Pacific-Basin Finance Journal 82 (2023) 102152

Contents lists available at ScienceDirect

Pacific-Basin Finance Journal

journal homepage: www.elsevier.com/locate/pacfin

The effect of capitalization on the competition-stability Nexus: Evidence from dual banking systems

Indria Ernaningsih, Houcem Smaoui *, Akram Temimi

Department of Finance and Economics, Qatar University, Qatar

A R T I C L E I N F O

JEL classification:
C33
G10
G21
G29

Keywords:
Bank competition
Bank capitalization
Bank stability
Islamic banking

A B S T R A C T

The purpose of this paper is investigate how bank capitalization affects the relationship between competition and bank stability in dual banking systems. Using bank-level and country-level data from 17 countries over the period 2000–2019, the evidence shows a U-shaped relationship between competition and bank stability highlighting the dual importance of the franchise value and the risk-shifting paradigms in dual banking systems. The comparative analysis between conventional banks (CBs, hereafter) and Islamic banks (IBs, hereafter) reveals that, compared to CBs, competition is more detrimental to the stability of IBs. Importantly, our analysis reveals that higher bank capitalization moderates the negative effect of competition on bank stability and that the magnitude of the effect is similar between CBs and IBs.

1. Introduction

The effect of competition on bank stability has generated a large literature and three major conclusions. The seminal work of Keeley (1990) showed that competition has a negative impact on the charter value of banks leading them to take on more risk to recover lost profits. According to this view, there is a negative relationship between competition and stability, known in the literature as the competition-fragility hypothesis. Alternatively, Boyd and De Nicolo (2005) advocate that competition enhances bank stability as it forces banks to lower their lending rates, hence increasing the chance of repayments and lowering adverse selection problems. This is known as the competition-stability hypothesis. The third view, proposed by Matinez-Miera and Repullo (2010), states that the relationship between competition and bank failure is U-shaped. Initially, when competition is low, an increase in competition enhances bank stability. After a certain threshold, competition becomes detrimental to bank stability as the margin effect dominates the risk-shifting effect. These alternative theories have received vast empirical support (Hellmann et al., 2000; Repullo, 2004; Boyd et al., 2006; Yeyati and Micro, 2007; Tabak et al., 2012; Schaeck and Cihák, 2014,).

Another strand of literature has analyzed the relationship between capital adequacy and bank stability. The “skin in the game” hypothesis contends that higher capital adequacy leads to more stability, as banks are more careful taking on excessive risk when they have more capital at stake (Bitar et al., 2018). Alternatively, the regulatory hypothesis suggests that banks exposed to higher risk are required to hold higher capital by regulatory authorities. Thus, a negative relationship between capital and bank stability ensues. The empirical literature is divided between the two hypotheses (Demirguc-Kunt et al., 2013; Lee and Hsieh, 2013; Bitar et al., 2018).

Most of the earlier work on bank stability has separately analyzed the effects of competition and capital adequacy on bank stability. When analyzing bank stability, including only competition while omitting capital adequacy leads to an omission of an important factor

* Corresponding author.
E-mail addresses: iernaningsih@qu.edu.qa (I. Ernaningsih), hsmaoui@qu.edu.qa (H. Smaoui), atemimi@qu.edu.qa (A. Temimi).

https://doi.org/10.1016/j.pacfin.2023.102152
Received 6 October 2021; Received in revised form 28 September 2022; Accepted 11 September 2023
Available online 12 September 2023

that affects bank stability and may lead to biases in the results and misleading policy implications. This is of particular concern given the new regulations on capital adequacy introduced in the Basel III accords after the global financial crisis to foster the stability of the banking system and the dual importance of competition and capital requirement.

A growing literature takes into account competition and capital when analyzing bank stability. (Alam et al., 2019; Azmi et al., 2019; Albaity et al., 2019; Davis et al., 2020). In this paper, we contribute to this literature and take into account competition and capital adequacy in all our investigations of bank stability. More importantly, we investigate the *moderating* effect of capitalization on the relationship between competition and bank stability in dual banking systems. Banks with high capitalization may be better able to absorb shocks, fulfill their liquidity requirements, and behave prudently in selecting asset portfolios when faced with increased competition.[1] The prior literature did not analyze how the interaction of bank capital and competition affects bank risk.

