Growth	0.007	0.058***	0.050	−0.010	−0.005	−0.063*
	(0.354)	(0.003)	(0.143)	(0.495)	(0.868)	(0.098)
Loan/Total Assets	−0.004	−0.027	−0.023	0.001	0.049	−0.177**
	(0.684)	(0.265)	(0.575)	(0.976)	(0.507)	(0.043)
Non-interest income	0.089*	0.198*	1.304***	−0.537***	−0.372*	1.877***
	(0.055)	(0.066)	(0.000)	(0.004)	(0.070)	(0.000)
Size	−0.003	0.011***	0.058***	0.003	0.025**	0.068***
	(0.816)	(0.002)	(0.000)	(0.499)	(0.015)	(0.000)
(Non-financial) Loan growth	0.006	0.077***	−0.067*	0.089***	0.178***	−0.047**
	(0.485)	(0.001)	(0.083)	(0.000)	(0.001)	(0.038)
Liquid Assets	0.010	−0.025	−0.022	0.020	0.043	−0.084
	(0.339)	(0.319)	(0.605)	(0.502)	(0.532)	(0.290)
Equity/TA	0.039***	0.022	0.096**	0.065**	0.050	0.147**
	(0.001)	(0.419)	(0.043)	(0.017)	(0.412)	(0.041)
CAR	0.008	0.107	−0.227*	−0.082	−0.145	0.564**
	(0.837)	(0.256)	(0.064)	(0.395)	(0.502)	(0.025)
GDP Growth	−0.004	0.053	−0.488***	−0.004	−0.115	−0.400**
	(0.899)	(0.548)	(0.001)	(0.963)	(0.598)	(0.106)
Inflation	−0.010	−0.016	−0.043	0.017	−0.029	−0.065
	(0.551)	(0.670)	(0.527)	(0.814)	(0.860)	(0.735)
GCC dummy	0.001	0.000	0.027	0.005	−0.191	0.270
	(0.972)	(0.999)	(0.812)	(0.962)	(0.455)	(0.363)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	709	709	709	176	176	176
R-squared (Overall)	0.2737	0.4473	0.4763	0.2727	0.5008	0.6775

This table reports the results estimating the relationship between market competition, efficiency, and bank performance for the period 2020-2021, while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. To measure bank profitability, we use Return on Assets (ROA) and Return on Equity (ROE). Cost efficiency is proxied by the Cost to income (C/I) ratio. Bank efficiency was computed as the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market competition was proxied by the Lerner index and the efficiency-adjusted Lerner index. 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. Bank-level characteristics, institutions, and macroeconomic variables are described in Appendix A.

necessarily associated with increased bank profitability (ROE and ROA). However, the impact of these two variables on bank cost efficiency was significant (see Models 3 and 6). Specifically, IBs with better efficiency are more cost-effective (a negative relationship with the cost-to-income ratio), while CBs with high market power suffer from increased cost inefficiency. According to prior research, the 'main reason for inefficiency of Islamic banks is their early age and small size. Islamic banks have increased their competitiveness with the increase in experience and size' (Shah, Sukmana, and Fianto 2021, 476). Our

results indicate that IBs should seek efficiency improvements to reduce their operating costs and increase profitability.

Although the empirical literature on bank performance and stability considers the individual effects of market competition and efficiency, the joint impact of these two factors has not yet been examined. To do so, we include an interaction term (Efficiency × Lerner) in each model. We find that the coefficient estimates for the interaction term are significant and positive for the models in which the dependent variable is ROE, and negative for the C/I ratio. This finding indicates that more efficient banks are more (less) profitable when they operate in less (more) competitive markets (i.e. when market power is high/low). Similarly, an interaction term between the efficiency variable and CAR (Efficiency × CAR) is used to measure the moderating effect of a bank's capitalization level. The coefficient estimates for the interaction term are statistically significant and negative only for the group of CBs, indicating that any further increase in capital adequacy mitigates the positive impact of efficiency on bank performance. A likely reason for the observed difference is that prudential regulations may not have the same effect on the risk-taking behavior of IBs aimed at increasing profitability as in the case of CBs, because Islamic institutions have capital ratios that are considerably higher than those of their conventional peers (Abedifar, Molyneux, and Tarazi 2013; Louati, Abida, and Boujelbene 2015; Mateev, Sahyouni, and Al-Masaeid 2024).

Table 5 reports the regression results for bank profitability during the period of COVID-19 pandemic. In support of our first hypothesis (H1b), we find that market competition and efficiency significantly influence bank profitability; this effect is, however, more pronounced in the group of IBs. In other words, during the pandemic period (2020-2021), increased competition (banks' market power is low) and better efficiency are associated with higher profitability (ROE) and better cost efficiency (C/I). Therefore, IBs will be able to better mitigate the adverse effects of COVID-19 pandemic than their conventional peers since markets with increased level of competitiveness create favorable conditions for efficient banks to enhance their profit performance during the crisis period. This positive effect of increased competition is confirmed by the negative sign of the interaction term (Efficiency × Lerner). Therefore, government policies that stimulate market competition in the MENA region will create incentives for IBs to increase their profitability level if they operate more efficiently. As a result, IBs become more resilience to the adverse effects of the COVID-19 pandemic on their profitability. Our findings provide sufficient support to our last hypothesis (H3) and speak of a complementary effect of market competition on bank performance in the MENA region.

4.3. The effect of competition and efficiency on bank stability

This section investigates the impact of competition and efficiency on bank stability, and whether this effect is more pronounced during the COVID-19 pandemic. To analyze bank stability and soundness, we used the distance to default (Z-score), the multilevel performance index (MLPS), and the financial stability indicator (FSI).Table 6 illustrates the results for IBs and CBs for the entire period (2006-2021).

We find that the coefficient estimates for the competition variable (the Lerner index) are statistically significant and negative, indicating that increased marker power (less

Table 6. Panel regressions of bank stability (CB vs IB, 2006-2021).

	Conventional banks			Islamic banks		
Risk measures:	Z-Score	MLPS	FSI	Z-Score	MLPS	FSI
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	−0.334	−19.490***	0.207***	−1.373	−27.603***	0.150**
	(0.314)	(0.000)	(0.000)	(0.175)	(0.000)	(0.050)
Efficiency	0.401***	6.171***	−0.114***	0.256	10.115***	−0.086***
	(0.001)	(0.000)	(0.000)	(0.405)	(0.000)	(0.000)
Lerner	−0.082	−3.517**	0.034**	−0.761**	−4.345**	0.049**
	(0.724)	(0.010)	(0.038)	(0.021)	(0.014)	(0.049)
Efficiency COVID-19*	−0.397*	−5.225***	0.036*	−0.304	−3.221	0.006
	(0.071)	(0.000)	(0.097)	(0.594)	(0.289)	(0.890)
Lerner COVID-19*	0.524**	4.092***	−0.019*	0.125	4.435*	−0.060*
	(0.017)	(0.001)	(0.069)	(0.807)	(0.101)	(0.102)
Institution	0.101***	0.191	0.002	0.075	0.803*	0.002
	(0.004)	(0.347)	(0.554)	(0.373)	(0.075)	(0.652)
Deposit Growth	−0.250***	−0.759**	0.034***	−0.276	−0.077	0.020
	(0.003)	(0.129)	(0.000)	(0.125)	(0.935)	(0.125)
Loan/Total Assets	−0.389***	−5.298***	0.061***	−0.327	−6.292***	0.095***
	(0.000)	(0.000)	(0.000)	(0.152)	(0.000)	(0.000)
Non-interest income	−0.146	−2.305***	0.076***	0.152	−0.138	−0.015
	(0.276)	(0.003)	(0.000)	(0.607)	(0.930)	(0.501)
Size	0.087***	1.412***	−0.013***	0.176***	1.599***	−0.014***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
(Non-financial) Loan growth	0.259***	2.001***	−0.023**	0.030	3.780***	−0.059***
	(0.005)	(0.000)	(0.012)	(0.889)	(0.001)	(0.000)
Liquid Assets	0.471***	−2.499***	0.171***	−0.047	−4.219***	0.243***
	(0.000)	(0.000)	(0.000)	(0.867)	(0.005)	(0.000)
Equity/TA	0.210**	3.809***	−0.014*	0.213	2.816**	−0.023*
	(0.035)	(0.000)	(0.158)	(0.380)	(0.030)	(0.095)
CAR	−0.860***	−10.176***	0.182***	−0.387*	−8.812***	0.242***
	(0.000)	(0.000)	(0.000)	(0.101)	(0.000)	(0.000)
GDP Growth	−0.587	−1.852	−0.017	1.073	−1.642	0.008
	(0.206)	(0.495)	(0.704)	(0.299)	(0.053)	(0.909)
Inflation	0.660***	1.506	−0.004	1.334*	0.071	−0.060
	(0.005)	(0.275)	(0.843)	(0.092)	(0.986)	(0.310)
GCC dummy	0.118*	8.859***	−0.061**	1.441*	12.436**	−0.107
	(0.680)	(0.000)	(0.031)	(0.103)	(0.015)	(0.141)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	4037	4037	4037	969	969	969
R-squared (Overall)	0.0598	0.1136	0.4021	0.0811	0.1645	0.3738

This table reports the results estimating the relationship between market competition, efficiency, and bank stability from 2006 to 2021, while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. To measure bank risk and stability, we use distance-to-default (Z-Score), Multi-Level Performance Index (MLPS) and Financial Stability Indicator (FSI). Bank efficiency was computed as the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market competition was proxied by the Lerner index and the efficiency-adjusted Lerner index. 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. Bank-level characteristics, institutions, and macroeconomic variables are described in Appendix A.

competition) is associated with reduced financial stability and performance (measured by the Z-score and MLPS). This effect is similar across the CB and IB samples and supports our second hypothesis (H2a). Regarding the second variable of main interest, the estimated coefficients of the efficiency variable are statistically significant and positive, indicating that improved efficiency leads to higher bank stability and soundness.[11] However, the expected signs of competition and efficiency effects are opposite to our predictions when the dependent variable is the short-term financial stability indicator (FSI). Specifically, market power is positively associated with short-term financial stability, whereas

the efficiency effect is negative for both samples. As explained in Section 4.1, the analysis of the short-term financial stability indicator shows that FSI values were not homogeneous across the two samples and negative in the case of IBs, which indicates a substantial credit risk related to NPLs, especially during the pandemic period. A similar relationship was reported by Miklaszewska, Kil, and Idzik (2021), who studied bank performance and stability in the Central, Eastern, and Northern Europe (CENE) region during the COVID-19 pandemic.

The moderating effect of COVID-19 on bank stability is statistically significant and negative for efficiency, indicating the decreased stability of efficient banks during the pandemic. By contrast, banks operating in more competitive markets (when the bank's market power is low) enjoy better performance and stability during the COVID-19 period. Our results align with the prediction of competition-stability theory (Boyd and De Nicoló 2005) and the findings of previous empirical studies (see e.g. Mirzaei, Liu, and Moore 2013; Fiordelisi and Mare 2014). More specifically, they support da Silva Neto (2021), who claims that 'competitive and/or less concentrated banking systems are more stable'. In other words, banks with less market power pursue less-risky investment strategies. Turning to the control variables, we assert that most variables are statistically significant, with an expected positive or negative impact, as per empirical literature (see Appendix A).