The effect of capitalization on the relationship between competition and bank stability in countries with dual banking systems is complex as IBs and CBs have different banking models. IBs are prohibited from investing in fixed-income securities, cannot engage in speculative activities, and are not allowed to use financial derivatives. IBs use risk-sharing contracts and may face a higher risk if due diligence is not taken and the projects they finance fail. As the profit-sharing contracts are complex, IBs may also incur more risks. However, they are insulated from the risks of toxic securities that affect CBs. In addition, they benefit from the risk-sharing arrangements if done well. It follows that IBs face different restrictions and invest in different financial instruments and bear distinct risks than their conventional counterparts. Accordingly, it is unclear at the outset how capitalization affects the relationship between competition and stability in dual banking systems and whether the effect is similar for IBs and CBs.

Against this backdrop, in addition to revisiting the competition stability nexus, we address the following novel questions: (1) How does bank capitalization affect the relationship between competition and bank stability in dual banking systems? (2) Is the effect of bank capitalization on the competition stability nexus different between IBs and CBs? (3) In dual banking systems, are both competition-fragility and competition-stability paradigms simultaneously present? To the best of our knowledge, our study is the first to investigate the above research questions.

To conduct our analysis, we use a sample of 204 CBs and 80 IBs from 17 countries that adopted dual banking systems over the 2000–2019 period. We employ the two-step system GMM estimator proposed by Arellano and Bover, 1995 and Blundell and Bond (1998) to tackle the issues of heteroscedasticity, serial correlation, and endogeneity. The competition measure and capital adequacy are both treated as endogenous to bank stability as suggested by the literature (Jimenez and Saurina, 2004; Louzis et al., 2012; Schaeck and Cihák, 2010; Hellmann et al., 2000; Allen and Gale, 2004; Smaoui et al., 2020a).

Our results show that there is a U-shaped relationship between competition and bank stability measured by the *z*-score and the net interest margin, thus highlighting the dual importance of the franchise value and the risk-shifting paradigms in dual banking systems. The comparative analysis of IBs and CBs reveals that the fragility effect is more pronounced for IBs than for CBs. Thus, while the effect of competition on stability is nonlinear for both types of banks, competition has a larger detrimental impact on the stability of IBs.

Importantly, our analysis reveals that better bank capitalization has a *moderating* effect on the relationship between competition and bank stability**.** This is because banks with high capitalization are more able to absorb shocks, fulfill their liquidity requirements, and tend to behave prudently in selecting asset portfolios when faced with increased competition, which makes them more stable. This result is of paramount importance as it underlines the importance of both competition policy and capital regulation and the need to coordinate between these two pillars of regulation to foster the stability of the banking system. Our results also reveal that there is no evidence that this moderating effect is different between IBs and CBs, suggesting that capital is equally important for both types of banks in mitigating the effect of competition. These findings add to our understanding of how competition policy and capital regulatory requirements interact in affecting the stability of banks in dual banking systems.

The rest of the paper is organized as follows. Section 2 provides a brief review of the literature. Section 3 includes the data analysis and describes the details of the model and methodology. Section 4 presents a discussion of the results. Section 5 provides the robustness analysis. Section 6 offers concluding remarks.

2. Literature review

There is a large literature on the relationship between competition and bank stability for conventional banks. In a seminal paper, Keeley (1990) showed that, for a sample of large US banks, competition erodes the charter value of banks, leading them to take on more risk to recover lost profits, thus providing early support for the competition-fragility hypothesis. Similarly, Salas and Saurina (2003) investigate the effect of competition on the stability of Spanish banks and show that increased competition leads banks to take on more risk. Beck et al. (2006) investigate the correlation between concentration, competition, and the likelihood of a crisis, using a sample of 69 countries over the period 1980–1997. Their evidence shows that a highly concentrated national banking system is less exposed to systemic risk; thus providing additional support for the competition–fragility view for a large sample of countries. Additional empirical support for the negative relationship between competition and bank stability is provided by Yeyati and Micro (2007) in a sample of Latin American countries, Soedarmono et al. (2013) for a sample of Asian banks, and Kasman and Kasman (2015) for Turkish banks.

Another strand of the literature provided support for the competition-stability hypothesis. In a seminal paper, Boyd et al. (2006) document that competition enhances bank stability for a large sample of US banks and a sample of 134 non-industrialized countries. In

[1] In our analysis, we address the potential endogeneity of capital adequacy to bank stability since the literature suggests that competition may increase bank risk-taking and, therefore, banks will be obligated to reduce their capital at risk by holding the minimum capital “buffer” (Hellman et al., 2000; Allen and Gale, 2004; Smaoui et al., 2020-a).

the same vein, Schaeck et al. (2009), using a sample of 145 countries over the period 1980–2005, provided evidence for the competition-stability hypothesis by showing that increased competition leads to more bank stability. Anginer et al. (2014) analyze systemic risk and provide support for the competition-stability hypothesis in a sample of 63 countries. Liu et al. (2013) show that competition enhances the stability of city banks in the Japanese banking system. Fu et al. (2014) provide additional evidence for the positive relationship between competition and bank stability in the Asia-Pacific region. The above discussion indicates that the empirical evidence on the relationship between competition and bank stability for CBs is mixed.

For dual banking systems, earlier work has mostly focused on either competition or bank stability. Cupian and Abduh (2017) and Weill (2011) focused on the competitiveness of dual banking systems without investigating bank risks. Čihák and Hesse (2010), Beck et al. (2013), Abedifar et al. (2013), and Alqahtani et al. (2017), among many others, compare the riskiness of IBs and CBs without looking at the effect of competition. This latter branch of the literature on the relative stability of IBs versus CBs did not reach a consensus. Wiyono and Rahmayuni (2012) and Alqahtani et al. (2017) show that IBs are riskier than CBs. Čihák and Hesse (2010) document that large CBs are less risky than large IBs. Another strand has documented that IBs are less risky than CBs due to the risk-sharing nature of their business model (Abedifar et al., 2013; Baele et al., 2014; Bourkhis and Nabi, 2013). Čihák and Hesse (2010) showed that small CBs are risker than small IBs.

More recently, a growing literature combined both dimensions by analyzing the effect of competition on the stability and risks of banks in dual banking systems. The extant literature considered capitalization as a control variable when studying the relationship between competition and financial stability/risk-taking (Azmi et al., 2019; Albaity et al., 2019; Ebrahim et al., 2019; Alam et al., 2019; Risfandy et al., 2020). Nurul Kabir and Worthington (2017) document that competition is detrimental to the stability of both IBs and CBs in a sample of 16 countries with dual banking systems over the 2000–2012 period. Moreover, they show that the harmful effect of the competition is larger for CBs. Alam et al. (2019) investigate ten countries with dual banking systems from 2006 to 2016 and document that competition is detrimental to the stability of CBs but beneficial to the stability of IBs. Focusing on the role of religiosity, Risfandy et al. (2020) establish that competition is detrimental only to the stability of conventional banks. In particular, they show that in countries where religion is more predominant, the stability of IBs is not affected. On the contrary, Albaity et al. (2019) show that in the MENA region, competition is more harmful to IBs compared to CBs over the 2006–2015 period. Finally, allowing for the interaction of competition and diversification, Azmi et al. (2019) document that the stability of IBs and CBs is not affected by competition in a sample of 14 dual banking countries over the 2005–2016 period. The above discussion suggests that the literature findings on the effect of competition on the stability of banks in dual banking systems are mixed at best.

In a seminal paper, Matinez-Miera and Repullo (2010) showed that both competition-fragility and competition-stability play a role in analyzing the relationship between competition and bank failure and that the relationship is U-shaped. When markets are monopolistic, an increase in competition leads to more stability whereas, in sufficiently competitive markets, stiff competition exacerbates bank risk, as the margin effect becomes larger than the risk-shifting effect. Accordingly, in our analysis, we allow for the existence of a nonlinear relationship between competition and bank stability.