To further differentiate the effects of market competition and efficiency on bank stability across different banking systems and time periods, we compared these effects during the pre-COVID-19 period (Table 7) and the COVID-19 pandemic (Table 8). Both market competition (the Lerner index) and efficiency are significant determinants of bank stability and soundness during the pre-pandemic period. The coefficient estimates for the interaction term (Efficiency×Lerner) are statistically significant in both samples, thus supporting our last hypothesis (H3). This finding indicates that efficient banks with higher market power were more sustainable during the pre-COVID-19 period (a positive sign of the interaction term). In contrast, the negative sign of the interaction term with CAR indicates that a further increase in the capitalization level of efficient banks exposed them to greater risk of default (a negative sign of the interaction term). As predicted, the results for the pandemic period (2020-2021) show a strong differential effect of market competition (and efficiency) on IBs stability (Table 8). Furthermore, the significant interaction effects of efficiency and market power indicate (see Models 4 though 6) that efficient banks operating in more competitive environments were more stable during the recent financial crisis. This provides further support for our last hypothesis (H3).

Our findings align with the competition-fragility hypothesis, which suggests several arguments that support this view (Keeley 1990; Hellmann, Murdock, and Stiglitz 2000; Allen and Gale 2004). The first postulates that increased market competition reduces market power and profits, thereby weakening a bank's franchise value. Consequently, banks may have more incentives to take additional risks to cover the reduction in franchise value and profit. The second argument suggests 'that in more competitive banking environments, the economic rents from intermediation decrease considerably, leading banks to reduce their screening of potential borrowers and, thus, overall portfolio credit quality declines' (da Silva Neto 2021, 16). In both cases, aggressive competition motivates banks to improve financial stability. In the context of the

Table 7. Panel regressions of bank stability (CB vs. IB, 2006-2019).

	Conventional banks			Islamic banks		
Risk measures:	Z-Score	MLPS	FSI	Z-Score	MLPS	FSI
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	1.652***	−14.675***	0.108***	−1.573	−22.377**	0.056
	(0.001)	(0.000)	(0.001)	(0.388)	(0.027)	(0.644)
Efficiency	0.197	6.693***	−0.125**	2.395***	12.766***	−0.063*
	(0.506)	(0.000)	(0.000)	(0.002)	(0.003)	(0.057)
Lerner	−0.737	−7.258***	0.083*	−2.330**	−2.254*	0.224***
	(0.113)	(0.009)	(0.070)	(0.025)	(0.096)	(0.003)
Efficiency Lerner*	0.899**	4.573*	−0.089*	2.029*	7.128**	−0.203**
	(0.048)	(0.090)	(0.050)	(0.069)	(0.049)	(0.014)
Efficiency CAR*	−1.349***	−11.379***	0.204***	−2.564***	−15.665***	0.246***
	(0.000)	(0.000)	(0.000)	(0.007)	(0.003)	(0.000)
Institutions	0.035	0.322	0.001	−0.037	0.292	0.005
	(0.337)	(0.145)	(0.665)	(0.694)	(0.576)	(0.387)
Deposit Growth	−0.383***	−2.062***	0.048***	−0.402*	−0.160	0.041***
	(0.000)	(0.000)	(0.000)	(0.073)	(0.897)	(0.009)
Loan/Total Assets	−0.204**	−3.151***	0.021**	−0.204	−3.234**	0.049***
	(0.027)	(0.000)	(0.018)	(0.408)	(0.018)	(0.005)
Non-interest income	−0.066	−1.676**	0.055***	0.234	0.491	−0.019
	(0.619)	(0.034)	(0.000)	(0.422)	(0.762)	(0.357)
Size	−0.013	0.802***	−0.007***	0.004	0.718	0.002
	(0.654)	(0.135)	(0.000)	(0.950)	(0.103)	(0.588)
(Non-financial) Loan growth	−0.258**	1.944***	−0.018*	0.011	2.683**	−0.047***
	(0.010)	(0.001)	(0.056)	(0.962)	(0.049)	(0.006)
Liquid Assets	0.359***	−3.918***	0.221***	−0.159	−5.255***	0.242***
	(0.000)	(0.001)	(0.000)	(0.608)	(0.002)	(0.000)
Equity/TA	−0.027	2.513***	−0.022**	−0.165	2.437	−0.018
	(0.824)	(0.001)	(0.024)	(0.601)	(0.164)	(0.314)
CAR	0.094	4.199**	−0.060*	1.403*	1.408	0.068
	(0.763)	(0.024)	(0.056)	(0.093)	(0.761)	(0.259)
GDP Growth	0.121	0.932	−0.108**	0.694	−9.264	−0.065
	(0.820)	(0.768)	(0.033)	(0.554)	(0.155)	(0.440)
Inflation	1.660***	6.335**	−0.019*	1.222	−0.556	−0.130*
	(0.000)	(0.018)	(0.055)	(0.222)	(0.920)	(0.069)
GCC dummy	0.277*	12.239***	−0.056***	1.245	2.647	−0.215*
	(0.060)	(0.000)	(0.005)	(0.438)	(0.766)	(0.064)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	3328	3328	3328	793	793	793
R-squared (Overall)	0.0819	0.2213	0.4348	0.0885	0.2373	0.4304

This table reports the results estimating the relationship between market competition, efficiency, and bank stability for the period 2006-2019, while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. To measure bank risk and stability, we use distance-to-default (Z-Score), Multi-Level Performance Index (MLPS) and Financial Stability Indicator (FSI). Bank efficiency was computed as the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market competition was proxied by the Lerner index and the efficiency-adjusted Lerner index. 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. Bank-level characteristics, institutions, and macroeconomic variables are described in Appendix A.

MENA region, our analysis indicates that the effects of competition and efficiency are significant only in the sample of IBs. In other words, during COIVD-19, IBs with less marker power (high market competition) but superior efficiency improves their overall performance and stability during the pandemic period. This can be explained by the efficient structure (ES) hypothesis, which 'predicts that under the pressure of market competition, efficient firms defeat the competition and grow, so that they become larger, obtain greater market share, and earn higher profits' (Homma,

Table 8. Panel regressions of bank stability (CB vs. IB, 2020-2021).

	Conventional banks			Islamic banks		
Risk measures:	Z-Score	MLPS	FSI	Z-Score	MLPS	FSI
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	2.565**	−2.209	0.070	−3.078*	−22.231***	−0.035
	(0.049)	(0.699)	(0.525)	(0.065)	(0.000)	(0.776)
Efficiency	0.471	3.027	0.038	2.797*	10.578**	−0.067**
	(0.338)	(0.160)	(0.360)	(0.055)	(0.040)	(0.038)
Lerner	−1.475	−0.836	0.080	−2.053*	−0.690**	0.358*
	(0.267)	(0.886)	(0.478)	(0.082)	(0.047)	(0.101)
Efficiency Lerner*	−0.929	−5.739	−0.098	−3.746*	−16.541**	0.008*
	(0.244)	(0.105)	(0.150)	(0.085)	(0.032)	(0.056)
Efficiency CAR*	0.608	0.060	0.150	0.403**	32.581**	−0.746**
	(0.646)	(0.992)	(0.185)	(0.021)	(0.025)	(0.015)
Institutions	1.798	−2.710	−0.125	0.971	6.041	−0.532
	(0.268)	(0.703)	(0.367)	(0.795)	(0.649)	(0.058)
Deposit Growth	−0.109	−0.624	0.013	−0.440	−0.472	0.014
	(0.606)	(0.501)	(0.460)	(0.176)	(0.682)	(0.540)
Loan/Total Assets	−0.710***	−14.244***	0.238***	1.259*	13.231***	−0.266***
	(0.006)	(0.000)	(0.000)	(0.090)	(0.000)	(0.000)
Non-interest income	−1.607	−6.819	0.598***	−8.177**	−28.708**	0.003
	(0.163)	(0.176)	(0.000)	(0.046)	(0.048)	(0.992)
Size	0.079**	0.802***	−0.003*	0.339***	1.437***	−0.012*
	(0.039)	(0.000)	(0.076)	(0.001)	(0.000)	(0.588)
(Non-financial) Loan growth	−0.616**	−0.110	−0.041**	0.326	2.307	0.014
	(0.010)	(0.916)	(0.044)	(0.528)	(0.209)	(0.708)
Liquid Assets	0.327	1.051	0.177***	−1.131*	−1.836	0.309***
	(0.225)	(0.374)	(0.000)	(0.095)	(0.445)	(0.000)
Equity/TA	−0.137	−0.432	0.100***	0.297**	−2.115	0.178***
	(0.643)	(0.739)	(0.000)	(0.026)	(0.328)	(0.000)
CAR	−0.221	2.640	−0.087	3.681*	−10.231	0.459***
	(0.827)	(0.552)	(0.311)	(0.084)	(0.176)	(0.004)
GDP Growth	2.069**	5.051	−0.136*	2.911	6.101	−0.189
	(0.030)	(0.226)	(0.094)	(0.177)	(0.424)	(0.242)
Inflation	0.081	−2.008	0.006	−0.402	1.392	−0.045
	(0.848)	(0.281)	(0.866)	(0.805)	(0.810)	(0.713)
GCC dummy	−1.995***	−2.640	−0.071	2.174	9.441	0.223
	(0.005)	(0.399)	(0.243)	(0.388)	(0.290)	(0.236)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	709	709	709	176	176	176
R-squared (Overall)	0.2800	0.5785	0.5448	0.4600	0.7560	0.5796

This table reports the results estimating the relationship between market competition, efficiency, and bank stability for the period 2020-2021, while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. To measure bank risk and stability, we use distance-to-default (Z-Score), Multi-Level Performance Index (MLPS) and Financial Stability Indicator (FSI). Bank efficiency was computed as the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market competition was proxied by the Lerner index and the efficiency-adjusted Lerner index. 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. Bank-level characteristics, institutions, and macroeconomic variables are described in Appendix A.

Tsutsui, and Uchida 2014, 143). Consequently, IBs have become more resilient to the COVID-19 pandemic than their conventional peers. Therefore, Islamic banking institutions may be assigned a more essential role during the post-COVID-19 revival.

5. Robustness checks and alternative specifications

Numerous tests have been conducted to assess the robustness of the results. First, we employ the Generalized Method of Moments (GMM) estimator developed by Arellano

Table 9. Panel regressions (one-step GMM estimator) of bank performance (CB vs IB, 2006-2021).

	Conventional banks			Islamic banks		
Performance measures:	ROA `a	ROE (2)	C/I (3)	ROA (4)	ROE (5)	C/I (6)
Constant	0.087	0.086	0.209	−0.197	−0.122	0.561
	(0.131)	(0.450)	(0.310)	(0.425)	(0.813)	(0.381)
Efficiency	0.016	0.064*	−0.067	0.031**	0.174**	−0.169*
	(0.354)	(0.057)	(0.305)	(0.038)	(0.015)	(0.067)
Lerner	0.058**	0.056*	−0.166**	0.008*	0.103**	−0.089*
	(0.048)	(0.091)	(0.032)	(0.057)	(0.039)	(0.086)
Efficiency COVID-19*	−0.048*	−0.013**	0.103*	−0.024	0.041	−0.079
	(0.080)	(0.019)	(0.065)	(0.269)	(0.638)	(0.379)
Lerner COVID-19*	−0.010	−0.020	0.167	−0.080**	−0.207*	0.214*
	(0.724)	(0.750)	(0.722)	(0.026)	(0.060)	(0.053)
Institutions	0.002	0.005	−0.005	0.003	0.004	−0.021
	(0.293)	(0.297)	(0.567)	(0.905)	(0.674)	(0.133)
Deposit Growth	0.014**	0.023*	−0.049**	0.007	0.019	−0.056
	(0.033)	(0.1012)	(0.042)	(0.337)	(0.370)	(0.206)
Loan/Total Assets	−0.001	0.019	0.064***	0.019*	0.023	−0.007
	(0.077)	(0.172)	(0.002)	(0.065)	(0.324)	(0.856)
Non-interest income	0.027**	0.121***	0.006*	0.012	0.036	−0.037
	(0.044)	(0.000)	(0.088)	(0.131)	(0.257)	(0.439)
Size	−0.005**	−0.009*	0.049***	−0.004*	0.001*	0.040***
	(0.033)	(0.070)	(0.000)	(0.090)	(0.068)	(0.000)
(Non-financial) Loan growth	0.013	0.053**	−0.057**	0.008**	0.048*	−0.018
	(0.132)	(0.020)	(0.029)	(0.031)	(0.050)	(0.639)
Liquid Assets	0.122**	0.328***	0.127	0.060	0.221*	0.368**
	(0.044)	(0.004)	(0.418)	(0.138)	(0.090)	(0.029)
Equity/TA	−0.027*	−0.014	0.043	−0.023*	−0.080	0.010
	(0.088)	(0.642)	(0.373)	(0.078)	(0.174)	(0.875)
CAR	−0.098*	−0.042	0.815***	0.092*	0.102	−0.500***
	(0.062)	(0.689)	(0.000)	(0.068)	(0.340)	(0.000)
GDP Growth	0.114	0.284*	−0.317	−0.047	−0.438	0.374
	(0.200)	(0.073)	(0.166)	(0.622)	(0.304)	(0.230)
Inflation	−0.008	−0.028	−0.238	−0.066	−0.081	0.381
	(0.987)	(0.798)	(0.125)	(0.493)	(0.621)	(0.133)
Lag_1(Profitability)	0.618***	0.447***	0.672***	0.329***	0.371***	0.381***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GCC	0.036	0.072	−0.022	0.257	0.335	−0.749
	(0.315)	(0.467)	(0.871)	(0.302)	(0.535)	(0.253)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	3439	3439	3439	840	840	840
P-value for AR (1) test	0.000	0.000	0.000	0.014	0.005	0.000
P-value for AR (2) test	0.357	0.467	0.480	0.882	0.330	0.895
Sargan-Hansen test of overidentification	101.579	92.237	90.721	90.152	104.132	114.570
(*p-value*)	(0.1359)	(0.3301)	(0.3712)	(0.9054)	(0.3687)	(0.3387)

This table reports the results estimating the relationship between market competition, efficiency, and bank performance from 2006 to 2021, while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. We use a one-step Generalized Method of Moments (GMM) estimator. To measure bank profitability, we use Return on Assets (ROA) and Return on Equity (ROE). Cost efficiency is proxied by the Cost to income (C/I) ratio. Bank efficiency was computed as the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market competition was proxied by the Lerner index and the efficiency-adjusted Lerner index. 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. Bank-level characteristics, institutions, and macroeconomic variables are described in Appendix A.

and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998) to re-estimate Eq. (1) and Eq. (2). Specifically, we used the one-step system GMM estimator because the empirical literature reported that 'the two-step method could lead to erroneous conclusions, especially in the case of heteroscedasticity of the random component'

Table 10. Panel regressions (GMM estimator) of bank stability (CB vs IB, 2006-2021).

	Conventional banks			Islamic banks		
Risk measures:	Z-Score	MLPS	FSI	Z-Score	MLPS	FSI
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	−0.675	−20.362	0.041	−16.029	6.371	−0.191
	(0.781)	(0.294)	(0.526)	(0.330)	(0.836)	(0.629)
Efficiency	0.424	9.336**	−0.064***	0.336	15.508**	−0.049**
	(0.676)	(0.012)	(0.000)	(0.702)	(0.025)	(0.035)
Lerner	−4.994***	−0.103*	0.021*	−0.388	−2.498**	0.036*
	(0.000)	(0.087)	(0.059)	(0.665)	(0.046)	(0.052)
Efficiency COVID-19*	−1.807*	−13.133*	0.062***	−3.363**	−0.805	0.052*
	(0.073)	(0.073)	(0.004)	(0.016)	(0.887)	(0.107)
Lerner COVID-19*	0.392*	5.907**	−0.072*	2.330**	2.026	−0.074*
	(0.064)	(0.014)	(0.099)	(0.043)	(0.631)	(0.059)
Institution	−0.252	0.170	0.002	−0.042	−0.111	−0.001
	(0.174)	(0.855)	(0.517)	(0.858)	(0.896)	(0.811)
Deposit Growth	−0.598**	−10.726**	0.049***	−0.833*	−3.063**	0.044**
	(0.034)	(0.029)	(0.000)	(0.067)	(0.041)	(0.028)
Loan/Total Assets	−0.182	−2.281	−0.004	−0.050	3.861*	−0.025**
	(0.881)	(0.507)	(0.538)	(0.961)	(0.096)	(0.037)
Non-interest income	1.091	15.674	0.025	−0.716	1.908	−0.007
	(0.694)	(0.359)	(0.225)	(0.750)	(0.581)	(0.712)
Size	0.375	−1.028	−0.002	0.100	−0.270	−0.007**
	(0.199)	(0.334)	(0.115)	(0.504)	(0.584)	(0.021)
(Non-financial) Loan growth	0.400*	8.864**	−0.053***	0.400*	4.206*	−0.031*
	(0.075)	(0.047)	(0.000)	(0.076)	(0.092)	(0.093)
Liquid Assets	−2.905	5.643	0.163***	0.268	4.690	0.279***
	(0.513)	(0.608)	(0.000)	(0.914)	(0.276)	(0.000)
Equity/TA	−2.225**	3.022	0.004**	−1.101	−1.185	−0.002
	(0.023)	(0.592)	(0.033)	(0.290)	(0.570)	(0.844)
CAR	−7.321*	−4.508	0.082**	−1.690*	−1.173	0.095*
	(0.069)	(0.814)	(0.014)	(0.074)	(0.817)	(0.105)
GDP Growth	6.583	8.505	−0.052	7.466	−4.416	−0.005
	(0.071)	(0.755)	(0.626)	(0.274)	(0.619)	(0.996)
Inflation	−0.587	−4.397	0.108	2.665	−8.196	0.094
	(0.794)	(0.650)	(0.115)	(0.489)	(0.435)	(0.233)
Lag_1(Default risk)	0.500***	0.602***	0.916***	0.667***	0.787***	0.785***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GCC dummy	−0.528	37.365**	0.020	15.138	6.8130	0.376
	(0.789)	(0.049)	(0.581)	(0.348)	(0.822)	(0.327)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	3439	3439	3439	840	840	840
P-value for AR (1) test	0.000	0.000	0.000	0.000	0.000	0.001
P-value for AR (2) test	0.735	0.565	0.922	0.370	0.542	0.320
Sargan-Hansen test of overidentification	47.600	31.195	117.195	43.612	29.292	94.618
(*p-value*)	(0.5300)	(0.4058)	(0.9199)	(0.4027)	(0.6524)	(0.7995)

This table reports the results estimating the relationship between market competition, efficiency, and bank stability from 2006 to 2021, while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. We use a one-step Generalized Method of Moments (GMM) estimator. To measure bank risk and stability, we use Z-Score, Multi-Level Performance Index (MLPS) and Financial Stability Indicator (FSI). Bank efficiency was computed as the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market competition was proxied by the Lerner index and the efficiency-adjusted Lerner index. 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. Bank-level characteristics, institutions, and macroeconomic variables are described in Appendix A.

(Miklaszewska, Kil, and Idzik 2021, 12). For consistency of the GMM estimator, we test the validity of our instruments using the Sargan-Hansen test and the Arellano-Bond test in the absence of second-order correlation (AR (2)). The failure to reject the null hypothesis for the Sargan-Hansen test shows no evidence of over-identification restrictions,

indicating the validity of our instrument. Moreover, the Arellano-Bond test for AR (2) provides evidence that the second-order autocorrelation coefficient is zero. Therefore, our estimates were valid. Tables 9 and 10 present the results of the regression analysis using the one-step system GMM estimator. Supporting our previous results in Table 3, we find that market power (the Lerner index) and efficiency are positively associated with bank performance (ROA and ROE) and negatively related to cost efficiency (C/I). These effects are significant for both samples (Table 9). Furthermore, our analysis indicates that COVID-19 mitigates the positive influence of marker power and efficiency on bank profitability. Table 10 displays the results for bank stability. We observed a negative association between marker power (the Lerner index) and financial stability. In contrast, the coefficients of the efficiency variable are statistically significant and positive, indicating that efficient banks exhibit better stability (measured by the Z-score) and performance (proxied by MLPS). Finally, we report a significant moderating effect of the COIVD-19 pandemic on the relationship between efficiency, competition, and bank stability.

Second, we run several alternative specifications. Following prior research, we use 'the efficiency-adjusted Lerner index as an alternative measure of market power' (Abulkhair, Mensi, and Labidi 2018, 221). This proxy corresponds to the power of a bank that influences the prices of its banking products. The relatively higher values of the efficiency-adjusted Lerner index indicate high market power of the banks included in our sample (see Table 2). Appendix B (Table B-1) presents the results of our analysis using the efficiency-adjusted Lerner index. Our main findings are similar to those reported using the traditional Lerner index. Specifically, market power is positively associated with bank profitability; this effect is more pronounced in the sample of IBs, but significantly weakened during the COVID-19 pandemic. Next, we replace the non-interest income to total assets variable with revenue diversification in order to test the hypothesis that banks with better revenue diversification have higher profitability levels. In line with da Silva Neto (2021) 'revenue diversification is measured by the ratio of non-interest income to operating revenues'. In the same regression, we assess the impact of non-performing loans (NPLs) as a measure of bank credit risk. The results of the regression analysis, including these two variables, are presented in Appendix B (Table B-2). We find a positive association between revenue diversification and bank profitability, thus supporting our hypothesis. However, consistent with the findings of Ahmed, El-Halaby, and Soliman (2022) and other similar studies, we report a strong negative association between NPLs and the financial performance of banks.

In addition to the traditional (accounting) measures of bank performance used in this paper (ROA and ROE), we employ an alternative (market-based) proxy of bank performance – Tobin's Q (see Abdallah and Ismail 2017). The results are reported in Appendix D (Table D-1) together with the regression outputs for models using ROA and ROE as dependent variables. Our results indicate that the financial performance of banks (measured by Tobin's Q) in the MENA region is strongly determined by the market power and efficiency of these institutions and this effect is more pronounced for IBs but deteriorates during the COVID-19 pandemic.