As emphasized by Berger et al. (2009), Tabak et al. (2012), and Davis et al. (2020), it is important to include both capital and competition when investigating bank stability. Indeed, including only competition, while omitting capital leads to an omission of an important factor that affects bank stability and may lead to biases in the results and misleading policy implications. In this paper, we follow this approach and take into account competition and capital adequacy in all our investigations of bank stability in countries with dual banking systems. When faced with more competition, banks may take on more or less risk depending on their level of capital. In our analysis, we add to the existing literature by examining the *moderating* effect of capitalization on the competition-bank stability nexus in dual banking systems.

CBs and IBs have different models and face different constraints. Islamic banks are encouraged to operate based on the PLS model, in which they act as agents in investing the depositors' funds, while the depositors are the principals. The moral hazard problem that results from this relationship may provide the IBs with the incentives to take on more risk (Bashir, 1999). Moreover, to comply with Islamic rules, IBs must eliminate interest, gambling, speculation, and dealing in derivative instruments. Hence, given the different nature of their business model and the different constraints and risks they face, it is unclear a priori how capitalization affects the relationship between competition and stability in dual banking systems and whether the effect is similar for IBs and CBs. Thus, it is important to investigate the differential effect of capitalization on the competition stability nexus between IBs ad CBs.[2]

3. Variables description and data

In this section, we describe the variables and data used in the empirical analysis.

3.1. Variables description

3.1.1. Dependent variable

We use the z-score (*zscore*) to measure bank stability. The z-score represents the number of standard deviations by which bank returns must fall before bank equity is fully depleted (Beck et al., 2013). Therefore, the z-score is inversely proportional to the bank's probability of bankruptcy: the higher the z-score, the higher the bank stability, and the lower the bank insolvency risk. This variable is

[2] In our analysis, we address the potential endogeneity of capital adequacy to bank stability as suggested by the literature (Hellman et al., 2000; Allen and Gale, 2004; Smaoui et al., 2020-a).

commonly used in the banking literature to assess bank stability (see Albaity et al., 2019; Nurul Kabir and Worthington, 2017; Beck et al., 2013; Čihák and Hesse, 2010). Algebraically, the z-score is calculated as follows:

$$zscore_{it} = \frac{\frac{E_{it}}{TA_{it}} + ROA_{it}}{\sigma_{ROA_{it}}} \tag{1}$$

ROA_{it} and $\sigma_{ROA_{it}}$ are the return on assets and the standard deviation of return on assets of bank i at time t, respectively, with Eit/TAit being the equity to total assets ratio. Following Beck and Laeven (2006) and Hesse and Cihak (2007), we use the standard deviation of ROA calculated over the full sample. Since the distribution of z-score is skewed, we use the natural logarithm of the z-score (Abedifar et al., 2013; Smaoui et al., 2020b). We also use the net interest margin (nim) as an alternative measure of bank stability as suggested by the literature (Angbazo, 1997; Saksonova, 2014). For instance, Angbazo (1997) argues that the net interest margins of commercial banks reflect both the interest rate risk and default risk. He shows that banks with higher interest rate risk exposure and riskier loans would set loan and deposit rates to achieve higher net interest margins.

3.1.2. Independent variables

3.1.2.1. Competition measure. The Lerner index (*lerner*) has been extensively used in the literature to assess the degree of competition in the banking sector (Demirguc-Kunt and Martinez-Peria, 2010; Beck et al., 2013; Anginer et al., 2014; Lapteacru, 2014). It captures the degree to which banks can increase their price beyond their marginal cost. A higher value of the index indicates a higher bank market power. Therefore, *lerner* is an inverse proxy for bank competition, whereby a low index indicates a high competition level and vice versa.

The formula of the Lerner index is presented as follows:

$$lerner_{it} = (P_{it} - MC_{it})/P_{it} \tag{2}$$

Where $\boldsymbol{MC_{it}}$ is the marginal cost of bank i in year t, and $\boldsymbol{P_{it}}$ is the price of assets that is equal to the ratio of total revenue over total assets (Leroy and Lucotte, 2017; Fiordelisi and Mare, 2014). To estimate the marginal cost, we compute the trans-log cost function of bank i at time t using the following panel model:

$$\begin{aligned} ln(TC_{it}) = {} & \alpha + \beta_1 lnTA_{it} + \beta_2\alpha_2 ln(TA_{it})^2 + \beta_3 ln(W_{1,it}) + \beta_4 ln(W_{2,it}) + \beta_5 ln(W_{3,it}) + \beta_6 ln(TA_{it})ln(W_{1,it}) + \beta_7 ln(TA_{it})ln(W_{2,it}) \\ & + \beta_8 ln(TA_{it})ln(W_{3,it}) + \beta_9\, ln(W_{1,it})\, ln(W_{1,it}) + \beta_{10} ln(W_{2,it})ln(W_{2,it}) + \beta_{11} ln(W_{3,it})ln(W_{3,it}) + \beta_{12} ln(W_{1,it})ln(W_{2.it}) \\ & + \beta_{13} ln(W_{1,it})ln(W_{3.it}) + \beta_{14} ln(W_{2,it})ln(W_{3.it}) + \beta_{15} trend + \beta_{16} lnzscore_{it} + \beta_{17} eqta_{it} + \varepsilon_{it} \end{aligned} \tag{3}$$

where TC_{it} is the total costs of bank i at the time t, which is equal to the sum of interest expenses and non-interest expenses, while TA_{it} is the bank's total assets. Further, following the empirical banking literature (Anginer et al., 2014; Demirguc-Kunt and Martinez-Peria, 2010; Berger et al., 2009), we compute $W_{1,it}$ as the ratio of interest expenses to total assets; $W_{2,it}$ as the ratio of personnel expenses to total assets; and $W_{3,it}$ as the ratio of administrative and other operating expenses to total assets. We add a trend variable to control for technological changes. We also control for bank risk with $\boldsymbol{lnzscore_{it}}$ and for bank capitalization with the ratio of equity to total assets ($\boldsymbol{eqta_{it}}$). Finally, ε_i is the error term. All variables are winsorized at the 5th and 95th percentile levels to minimize the effect of outliers.

We apply the following constraints to the regression parameters to address the issue of heterogeneity on input prices:

$$\begin{aligned} & \beta_3 + \beta_4 + \beta_5 = 1 \\ & \beta_6 + \beta_7 + \beta_8 = 0 \\ & \beta_9 + \beta_{12} + \beta_{13} = 0 \\ & \beta_{10} + \beta_{12} + \beta_{14} = 0 \\ & \beta_{11} + \beta_{13} + \beta_{14} = 0 \end{aligned} \tag{4}$$

Based on the above conditions, we use the estimated coefficients of the regression model (3) to estimate the marginal cost for each bank i in year t:

$$MC_{it} = \frac{TC_{it}}{AT_{it}} \left[\beta_1 + 2\beta_2 TA_{it} + \beta_6 lnW_{1,it} + \beta_7 lnW_{2,it} + \beta_8 lnW_{3,it}\right] \tag{5}$$

In a robustness test, we use the concentration ratio (*conc*) as an alternative measure of competition. The concentration ratio is calculated by the sum of the total assets of the three largest banks divided by the total assets of the banking industry in each country.

3.1.2.2. Capitalization. In this paper, we undertake the task of examining the joint effect of competition and capital holding on bank stability. The banking literature puts forward two main hypotheses. The “skin in the game” hypothesis states that higher bank capital is associated with lower bank risk-taking because managers become more prudent in their investment choices (Davis et al., 2020; Bitar et al., 2018). Moreover, banks tend to hold higher capital ratios to be able to meet deposit withdrawals, thereby improving monitoring and screening and diminishing the risk of bailouts (Demirguc-Kunt et al., 2013). On the opposite, the “regulatory hypothesis' suggests a positive relationship between capital and bank risk because regulators would impose higher bank capital in response to higher risk (Ianotta et al., 2007; Bitar et al., 2018). To control for bank capital, we use the capital adequacy ratio, *car*, calculated as the sum of Tier 1 capital and Tier 2 capital over total risk-weighted assets.

3.1.2.3. Bank-level controls. We use an array of control variables at the individual bank level to control for the competition-bank stability relationship between IBs and CBs.