We further investigate whether market competition (the Lerner index) and financial performance are endogenously determined. Table E-1 in Appendix E presents the

estimation results of the instrumental variables (IV) regressions using the 2SLS. As expected, the instrument (two lags of Lerner index) is highly significant in the first stage regression. In the second stage, we find a positive and highly significant relationship between the fitted value of Lerner index and the financial performance (measured by ROA and ROE) for different samples of banks. The result is consistent with those presented in Tables 3–5 and suggests that the larger the market power (less market competition), the better the financial performance of the MENA banks. The results for the Hausman test fail to reject the null hypothesis that the market power is exogenous. Moreover, our instrument passed the Stock and Yogo (2005) test for weak instruments. We also estimate the 2SLS regression to address the endogeneity concerns between efficiency and financial performance. While in the first stage, the instrument used (first lag of efficiency) is highly significant, the predicted value of this instrument is statistically insignificant in the second stage (the results are available on request).

Finally, we considered the possibility that the sample size may have driven our results. As we are comparing the performance of IBs and CBs, there may be systematic differences between the two groups that could affect our analysis. To address this issue, we employ the Propensity Score Marching (PSM) technique (Rosenbaum and Rubin 1983), which allows us to create a more balanced comparison group by matching each Islamic bank with a conventional bank that has similar observable characteristics. This helps reduce the effects of confounding variables and allows for a more accurate estimation of the treatment effect. To be consistent with our regression results in Tables 3 and 6, the controls used to calculate the propensity score were the same country- and bank-level characteristics used as controls in the regression analysis. Table E-2 presents the results of the PSM analysis for different performance measures (profitability and risk). These results support the findings in Tables 3 and 6 that efficiency and competition have similar effects on bank performance among the two groups of banks (IBs and CBs).

6. Conclusions

Several studies have investigated the individual effects of efficiency and market competition on the risk and performance of different banking systems, in either a single-country or cross-country context. To the best of our knowledge, no econometric study has examined whether and how efficiency and market competition interact and influence banking sector performance in the MENA region. Compared with other developing economies, the MENA region has some specificities that make bank stability problems more complex. One of them is Islamic banking and finance. Therefore, it is important to assess the role of efficiency and market competition to the stability of Islamic banking institutions during the COVID-19 pandemic. Our main finding is that the more efficient IBs are, the more profitable and stable they are during a pandemic crisis.

Our results provide further support for the competition-efficiency-stability paradigm, which states that, in general, market power and efficiency increase bank profitability and financial stability. We also examine whether the effect of competition and efficiency on bank performance differs between the two banking systems (Islamic and conventional), and whether it is more pronounced during the recent financial crisis. We find that the COVID-19 pandemic has mitigated the positive influence of marker power and

efficiency on bank profitability. Further analysis of bank stability in the MENA region in the pre-crisis period indicates that efficient banks with high market power can achieve better stability. However, during the pandemic, competitive markets created favorable conditions for efficient banks to attain higher financial stability. These effects were stronger in the sample of IBs . Therefore, the higher level of IBs resilience to the COVID-19 pandemic compared to their conventional peers, can be seen as a result of introducing new governance-related initiatives based on Shariah principles that enable Islamic banking institutions to mitigate the adverse effects of the pandemic crisis (Abdulla and Ebrahim 2022).

In addition, we contribute to the existing literature by addressing the issue of whether market competition reinforces banks' efficiency, or if they are 'substitutes' in explaining bank performance and risk. Our results suggest that, in the pre-COVID-19 period, less competitive markets allow efficient banks with high maker power to achieve better profitability. These banks are also more stable and independent of the business model used. However, during the COVID-19 pandemic (2020-2021), the moderating effect of market competition was significant only in the sample of Islamic banking institutions. In other words, more efficient IBs are more stable if they operate in competitive markets. Thus, we may conclude that, during the pandemic, market competition reinforces the positive impact of efficiency on bank performance. Our results align with the prediction of competition-stability theory and previous empirical studies which confirmed that 'competitive and/or less concentrated banking systems are more stable' (da Silva Neto 2021, 16). In other words, banks with less market power will pursue less-risky investment strategies in order to maintain stability. Similarly, bank managers are requested to apply revenue diversification strategies that will increase bank profitability and stability (Li et al. 2021).

Our results are important for regulators, policymakers, and bank managers to help expand their understanding of the implications of the recent financial crisis on banking systems in the MENA region, in terms of efficiency, financial stability, and profitability. Specifically, our results call for changes in the regulatory framework that force Islamic banks to operate in accordance with best practices and increase their efficiency to become more sustainable. Efficient banks are more profitable in concentrated markets (i.e. low competition). However, policymakers should carefully design their policies to support competition in the banking industry in the MENA region, as competitive markets have a positive influence on bank stability during the COVID-19 pandemic. Our findings also have managerial implications related to the fact that bank managers have to opt for an optimal efficiency level that best fits the bank business model and the level of competition in the country. Furthermore, because banks with strong marker power are more profitable but less stable in competitive environments, bank managers should adopt appropriate risk diversification strategies to increase bank stability and soundness. These strategies are particularly relevant in the context of the recent financial crisis, which is characterized by an increase in credit risk and operating costs. As market competition and efficiency play a significant role in the sustainable performance of Islamic banks during the pandemic, policymakers and regulators should implement a set of policies and best practices that support competition and banking system stability in the MENA region and assign a more essential role to Islamic banks in the post-COVID-19 revival.

Future research in this field will focus on evaluating the effects of governance mechanisms, such as ownership concentration and board of directors' diversity, on the performance of Islamic banks in the MENA region. Specifically, we will investigate whether ownership concentration and competition are substitutes or complements that improve bank performance. Next, our analysis will examine the moderating role of board gender diversity in the relationship between board composition and bank efficiency in the MENA region. Encouraging Islamic (and other) banks to implement specific quotas or guidelines to enhance the gender diversity of bank board structures can contribute to improving efficiency and competitiveness in the region.

Notes

1. The empirical literature alsoexamined 'the influence of the dual board structure on the financial performance of Islamic banks' (Farag, Mallin, and Ow-Yong 2018, 59). Someauthorsfind 'that the larger the Shari'ah Supervisory Board (SSB) the better the financial performance and this result reinforces the fundamental role of the SSB to certify permissible financial instruments and products' (Farag, Mallin, and Ow-Yong 2018, 59).
2. Using a sample of 532 banks (129 Islamic and 403 conventional) located in 23 Muslim countries, Boubaker et al. (2023) investigated 'whether the Islamic banking business model makes corporate earnings more uncertain'. They reported that 'IBs' return on assets is significantly more uncertain than CBs due to higher operational costs' (Boubaker et al. 2023, 1).
3. According to Cosset, Somé, and Valéry (2016) market competition and corporate governance seem to be complementary in explaining firm value in developing countries. The complementarity hypothesis becomes even more important for banks in the sense that market competition may support internal governance mechanisms for improving bank performance.
4. In our robustness tests, we and employ the efficiency-adjusted Lerner index instead of the traditional Lerner index 'to deal with both cost and profit inefficiencies in the empirical measurement of the Lerner index' (da Silva Neto 2021, 24).
5. We also use non-interest income to total assets ratio as a proxy of revenue diversification (see Appendix A). The expect sign of the relationship with bank profitability is positive.
6. In the risk-taking models in which the dependent variable is Z-score, for methodological reasons, the NPL ratio was not included as an explanatory variable.
7. To address the issue of time-variant factors that might influence bank performance, we add year dummies to our baseline model and run a Robust Hausman test. The results indicate that the random effects specification is the valid model in this case. Another approach used in the empirical literature to address this issue is the two-way panel fixed effects model (Wooldridge 2021).
8. In the first stage, we estimate the main determinants of market power (the Learner index) and efficiency (DEA score) – as suspect endogenous variables – using their lagged variables (up to 3 lags) as instruments. In the second stage, we estimate the relationship between market power and efficiency and financial performance, 'controlling for the fitted variables of the suspect endogenous variable' (Farag, Mallin, and Ow-Yong 2018, 21).
9. 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. 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 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 that translates in negative values of FSI index. Furthermore, we removed few extreme values (outliers). The adjusted index values in Table 2 show slightly negative values for IBs and positive for CBs.
10. The economic relevance of the coefficient estimates in Table 3 indicates that, for instance, in column 2 and 5, a one standard deviation increase in market power (20%) leads to an

increase of 0.32% (0.016*20%) of bank profitability of CBs and 2.28% (0.114*20%) for IBs (measured by ROE).

11. The impact of market power on bank stability is not only statistically significant but also economically relevant. For instance, in Table 6, a one standard deviation increase in market power (20%), leads to a decrease of 1.64% (-0.082*20%) of bank stability of CBs and 15.22% (-0.761*20%) for IBs (measured by Z-Score). Likewise, the efficiency effects are economically relevant for both types of banks (CBs and IBs).

Disclosure statement

No potential conflict of interest was reported by the author(s).

Ethical compliance

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

References

Abdallah, A.A.-N., and A. Ismail. 2017. Corporate governance practices, ownership structure, and corporate performance in the GCC countries. *Journal of International Financial Markets, Institutions and Money* 46: 98–115.

Abdelsalam, O., M. Elnahas, H. Ahmed, and J. Williams. 2022. Asset securitization and bank stability: Evidence from different banking systems. *Global Finance Journal* 51, no. February 2022: 100551.

Abdulla, Y., and Y. Ebrahim. 2022. Effect of COVID-19 on the performance of Islamic and conventional GCC banks. *Review of Financial Economics* 40, no. 3: 239–258.

Abedifar, P., P. Molyneux, and A. Tarazi. 2013. Risk in Islamic banking. *Review of Finance* 17, no. 6: 2035–2096.

Abu-Alkheil, A.M., W.A. Khan, and G.M. Khartabiel. 2017. Do Islamic banks optimally balance the trade-off in capital structure mix? A comparison approach. *Quarterly Journal of Finance and Accounting* 55, no. 3-4: 1–36.

Abulkhair, M., S. Mensi, and W. Labidi. 2018. The Saudi Arabian banking competition and financial stability: Evidence through the market power paradigm. *International Review of Social Sciences* 6, no. 5: 214–226.

Ahmed, H.M., S.I. El-Halaby, and H.A. Soliman. 2022. The consequence of the credit risk on the financial performance in light of COVID-19: Evidence from Islamic versus conventional banks across MEA region. *Future Business Journal* 8, no. 1: 21.

Al-Awadhi, A.M., K. Alsaifi, A. Al-Awadhi, and S. Alhammadi. 2020. Death and contagious infectious diseases: Impact of the COVID-19 virus on stock market returns. *Journal of Behavioral and Experimental Finance* 27, no. C: 100326.

Alfaro, L., A. Chari, A.N. Greenland, and P.K. Schott. 2020. "Aggregate and firm-level stock returns during pandemics, in real time." NBER Working Paper Series Working Paper No. 26950.

Ali, M., and C.H. Puah. 2019. The internal determinants of bank profitability and stability: An insight from banking sector of Pakistan. *Management Research Review* 42, no. 1: 49–67.

Aliani, K., L. Al-kayed, and R. Boujlil. 2022. COVID-19 effect on Islamic vs. conventional banks stock prices: Case of GCC countries. *Journal of Economic Asymmetries* 26, no. November 2022: e00263.

Allen, F., and D. Gale. 2004. Competition and financial stability. *Journal of Money, Credit and Banking* 36, no. 3: 453–480.

Ammar, N., and A. Boughrara. 2019. The impact of revenue diversification on bank profitability and risk: Evidence from MENA banking industry. *Macroeconomics and Finance in Emerging Market Economies* 12, no. 1: 1–35.
Anginer, D., A. Demirguc-Kunt, and M. Zhu. 2014. How does competition affect bank systemic risk? *Journal of Financial Intermediation* 23, no. 1: 1–26.
Arellano, M., and S. Bond. 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies* 58, no. 2: 277–297.
Arellano, M., and O. Bover. 1995. Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics* 68, no. 1: 29–51.
Ashraf, B.N. 2020. Stock markets' reaction to COVID-19: Cases or fatalities? *Research in International Business and Finance* 54: 101249.
Ashraf, B.N., M.I. Tabash, and M.K. Hassan. 2022. Are Islamic banks more resilient to the crises vis-à-vis conventional banks? Evidence from the COVID-19 shock using stock market data. *Pacific-Basin Finance Journal* 73: 101774.
Assaf, A.G., A.N. Berger, R.A. Roman, and M.G. Tsionas. 2019. Does efficiency help banks survive and thrive during financial crises? *Journal of Banking and Finance* 106: 445–470.
Banker, R.D., A. Charnes, and W.W. Cooper. 1984. Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science* 30: 8–92.
Barth, J., C. Lin, Y. Ma, J. Seade, and F.M. Song. 2013. Do bank regulation, supervision and monitoring enhance or impede bank efficiency? *Journal of Banking and Finance* 37: 2879–2892.
Belanès, A., Z. Ftiti, and R. Regaïeg. 2015. What can we learn about Islamic banks efficiency under the subprime crisis? Evidence from GCC Region. *Pacific-Basin Finance Journal* 33: 81–92.
Belasri, S., M. Gomes, and G. Pijourle. 2020. Corporate social responsibility and bank efficiency. *Journal of Multinational Financial Management* 54: 100612.
Bitar, M., W. Saad, and M. Benlemlih. 2016. Bank risk and performance in the MENA region: The importance of capital requirements. *Economic Systems* 40: 398–421.
Blundell, R., and S. Bond. 1998. Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics* 87: 115–143.
Borri, N., and G. Di Giorgio. 2021. Systemic risk and the COVID challenge in the European banking sector. *Journal of Banking and Finance* 6, no. February 2021: 106073.
Boubaker, S., T.D.Q. Le, and T. Ngo. 2022. Managing bank performance under COVID-19: A novel inverse DEA efficiency approach. *International Transactions in Operational Research* 30, no. 5: 2436–2452. doi:10.1111/itor.13132.
Boubaker, S., M.H. Uddin, S.H. Kabir, and S. Mollah. 2023. Does cost inefficiency in Islamic banking matter for earnings uncertainty? *Review of Accounting and Finance* 22, no. 1: 1–36.
Boyd, J.H., and G. De Nicoló. 2005. The theory of bank risk-taking and competition revisited. *Journal of Finance* 60, no. 3: 1329–1343.
Carletti, E., S. Claessens, A. Fatás, and X. Vives. 2020. "The bank business model in the post-COVID-19 world." Centre for Economic Policy Research, IESE Business School. CEPR Press.
Chaffai, M., and M.K. Hassan. 2019. Technology gap and managerial efficiency: A comparison between Islamic and conventional banks in MENA. *Journal of Productivity Analysis* 51, no. 1: 39–53.
Charnes, A., W.W. Cooper, and E. Rhodes. 1978. Measuring the efficiency of decision-making units. *European Journal of Operational Research* 2, no. 6: 429–444.
Chong, B.S., and M.-H. Liu. 2009. Islamic banking: Interest-free or interest-based? *Pacific-Basin Finance Journal* 17: 125–144.
Čihák, M., and H. Hesse. 2010. Islamic banks and financial stability: An empirical analysis. *Journal of Financial Services Research* 38, no. 2-3: 95–113.
Clark, E., N. Radić, and A. Sharipova. 2018. Bank competition and stability in the CIS markets. *Journal of International Financial Markets, Institutions & Money* 54: 190–203.
Cooper, W.W., L.M. Seiford, and J. Zhu. 2011. Data envelopment analysis: History, models, and interpretations. In *Handbook on data envelopment analysis*, edited by W.W. Cooper, L.M. Seiford, and J. Zhu, 1–39. Boston, MA: Springer.

Cosset, J.-C., H.Y. Somé, and P. Valéry. 2016. Does competition matter for corporate governance? The role of country characteristics. *Journal of Financial and Quantitative Analysis* 51: 1231–1267.

Cristian, E., W. Leonarsan, and S.S. Kim. 2020. The impacts of competition, efficiency, and risk towards bank's performance in Indonesia. *Journal of Finance and Banking* 24, no. 4: 407–419.

Cuestas, J.C., Y. Lucotte, and N. Reigl. 2020. Banking sector concentration, competition, and financial stability: the case of the Baltic countries. *Post-Communist Economies* 32, no. 2: 215–249.

da Silva Neto, J.F. 2021. *Essays on the European banks financial stability, profitability, and efficiency*. Doctoral Thesis. Universidade de Santiago de Compostela, Escola de Doutoramento Internacional (EDIUS). http://hdl.handle.net/10347/27260.

Demirgüç-Kunt, A., A. Pedraza, and C. Ruiz-Ortega. 2021. Banking sector performance during the COVID-19 crisis. *Journal of Banking and Finance* 133: 106305.

El-Chaarani, H., T.H. Ismail, Z. El-Abiad, and M.S. El-Deeb. 2022. The impact of COVID-19 on financial structure and performance of Islamic banks: A comparative study with conventional banks in the GCC countries. *Journal of Economic and Administrative Sciences*, 1–29.

EL-Chaarani, H., Y. Skaf, F. Roberto, A. Hamdan, and R.O. Binsaddig. 2023. Assessing the direct and moderating effect of COVID-19 on the performance of the banking sector in the MENA region. *FIIB Business Review* (first published online January 11, 2023), doi:10.1177/231971452211379.

El-Hawary, D., W. Grais, and Z. Iqbal. 2013. "Regulating Islamic financial institutions: The nature of the regulated." Policy Research Working Papers (21 June 2013).

Elnahass, M., V.Q. Trinh, and T. Li. 2021. Global banking stability in the shadow of COVID-19 outbreak. *Journal of International Financial Markets, Institutions & Money* 72: 101322.

Fakhri, U.N., and A. Darmawan. 2021. Comparison of Islamic and conventional banking financial performance during the COVID-19 period. *International Journal of Islamic Economics and Finance* 4, no. SI: 19–40.

Farag, H., C. Mallin, and K. Ow-Yong. 2018. Corporate governance in Islamic banks: New Insights for dual board structure and agency relationships. *Journal of International Financial Markets Institutions and Money* 54, no. 2: 59–77.

Farazi, S., E. Feyen, and R. Rocha. 2011. "Bank ownership and performance in the Middle East and North Africa Region." The World Bank Policy Research Working Paper, No. 5620, Washington, DC: The World Bank.

Fiordelisi, F., and D.S. Mare. 2014. Competition and financial stability in European cooperative banks. *Journal of International Money and Finance* 45, no. C: 1–16.

Fungáčová, Z., P. Pessarossi, and L. Weill. 2013. Is bank competition detrimental to efficiency? Evidence from China. *China Economic Review* 27: 121–134.

García-Herrero, A., S. Gavilá, and D. Santabárbara. 2009. What explains the low profitability of Chinese banks? *Journal of Banking & Finance* 33, no. 11: 2080–2092.

Goldberga, L.G., and A. Rai. 1996. The structure-performance relationship for European banking. *Journal of Banking & Finance* 20, no. 4: 745–771.

González, L.O., A. Razia, M.V. Búa, and R.L. Sestayo. 2017. Competition, concentration and risk-taking in banking sector of MENA countries. *Research in International Business and Finance* 42, no. December 2017: 591–604.

Grassa, R., A. Sarea, S. El-Halaby, and A.N. Damak. 2022. Between two crises: Do Islamic banks suffer? *Journal of Islamic Monetary Economics and Finance* 8, no. 2: 251–274.

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

Hamza, H., and S. Kachtouli. 2014. Competitive conditions and market power of Islamic and conventional commercial banks. *Journal of Islamic Accounting and Business Research* 5, no. 1: 29–46.

Haque, F., and K. Brown. 2017. Bank ownership, regulation, and efficiency: Perspectives from the Middle East and North Africa (MENA) region. *International Review of Economics & Finance* 47: 273–293.

Hasan, M.M., and J. Dridi. 2010. "The effects of the global crisis on Islamic and conventional banks: A comparative study." IMF Working Paper, WP/10/201. International Monetary Fund: Washington DC.

Hasan, M.B., M. Mahi, M.K. Hassan, and A. Bashar Bhuiyan. 2021. Impact of COVID-19 pandemic on stock markets: conventional vs. Islamic indices using wavelet-based multi-timescales analysis. *North American Journal of Economics and Finance* 58: 101504.

Hassan, M.K., M.R. Rabbani, and Y. Abdulla. 2021. Socioeconomic impact of COVID-19 in MENA region and the role of Islamic finance. *International Journal of Islamic Economics and Finance* 4, no. 1: 51–78.

Hellmann, T.F., K.C. Murdock, and J.E. Stiglitz. 2000. Liberalization, moral hazard in banking and prudential regulation: Are capital requirements enough? *American Economic Review* 90, no. 1: 147–165.

Homma, T., Y. Tsutsui, and H. Uchida. 2014. Firm growth and efficiency in the banking industry: A new test of the efficient structure hypothesis. *Journal of Banking & Finance* 40: 143–153.

Isnurhadi, I., M. Adam, S. Sulastri, I. Andriana, and M. Muizzuddin. 2021. Bank capital, efficiency, and risk: Evidence from Islamic banks. *Journal of Asian Finance, Economics and Business* 8, no. 1: 841–850.

Kablan, S., and O. Yousfi. 2017. "Efficiency of Islamic and conventional banks in countries with Islamic banking." Working Papers hal-01527697. Available at https://mpra.ub.uni-muenchen.de/32951/.

Kaffash, S., and M. Marra. 2017. Data envelopment analysis in financial services: a citations network analysis of banks, insurance companies and money market funds. *Annals of Operations Research* 253: 307–344.

Kasman, A., G. Tunc, G. Tunc, and B. Okan. 2010. Consolidation and commercial bank net interest margins: evidence from the old and new European Union members and candidate countries. *Economic Modelling* 27, no. 3: 648–655.

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

Keeley, M.C. 1990. Deposit insurance, risk and market power in banking. *American Economic Review* 80, no. 5: 1183–1200.

Kevser, M. 2020. Does bank size affect the bank profitability? Evidence from Borsa Istanbul (BIST), Turkey. *International Journal of Business and Economic Studies* 2, no. 2: 63–71.

Khan, M.A., A. Siddique, and Z. Sarwar. 2020. Determinants of non-performing loans in the banking sector in developing state. *Asian Journal of Accounting Research* 5, no. 1: 135–145.

Khediri, K.B., L. Charfeddine, and S.B. Youssef. 2015. Islamic versus conventional banks in the GCC countries: A comparative study using classification techniques. *Research in International Business and Finance* 33, no. C: 75–98.

Koetter, M., J.W. Kolari, and L. Spierdijk. 2012. Enjoying the quiet life under deregulation? Evidence from adjusted Lerner indices for U.S. banks. *Review of Economics and Statistics* 94, no. 2: 462–480.

Koutsomanoli-Filippaki, A., and E. Mamatzakis. 2009. Performance and Merton-type default risk of listed banks in the EU: A panel VAR approach. *Journal of Banking & Finance* 33, no. 11: 2050–2020.