3.1.2.3.1. Size (size). Empirical studies show that bank size influences the stability of the banking industry. In general, large banks enjoy the opportunity of diversifying their assets compared to small banks (Tabak et al., 2012). They achieve cost efficiency by reaching economies of scale of production costs as well as gaining stable income without excessive risk-taking (Schaeck and Cihák, 2014). They also have resources for screening and monitoring the loans to be granted to clients (Nurul Kabir and Worthington, 2017). On the other hand, Liu et al. (2012) and Abdulkarim et al. (2014) show that large banks tend to increase risk-taking behavior because they take advantage of the "too-big-to-fail" safety net subsidies. The size is proxied by the natural logarithm of total assets. Thus, size is expected to have a positive (negative) association with *zscore*.

3.1.2.3.2. Diversification (diver). Diamond (1984) suggests that diversification allows a bank to reduce financial intermediation costs. Diversification strategies are carried out by reducing concentration on both deposits and costs of funding. Diversification of deposits aims at preventing liquidity risk against unexpected withdrawals or a surge in loan demand. The empirical literature suggests that well-diversified banks are exposed to less insolvency risk (Schaeck and Cihák, 2014; Rossi et al., 2009; Amidu and Wolfe, 2013). We employ the ratio of non-interest income to total income as a proxy for diversification. A positive relationship is expected between *diver* and *zscore*.

3.1.2.3.3. Liquidity (nlta). The ratio of net loans to total assets, which indicates how much of the bank's total assets are tied up in loans, is used as a proxy for measuring liquidity. The higher the ratio, the more illiquid the bank is. The literature puts forward a direct link between liquidity and the risk-taking behavior of banks. For instance, Acharya and Naqvi (2012) and Wagner (2007) argue that when a bank holds abundant liquidity, managers will have incentives to take excessive risks because they believe that the bank is secure from short-term liquidity risk. On the other hand, a strand of the literature shows that banks with higher access to liquidity buffers are exposed to less risk (Bolton et al., 2011; Hugonnier et al., 2017; Milne and Whalley, 2001; Peura and Keppo, 2006). We conjecture that a higher net loans to total asset ratio points to drained liquidity, implying a higher bank instability.

3.1.2.3.4. Loan growth (loang). The literature states that financial crises are often preceded by uncontrolled loan growth, followed by an asset bubble (Tenjo and López, 2010; Alessi and Detken, 2011), which fuels an explosion of credit defaults (Jorda et al., 2011; Schularick and Taylor, 2012). Furthermore, this uncontrolled loan growth leads to a decrease in the bank capital ratio, increased non-performing loans, and insolvency risk (Salas and Saurina, 2002; Foss et al., 2010; Amador et al., 2013). Hence, we predict a negative relationship between loan growth and bank stability. We compute loan growth by the annual percentage change in net loans.

3.1.2.4. Country-level controls

3.1.2.4.1. Macroeconomic variables. Macroeconomic variables have the potential to affect bank stability. Therefore, we control for GDP growth (*gdpg*) and inflation rate (inf). GDP growth is a proxy for the business cycle. Higher economic growth usually reduces bank defaults and enhances business activities, thereby increasing bank profits and reducing their risks (Smaoui et al., 2020b). Furthermore, the inflation rate is a proxy for macroeconomic imbalances, whereby higher inflation triggers excessive borrowing, increasing the possibility of massive default when prices begin to fall (Fazio et al., 2015). Hence, we expect a positive relationship between *gdpg* and *zscore* and a negative association between *inf* and *zscore*.

3.1.2.4.2. The global financial crisis (gfc). According to Soedarmono et al. (2013), the 2008 global financial crisis is an important variable affecting the competition–stability nexus as it altered the landscape of market competitiveness and risk-taking behavior. Furthermore, Berger and Bouwman (2009) contend that banks are likely to restrict loans and hold more capital ratios as a buffer to absorb shocks during a crisis. To control for the impact of the global financial crisis, we include a dummy variable (*gfc)* equal to 1 in the period of crisis (2008–2009), and 0 otherwise.