Kozak, S., and A. Wierzbowska. 2021. Banking market concentration and bank efficiency. Evidence from Southern, Eastern and Central Europe. *Southeast European Journal of Economics and Business* 16, no. 1: 38–52.

Le, T.D., T.H. Ho, D.T. Nguyen, and T. Ngo. 2022. A cross-country analysis on diversification, Sukuk investment, and the performance of Islamic banking systems under the COVID-19 pandemic. *Heliyon* 8, no. 3: e09106.

Li, X., H. Feng, S. Zhao, and D.A. Carter. 2021. The effect of revenue diversification on bank profitability and risk during the COVID-19 pandemic. *Finance Research Letters* 43, no. November 2021: 101957.

Liu, H., P. Molyneux, and J.O.S. Wilson. 2013. Competition and stability in European banking: a regional analysis. *Manchester School* 81, no. 2: 176–201.

Louati, S., I.G. Abida, and Y. Boujelbene. 2015. Capital adequacy implications on Islamic and non-Islamic bank's behavior: Does market power matter? *Borsa Istanbul Review* 15, no. 3: 192–204.

Mateev, M., S. Moudud-Ul-Huq, A. Sahyouni, and M.U. Tariq. 2022. Capital regulation, competition and risk-taking: Policy implications for banking sector stability in the MENA region. *Research in International Business and Finance* 60, no. April 2022: 101579.

Mateev, M., A. Sahyouni, and T. Al-Masaeid. 2024. Bank performance before and during the COVID-19 crisis: Does efficiency play a role? *Review of Managerial Science* 18: 29–82.

Mateev, M., M.U. Tariq, and A. Sahyouni. 2023. Bank efficiency, market concentration and the impact of COVID-19 pandemic: Evidence from the MENA region. *PLoS One* 18, no. 5: e0285403.

Maudos, J., and J.F. de Guevara. 2004. Factors explaining the interest margin in the banking sectors of the European Union. *Journal of Banking & Finance* 28, no. 9: 2259–2281.

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

Mirzaei, A., G. Liu, and T. Moore. 2013. Does market structure matter on banks' profitability and stability? Emerging vs. advanced economies. *Journal of Banking and Finance* 37: 2920–2937.

Mirzaei, A., M. Saad, and A. Emrouznejad. 2024. Bank stock performance during the COVID-19 crisis: Does efficiency explain why Islamic banks fared relatively better? *Annals of Operations Research* 334: 317–335.

Rashid, A., and S. Jabeen. 2016. Analyzing performance determinants: Conventional versus Islamic banks in Pakistan. *Borsa Istanbul Review* 16, no. 2: 92–107.

Rosenbaum, P.R., and D.B. Rubin. 1983. The central role of the propensity score in observational studies for causal effects. *Biometrika* 70, no. 1: 41–55.

Saâdaoui, F., and M. Khalfi. 2022. Revisiting Islamic banking efficiency using multivariate adaptive regression splines. *Annals of Operations Research*, doi:10.1007/s10479-022-04545-2.

Saeed, M., and M. Izzeldin. 2016. Examining the relationship between default risk and efficiency in Islamic and conventional banks. *Journal of Economic Behavior & Organization* 132, no. S: 127–154.

Safiullah, M., and A. Shamsuddin. 2019. Risk-adjusted efficiency and corporate governance: Evidence from Islamic and conventional banks. *Journal of Corporate Finance* 55: 105–140.

Sahyouni, A., and M. Wang. 2019. Liquidity creation and bank performance of Syrian banks before and during the Syrian war. *International Journal of Financial Studies* 7, no. 3: 1–17.

Seiford, L.M., and J. Zhu. 1999. Profitability and marketability of the top 55 US commercial banks. *Management Science* 45: 1270–1288.

Shah, S.A.A., R. Sukmana, and B.A. Fianto. 2021. Efficiencies in Islamic banking: A bibliometric and theoretical review. *International Journal of Productivity and Quality Management* 32, no. 4: 458–501.

Shawtari, F.A., M. Ariff, and S.H.A. Razak. 2019. Efficiency and bank margins: a comparative analysis of Islamic and conventional banks in Yemen. *Journal of Islamic Accounting and Business Research* 10, no. 1: 50–72.

Sun, P.H., S. Mohamad, and M. Ariff. 2017. Determinants driving bank performance: A comparison of two types of banks in the OIC. *Pacific-Basin Finance Journal* 42: 193–203.

Syed, M.H., S. Khan, M.R. Rabbani, and Y.E. Thalassinos. 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* 8, no. 2: 351–364.

Tan, Y., C. Floros, and J. Anchor. 2017. The profitability of Chinese banks: Impacts of risk, competition, and efficiency.". *Review of Accounting and Finance* 16, no. 1: 86–105.
Tone, K., and M. Tsutsui. 2014. Dynamic DEA with network structure: A Slacks-Based Measure approach. *Omega-International Journal of Management Science* 42, no. 1: 124–131.
Viphindrartin, S., R.N. Wilantari, and S. Bawono. 2022. The comparison of the Islamic and conventional bank performance before and during Covid-19 pandemic in Indonesia. *Journal of Management and Business* 21, no. 1: 76–84.
Wasiuzzaman, S., and H.A.A. Tarmizi. 2010. Profitability of Islamic banks in Malaysia: An empirical analysis. *Journal of Islamic Economics, Banking and Finance* 6, no. 4: 52–68.
Wooldridge, J.M. 2021. "Two-way fixed effects, the two-way mundlak regression, and difference-in-differences estimators." Working paper (August 17, 2021), Michigan State University. Available at SSRN: https://ssrn.com/abstract = 3906345.
The World Bank Development Indicators. 2006-2021. World development indicators [Online]. Available at: http://data.worldbank.org/indicator/NY.GDP.MKTP.CD (Accessed 15/03/2022).
The World Bank Worldwide Governance Indicators. 2006-2021. Interactive data access [Online]. Available at: http://info.worldbank.org/governance/wgi/index.aspx#reports (Accessed 15/03/2022).
Xie, H., H.-L. Chang, M. Hafeez, and C. Saliba. 2021. COVID-19 post-implications for sustainable banking sector performance: Evidence from emerging Asian economies. *Economic Research-Ekonomska Istraživanja* 35, no. 1: 4801–4816.
Yılmaz, D. 2009. *Islamic finance during and after the global financial crisis, Speech at the conference "Islamic finance – during and after the global financial crisis*. IMF-World Bank Annual Meetings 2009, Istanbul, 5 October 2009.

Appendix A. Dependent and explanatory variables

Table A-1. Variable definitions and sources.

Variable	Explanation	Data Source	Expected Sign
Dependent Variables			
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; Authors' calculations	
Multilevel Performance Index (MLPI)	Multilevel 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; Miklaszewska, Kil, and Idzik(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; Miklaszewska, Kil, and Idzik (2021)	
Performance measures			
Return on Assets (ROA)	Net profit to the average total assets of a bank	Authors' calculations based on Bankscope	
Return on Assets (ROE)	Net profit to the average total equity of a bank	Authors' calculations based on Bankscope	
Cost to income ratio (C/I)	Cost efficiency: operating cost to operating income of a bank	Authors' calculations based on Bankscope	
Explanatory Variables			
Efficiency measures			
DEA efficiency score (ES)	Average of the efficiency scores of three different efficiency estimation models	Authors' calculations based on Bankscope	+

(*Continued*)

Table A-1. Continued.

Variable	Explanation	Data Source	Expected Sign
	(CRS, VRS, and SCALE) using DEA approach		
Market Competition			
Lerner index	The index is measured by the difference between the output price of a firm and the marginal cost divided by the output price. The value of the index varies between 0 and 1, such a higher Lerner value (i.e. close to 1) indicate monopoly situation.	Authors' calculations based on Bankscope	+/-
Efficiency-adjusted Lerner	A bank-level measure of bank market power following the methodology proposed by Koetter, Kolari, and Spierdijk (2012). A higher index value represents greater market power, while a value of zero corresponds to a perfect competition.	Authors' calculations based on Bankscope	+/-
Bank-level Characteristics			
Deposit Growth	The annual growth rate of deposits placed by non-financial sector	Authors' calculations based on Bankscope	+
Net Loans/Assets	Loans divided by total assets	Authors' calculations based on Bankscope	+
Non-interest income/Assets	The share of operating income that is not due to interest income to total assets of a bank	Authors' calculations based on Bankscope	+
Revenue diversification	The ratio of non-interest income to total operating revenues	Authors' calculations based on Bankscope	+
Size	Natural logarithm of total assets of a bank	Authors' calculations based on Bankscope	+
Non-financial Loan Growth	Rate of growth of non-financial loans (annual % change)	Authors' calculations based on Bankscope	-
Liquid Assets	Liquid assets divided by total assets of a bank	Authors' calculations based on Bankscope	+
Equity/Total Assets	Leverage: The ratio of equity to total assets of a bank	Authors' calculations based on Bankscope	+/-
Capital Adequacy Ratio (CAR)	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	-/+
Credit Risk measures			
Non-performing loans ratio	Bank non-performing loans divided by total loans	Authors' calculations based on Bankscope	-
Quality of institutions			
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, Kraay, and Mastruzzi (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	-

Appendix B. Robustness tests

Table B-1. Panel regressions of bank performance with efficiency-adjusted Lerner index (CB vs. IB, 2006-2021).

	Conventional banks			Islamic banks		
Performance	ROA	ROE	C/I	ROA	ROE	C/I
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	−0.003	0.031	0.233***	−0.010	−0.113	0.285*
	(0.748)	(0.310)	(0.000)	(0.764)	(0.233)	(0.059)
Efficiency	0.006*	0.028**	−0.101***	0.015*	0.010**	−0.317***
	(0.103)	(0.042)	(0.000)	(0.100)	(0.015)	(0.000)
Adjusted Lerner	0.011	0.028	−0.182***	0.016*	0.114***	−0.079*
	(0.141)	(0.184)	(0.000)	(0.101)	(0.000)	(0.102)
Efficiency COVID-19*	−0.027***	−0.070***	0.104***	−0.003	−0.010	0.022
	(0.000)	(0.001)	(0.005)	(0.776)	(0.848)	(0.791)
Adj. Lerner COVID-19*	−0.013*	−0.007	0.011*	−0.005*	−0.084*	0.221***
	(0.076)	(0.718)	(0.053)	(0.068)	(0.081)	(0.004)
Institutions	−0.000	−0.005	−0.001	0.001	−0.008	0.009
	(0.971)	(0.101)	(0.856)	(0.570)	(0.299)	(0.265)
Deposit Growth	0.006**	0.023***	0.039***	0.005	0.017	0.024
	(0.036)	(0.003)	(0.006)	(0.342)	(0.308)	(0.361)
Loan/Total Assets	−0.004	0.007	0.014	0.022***	0.026	−0.007
	(0.146)	(0.352)	(0.308)	(0.003)	(0.210)	(0.816)
Non-interest income	0.043***	0.102***	0.183***	0.029***	0.071**	0.079*
	(0.000)	(0.000)	(0.000)	(0.004)	(0.011)	(0.073)
Size	0.001**	0.010***	0.033***	0.002**	0.016***	0.024***
	(0.020)	(0.000)	(0.000)	(0.048)	(0.000)	(0.000)
(Non-financial) Loan growth	0.005*	0.040***	−0.028*	0.022***	0.032*	−0.018
	(0.086)	(0.000)	(0.064)	(0.001)	(0.108)	(0.573)
Liquid Assets	−0.003	0.031***	0.049**	0.004	0.029	0.069*
	(0.209)	(0.000)	(0.001)	(0.673)	(0.273)	(0.098)
Equity/TA	0.007**	0.024***	0.126***	0.008	0.019	0.167***
	(0.031)	(0.007)	(0.000)	(0.280)	(0.391)	(0.000)
CAR	0.011***	−0.068***	0.052***	−0.002	−0.087***	0.033
	(0.002)	(0.000)	(0.004)	(0.774)	(0.000)	(0.356)
GDP Growth	−0.016	−0.043	−0.042	−0.041	−0.257***	0.339**
	(0.297)	(0.317)	(0.584)	(0.222)	(0.008)	(0.028)
Inflation	−0.006	−0.015	−0.047	−0.043	−0.035	−0.044
	(0.425)	(0.478)	(0.233)	(0.101)	(0.632)	(0.707)
GCC	−0.014*	−0.030	−0.136***	−0.011	0.016	0.114
	(0.104)	(0.253)	(0.004)	(0.734)	(0.857)	(0.422)
Country Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	4037	4037	4037	969	969	969
R-squared (Overall)	0.0468	0.1023	0.1034	0.0823	0.1579	0.1878

This table presents the estimation results of the relationship between bank competition, efficiency, and bank performance from 2006 to 2021, while controlling for important bank levels and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. To measure bank profitability, we used return on assets (ROA) and return on equity (ROE).Cost efficiency is proxed by the cost-to-income (C/I) ratio. Bank efficiency was measured as the average of the three DEA efficiency scores (CRS, VRS, and SCAL).Market competition was measured using the efficiency-adjusted Lerner index. Country-level characteristics were computed as ofyear *t-1*. All regressions control for year and country fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. Appendix A describes the bank-level characteristics, regulations, and macroeconomic variables.

Table B-2. Panel regressions of bank performance with revenue diversification and non-performing loans (CB vs. IB, 2006-2021).

	Conventional banks			Islamic banks		
Performance	ROA	ROE	C/I	ROA	ROE	C/I
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	−0.003	0.031	0.233***	−0.010	−0.113	0.285*
	(0.748)	(0.310)	(0.000)	(0.764)	(0.233)	(0.059)

(*Continued*)

Table B-2. Continued.

	Conventional banks			Islamic banks		
Performance	ROA	ROE	C/I	ROA	ROE	C/I
Efficiency	0.006*	0.028**	−0.101***	0.015*	0.010**	−0.317***
	(0.103)	(0.042)	(0.000)	(0.107)	(0.015)	(0.000)
Lerner	0.011	0.028	−0.182***	0.016*	0.114***	−0.079*
	(0.141)	(0.184)	(0.000)	(0.101)	(0.000)	(0.108)
Efficiency COVID-19*	−0.027***	−0.070***	0.104***	−0.003	−0.010	0.022
	(0.000)	(0.001)	(0.005)	(0.776)	(0.848)	(0.791)
Lerner COVID-19*	−0.013*	−0.007	0.011*	−0.005*	−0.084*	0.221***
	(0.076)	(0.718)	(0.053)	(0.068)	(0.081)	(0.004)
Institutions	−0.000	−0.005	−0.001	0.001	−0.008	0.009
	(0.971)	(0.101)	(0.856)	(0.570)	(0.299)	(0.265)
Deposit Growth	0.006**	0.023***	0.039***	0.005	0.017	0.024
	(0.036)	(0.003)	(0.006)	(0.342)	(0.308)	(0.361)
Loan/Total Assets	−0.004	0.007	0.014	0.022***	0.026	−0.007
	(0.146)	(0.352)	(0.308)	(0.003)	(0.210)	(0.816)
Revenue diversification	0.043***	0.102***	0.183***	0.029***	0.071**	0.079**
	(0.000)	(0.000)	(0.000)	(0.004)	(0.011)	(0.073)
Size	0.001**	0.010***	0.033***	0.002**	0.016***	0.024***
	(0.020)	(0.000)	(0.000)	(0.048)	(0.000)	(0.000)
(Non-financial) Loan growth	0.005*	0.040***	−0.028**	0.022***	0.032*	−0.018
	(0.086)	(0.000)	(0.064)	(0.001)	(0.108)	(0.573)
Liquid Assets	−0.003	0.031***	0.049**	0.004	0.029	0.069*
	(0.209)	(0.000)	(0.001)	(0.673)	(0.273)	(0.098)
Equity/TA	0.007**	0.024***	0.126***	0.008	0.019	0.167***
	(0.031)	(0.007)	(0.000)	(0.280)	(0.391)	(0.000)
CAR	0.011***	−0.068***	0.052***	−0.002	−0.087***	0.033
	(0.002)	(0.000)	(0.004)	(0.774)	(0.000)	(0.356)
None-performing loans	−0.007**	−0.024***	0.126***	−0.008	−0.019	0.167***
	(0.031)	(0.007)	(0.000)	(0.280)	(0.391)	(0.000)
GDP Growth	−0.016	−0.043	−0.042	−0.041	−0.257***	0.339**
	(0.297)	(0.317)	(0.584)	(0.222)	(0.008)	(0.028)
Inflation	−0.006	−0.015	−0.047	−0.043	−0.035	−0.044
	(0.425)	(0.478)	(0.233)	(0.101)	(0.632)	(0.707)
GCC	−0.014*	−0.030	−0.136***	−0.011	0.016	0.114
	(0.104)	(0.253)	(0.004)	(0.734)	(0.857)	(0.422)
Country Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	4037	4037	4037	969	969	969
R-squared (Overall)	0.0468	0.1023	0.1034	0.0823	0.1579	0.1878

This table presents the estimation results of the relationship between market competition, efficiency, and bank performance from 2006 to 2021, while controlling for important banklevels and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. To measure bank profitability, we used Return on Assets (ROA) and Return on Equity (ROE).Cost efficiency is proxied by the Cost-to-Income (C/I) ratio. Bank efficiency was measured as the average of the three DEA efficiency scores (CRS, VRS, and SCAL).Market competition was proxiedby the Lerner index. 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 A describes the bank-level characteristics, regulations, and macroeconomic variables.

Appendix C. Efficiency and Lerner index

C-1. Efficiency estimation

The popularity of using Data Envelopment Analysis (DEA) is due to the fact that it does not require any assumption on the shape of the frontier surface, and it makes no assumptions concerning the internal operations of a decision-making unit (DMU). Accordingly, DEA has been widely used to assess entities related to financial institutions, including banks, branches, and insurance companies (Hamid, Ramli, and Hussin 2017; Kaffash and Marra 2017). Mathematically, DEA is a linear-programming-based methodology for benchmarking a set of DMUs, such as a bank, based on the envelopment of multiple input and output variables. DEA

estimates the production possibility frontier and evaluates the efficiency of each DMU against the frontier.

Charnes, Cooper, and Rhodes (1978) developed the DEA method. This method assumes a linear relationship between the inputs and outputs to measure efficiency. Generally, DEA can be divided into input- and output-oriented DEAs. The input-oriented model minimizes the input to achieve the desired output level and the output-oriented model maximizes the output while maintaining the input at a constant level. Both the input- and output-oriented models attempt to maximize outputs, minimize inputs, and maximize efficiency. The two main types of DEA models are the constant returns-to-scale (CRS) or CCR model (Charnes, Cooper, and Rhodes 1978), and the variable returns-to-scale (VRS) or BCC model (Banker, Charnes, and Cooper 1984). The BCC model is an extension of the CCR model in which the efficient frontier set is represented by a convex curve passing through all efficient DMUs. VRS includes both decreasing and increasing returns to scale. It helps estimate the efficiency of whether an input or an output increase or decrease leads to a proportional change in output or input, respectively (Cooper, Seiford, and Zhu 2011). This reflects that production technology can be constant, decreasing, or increasing returns to scale.

Empirically, this study followed the intermediation approach for inputs and outputs (Chaffai and Hassan 2019). This approach assumes that the main purpose of commercial banks is to create outputs defined as loans and investments, while using liabilities (including deposits), labor, and capital as inputs. Specifically, we consider three outputs: (i) gross customer loans; (ii) other earning assets, including investment securities, loans, and advances to banks and other investments; and (iii) non-interest income, including net fees and commissions, net gains/losses on trading and derivatives, and other operating income (Safiullah and Shamsuddin 2019). Accordingly, this study uses the following variables as inputs: (i) staff costs (as a proxy for labor inputs), (ii) fixed assets (as a proxy for capital input), (iii) total deposits (as a proxy for financial input), and (iv) impaired loans (to account for credit risk).

While the input variables (i), (ii), and (iii) are similar to those of many other studies, Barth et al. (2013) argue that loan loss provisions should be considered as an additional input in bank efficiency analysis because they capture the risks or potential costs of lending decisions, given loan quality. This argument might also be relevant to MENA banking, where loan loss provisions tend to be high, especially for state-owned banks (Farazi, Feyen, and Rocha 2011). According to the DEA method, a bank's cost efficiency score falls between 0 and 1. A bank with an efficiency score of 1 indicates an efficient bank, as it is located on the efficient frontier, whereas a score below 1 indicates relative inefficiency (Haque and Brown 2017).

C-2. The lerner index

The Lerner Index is the most popularly used index and is estimated by taking the ratio of the discrepancy between marginal cost and price to that of the price measure of competition through the distance between the price and the marginal cost (Hamza and Kachtouli 2014). Researchers have used different indicators to determine the price of bank output when computing the Lerner index. Applying the intermediation approach to measure bank outputs, the gross loans, advances, and total assets of banks are the most commonly used. To determine price, this study used the ratio of the total revenue of commercial banks to total assets. The marginal cost is derived from the log-cost function. The total cost is computed by summing the costs of three inputs: personnel expenses (salary and benefits to employees), interest expenses, and other operating expenses used in this study. The total marginal cost calculated using the trans-log cost function depends on the prices of these three inputs. The two output variables, three input factors, and the respective prices used in the calculation of the Lerner index have been summarized in the table given below (see Table C.2).

Table C.2. Inputs in calculating the Lerner index.

Variable	Description	Unit Cost/Price
Total Assets	Total Assets of the bank	Ratio of Total Revenues to Total Assets
Personnel expense	Salary and other benefits paid to employees	Ratio of Salaries & Benefits to Total Assets (w1)
Interest Expense	Total interest paid on customer deposits	Ratio of Interest paid on Deposits to Total Deposits (w2)
Other Operating Expense	Operating expenses other than interest and personnel	Ratio of Other operating expenses to Total Assets (w3)

The model specified below is based on previous studies and has been used to calculate the bank-level time-variant Lerner index, as follows:

$$Lernerindex = \frac{P_{it} - MC_{it}}{P_{it}}, \tag{C.1}$$

where P_{it} is the price of outputs for a bank (measured by total assets) i at time$_t$, MC_{it} is the marginal cost.

For robustness purposes, we employed the efficiency-adjusted Lerner index instead of the traditional Lerner index, as proposed by Koetter, Kolari, and Spierdijk(2012). The adjusted Lerner index was defined using the following equation:

$$Efficiency - Adjusted\ Lernerit = \frac{(\hat{\pi}it + \hat{C}it) - \hat{m}cit}{(\hat{\pi}it + \hat{C}it)} \tag{C.2}$$

In this model '$\hat{\pi}_{\text{it}}$ is the estimated profit, $\hat{C}_{\text{it}}$ the estimated total cost, and $\hat{m}c_{\text{it}}$ the estimated marginal cost' (Cuestas, Lucotte, and Reigl 2020, 11). Here, 'a higher index value represents greater market power, while a value of zero corresponds to perfect competition' (Mateev et al. 2022, 11).

Appendix D. Alternative tests using Tobin's Q as a measure of bank performance.

Table D-1. Panel regressions of bank performance with Tobin's Q (CB vs. IB, 2006-2021).

	Conventional banks			Islamic banks		
	Accounting measures		Market measure	Accounting measures		Market measure
Performance	ROA	ROE	Tobin Q	ROA	ROE	Tobin Q
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.018**	0.024	−0.030	−0.010	−0.016	0.202
	(0.035)	(0.293)	(0.609)	(0.767)	(0.864)	(0.358)
Efficiency	0.006	0.021**	0.093***	0.024**	0.012**	0.048*
	(0.134)	(0.042)	(0.001)	(0.023)	(0.048)	(0.063)
Lerner	0.012	0.028*	0.185***	0.018*	0.115***	0.246*
	(0.136)	(0.085)	(0.007)	(0.097)	(0.000)	(0.084)
Efficiency COVID-19*	−0.027***	−0.070***	−0.045*	−0.016	−0.010	−0.155*
	(0.000)	(0.001)	(0.088)	(0.411)	(0.842)	(0.083)
Lerner COVID-19*	0.013	0.007	−0.232***	−0.023*	−0.089*	−0.267*
	(0.186)	(0.728)	(0.002)	(0.085)	(0.064)	(0.060)
Institutions	−0.001	−0.005	−0.010	0.001	−0.008	0.008

(*Continued*)

Table D-1. Continued.

	Conventional banks			Islamic banks		
	Accounting measures		Market measure	Accounting measures		Market measure
Performance	ROA	ROE	Tobin Q	ROA	ROE	Tobin Q
	(0.942)	(0.102)	(0.203)	(0.858)	(0.266)	(0.653)
Deposit Growth	0.006**	0.023***	−0.012	−0.006	0.017	0.007
	(0.038)	(0.003)	(0.544)	(0.256)	(0.300)	(0.844)
Loan/Total Assets	−0.004	0.007	0.103***	0.023***	0.026	0.182***
	(0.142)	(0.351)	(0.000)	(0.003)	(0.220)	(0.000)
Non-interest income	0.043***	0.102***	0.072**	0.022**	0.070**	0.115*
	(0.000)	(0.000)	(0.024)	(0.023)	(0.011)	(0.074)
Size	0.001**	0.010***	0.087***	0.001**	0.017***	0.080***
	(0.019)	(0.000)	(0.000)	(0.045)	(0.000)	(0.000)
(Non-financial) Loan growth	0.005*	0.040***	−0.023	0.018**	0.031**	0.026
	(0.085)	(0.000)	(0.288)	(0.013)	(0.029)	(0.577)
Liquid Assets	−0.003	0.031***	−0.005	0.002	0.028	0.011
	(0.214)	(0.000)	(0.795)	(0.831)	(0.282)	(0.846)
Equity/TA	0.007**	0.024***	−0.455***	0.005	0.020	−0.156***
	(0.029)	(0.007)	(0.000)	(0.546)	(0.375)	(0.000)
CAR	−0.011***	−0.068***	−0.455***	−0.000	−0.086***	−0.474***
	(0.002)	(0.000)	(0.000)	(0.913)	(0.000)	(0.000)
GDP Growth	−0.019	−0.042	−0.058	−0.064*	−0.278***	−0.242
	(0.245)	(0.339)	(0.601)	(0.074)	(0.005)	(0.277)
Inflation	−0.007	−0.015	−0.079	−0.049	−0.051	−0.045
	(0.378)	(0.490)	(0.157)	(0.075)	(0.500)	(0.791)
GCC	0.003	0.013	0.118**	0.011	0.018	−0.189
	(0.639)	(0.461)	(0.047)	(0.729)	(0.836)	(0.400)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	4037	4037	4037	969	969	969
R-squared (Overall)	0.0815	0.1514	0.3938	0.1262	0.2501	0.3683

This table presents the estimation results of the relationship between market competition, efficiency, and bank performance from 2006 to 2021, while controlling for important bank levels and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. To measure bank profitability, we used return on assets (ROA) and return on equity (ROE).Cost efficiency is proxied by the Cost-to-Income (C/I) ratio. Bank efficiency was measured as the average of the three DEA efficiency scores (CRS, VRS, and SCAL).Market competition is measured using the efficiency-adjusted Lerner index. Country-level characteristics were computed as of year *t-1*. All regressions control for year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. Appendix A describes the bank-level characteristics, regulations, and macroeconomic variables.

Appendix E Alternative tests using 2SLS approach.

Table E-1. Instrumental Variables regressions using 2SLS (CB vs. IB, 2006-2021).

	Conventional banks				Islamic banks			
	First stage	Second stage			First stage	Second stage		
Performance	Lerner	ROA (1)	ROE (2)	C/I (3)	Lerner	ROA (4)	ROE (5)	C/I (6)
L.Lerner	0.068***	–	–	–	0.176***	–	–	–
	(0.001)				(0.000)			
Efficiency	0.024***	0.015**	0.030**	−0.140***	0.022***	0.026*	0.011	−0.374***
	(0.007)	(0.017)	(0.031)	(0.000)	(0.002)	(0.071)	(0.761)	(0.000)
LernerFitted Value		−0.096**	−0.039	0.073***		0.117**	0.116	−0.564***
		(0.039)	(0.706)	(0.001)		(0.010)	(0.320)	(0.005)
	−0.338***	−0.049***	−0.028	0.024	−0.329***	0.036*	0.130**	−0.211**

(*Continued*)

Table E-1. Continued.

	Conventional banks				Islamic banks			
	First stage	Second stage			First stage	Second stage		
Performance	Lerner	ROA (1)	ROE (2)	C/I (3)	Lerner	ROA (4)	ROE (5)	C/I (6)
Efficiency COVID-19*								
	(0.000)	(0.007)	(0.482)	(0.752)	(0.000)	(0.100)	(0.021)	(0.031)
Lerner COVID-19*	0.665***	0.095***	0.052	−0.062	0.673***	−0.088**	−0.179*	0.378**
	(0.000)	(0.004)	(0.480)	(0.657)	(0.000)	(0.020)	(0.066)	(0.025)
Institutions	0.020**	−0.002	−0.018***	−0.001	0.060***	−0.009*	−0.038***	0.062***
	(0.021)	(0.370)	(0.003)	(0.893)	(0.000)	(0.070)	(0.003)	(0.007)
Deposit Growth	0.017***	0.016*	0.023*	0.050*	0.011	−0.010	0.017	0.014
	(0.007)	(0.058)	(0.102)	(0.075)	(0.604)	(0.150)	(0.380)	(0.652)
Loan/Total Assets	0.009	0.001	0.011	0.063	0.091***	0.016	0.032	0.040
	(0.160)	(0.810)	(0.382)	(0.004)	(0.001)	(0.084)	(0.227)	(0.349)
Non-interest income	0.004	0.045***	0.109***	0.214***	0.055	0.018**	0.068**	0.079**
	(0.667)	(0.000)	(0.000)	(0.000)	(0.142)	(0.031)	(0.040)	(0.042)
Size	0.004***	0.002*	0.007**	0.021***	−0.006	−0.009	0.009**	0.031***
	(0.001)	(0.091)	(0.043)	(0.000)	(0.905)	(0.544)	(0.034)	(0.000)
N-F Loan growth	−0.006	−0.001	0.015	−0.106***	−0.056**	0.033***	0.001	−0.064*
	(0.327)	(0.764)	(0.223)	(0.000)	(0.032)	(0.001)	(0.955)	(0.096)
Liquid Assets	0.009*	0.001	0.045***	0.069***	0.073*	0.003	0.054*	0.020*
	(0.095)	(0.856)	(0.000)	(0.002)	(0.053)	(0.767)	(0.094)	(0.093)
Equity/TA	0.005	0.005	0.009	0.063***	0.073**	−0.001	−0.009	0.121***
	(0.426)	(0.382)	(0.478)	(0.003)	(0.014)	(0.885)	(0.727)	(0.000)
CAR	0.006**	−0.014*	−0.067***	0.012**	0.035	−0.010	−0.110***	0.050
	(0.047)	(0.069)	(0.000)	(0.033)	(0.263)	(0.295)	(0.000)	(0.254)
GDP Growth	0.046	0.011	0.002	−0.416***	−0.061	−0.022	−0.110**	0.273*
	(0.199)	(0.747)	(0.976)	(0.000)	(0.626)	(0.570)	(0.020)	(0.103)
Inflation	0.086***	0.059	0.076	0.101	0.767***	−0.007	−0.065	0.288
	(0.000)	(0.111)	(0.293)	(0.405)	(0.000)	(0.902)	(0.677)	(0.261)
GCC	0.322***	0.201*	0.281	0.133	−0.426***	0.006	−0.134*	−0.001
	(0.000)	(0.092)	(0.225)	(0.732)	(0.000)	(0.830)	(0.097)	(0.989)
Constant	−0.087***	−0.037	−0.051	0.347***	0.438***	−0.021	−0.125	0.455***
	(0.000)	(0.231)	(0.404)	(0.001)	(0.000)	(0.530)	(0.188)	(0.003)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Observations	2589	2589	2589	2589	663	663	663	663
F-stat (*p-value)*	–	0.000	0.000	0.000	–	0.000	0.000	0.000
R-squared (central)	–	−1.252	−0.1873	0.098	–	0.108	0.235	0.295
Hausman test (*p-value)*	0.000				0.000			

This table presents the estimation results of the relationship between market competition, efficiency, and bank performance from 2006 to 2021 using the 2SLS approach. The sample includes 575 banks in 20 countries in the MENA region. To measure bank profitability, we used Return on Assets (ROA) and Return on Equity (ROE). Cost efficiency is proxied by the cost-to-income (C/I) ratio. Bank efficiency was measured as the average of the three DEA efficiency scores (CRS, VRS, and SCAL).Market competition was proxied by the Lerner index and efficiency-adjustedLerner index. 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 A describes the bank-level characteristics, regulations, and macroeconomic variables.

Table E-2. Propensity Score Matching (PMS) analysis for bank performance (profitability and risk).

Panel A: Profitability measures			
Profitability	**ROA**	**ROE**	**C/I**
Islamic bank (IBs)	0.0059	0.0703	0.5581
Control (CBs)	0.0130	0.0758	0.4977
Difference	−0.0071***	−0.0056	0.0604***
t-statistics	−2.120	0.271	4.361
Panel B: Risk measures			
Risk measures	**Z-score**	**MLPS**	**FSI**
Islamic bank (IBs)	2.1179	1.6636	−0.0158
Control (CBs)	1.6091	0.8011	0.0122
Difference	0.5088***	0.8625***	−0.0280
t-statistics	8.246	2.127	−0.768

This table presents the results of the propensity score matching analyses. *, **, and *** statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. The detailed definitions of the variables are provided in Appendix A (see Table A-1).