3.1.2.4.3. Bank regulation and supervision. The banking sector is heavily regulated and supervised due to its vital role as a financial intermediary and its role as a country's money supply. The failure of the banking sector will jeopardize the country's economic system. In theory, the regulation of capital requirements imposes limits on the risk-return frontier and leverage. However, the leverage restrictions force banks to adapt to their assets' composition and encourage them to engage in risky activities (Kim and Santomero, 1988). Akins et al. (2016) empirically studied capital regulation's connection to risk-taking behavior. Their results show that stringent capital regulation increases risk-taking behavior to offset the expected returns. On the contrary, Cubillas and Gonzales (2014) find that capital requirements have succeeded in minimizing the adverse effect of deregulation on bank stability in both developed and developing countries. In a robustness check, we control for bank regulation and supervision using the following indicators from Barth et al. (2013): activity restrictions *(actrest*), capital stringency (*stringency*), supervisory power (*suppower*), and diversification index (*diverind*).[3]

The existence of deposit insurance prevents potential bank runs and promotes stability by providing a warranty for depositors, thereby increasing public confidence and stabilizing market expectations (Diamond and Dybvig, 1983). However, this scheme causes moral hazard by inducing managers to engage in riskier investments because their deposits are under warranty (Matutes and Vives, 1996). Accordingly, we add a dummy variable equal to 1 if the country adopts an explicit deposit insurance scheme, and 0 otherwise

[3] The detailed description of the bank regulation indicators appears in Table 1.

Table 1
Definitions, proxies, and expected signs.

Variable	Definition	Label	Expected Sign
Dependent variables			
Z-score	Log of z-score	*zscore*	
Net interest margin	(Interest income-interest expense)/total assets	*nim*	
Independent variables			
Lerner	Lerner index	*lerner*	+/−
Concentration ratio	Total assets of the three largest banks divided by total assets of the banking industry	*conc*	+/−
Islamic bank	Dummy variable equal to 1 for Islamic banks, and 0 otherwise	*ib*	+/−
Capitalization	Capital Adequacy Ratio	*car*	+/−
Size	Log of total assets	*size*	+/−
Diversification	Ratio of non-interest income to total income	*diver*	+
Liquidity	Ratio of net loans to total assets	*nlta*	−
Loan growth	Annual percentage change in the net loans	*loang*	−
GDP growth	Annual real GDP growth rate	*gdpg*	+
Inflation	Annual inflation rate	*inf*	−
Global financial crisis	Dummy variable equal to 1 in the period of crisis (2008–2009), and 0 otherwise	*gfc*	−
Activity restrictions index	The level of regulatory restrictiveness for bank participation in: (1) securities activities (2) insurance activities (3) real estate activities (4) bank ownership of nonfinancial firms	*actrest*	+
Supervisory power Index	The extent to which official supervisory authorities have the authority to take specific actions to prevent and correct problems	*suppower*	+
Capital stringency index	The extent of regulatory requirements regarding the amount of capital that banks must have relative to specific guidelines	*stringency*	+
Diversification index	Measures whether regulations support geographical asset diversification	*diverind*	+
Deposit insurance	Dummy variable equal to 1 if the country adopts an explicit deposit insurance scheme, and 0 otherwise	*depins*	+/−

This table shows the definitions, proxies, labels, and expected signs of our variables.

Table 2
Number of banks per country.

Country	IBs	CBs
Bahrain	5	5
Bangladesh	11	23
Egypt	3	10
Indonesia	14	31
Iraq	4	25
Jordan	2	14
Kuwait	4	7
Malaysia	3	7
Oman	4	5
Pakistan	5	16
Palestine	2	4
Qatar	5	4
Saudi Arabia	7	3
Syria	1	11
South Africa	1	9
Turkey	1	12
UAE	8	18
Total	**80**	**204**

This table presents the number of IBs and CBs by country.

(*depins*). Table 1 reports the definitions of our dependent and independent variables and their expected signs.

3.2. Data

In this study, we include in our sample all countries with a dual-type banking system, covered by the Eikon-Thomson Reuters database. The final sample comprises all CBs and IBs in the following countries (ordered alphabetically): Bahrain, Bangladesh, Egypt, Indonesia, Iraq, Jordan, Kuwait, Malaysia, Oman, Pakistan, Palestine, Qatar, Saudi Arabia, South Africa, Syrian Arab Republic, Turkey, and United Arab Emirates.

Banks with missing values on *zscore* were removed from our sample. Moreover, investment banks, development banks, finance houses, and central banks were excluded. We also used the consolidated financial statements to avoid double counting of parent and subsidiary banks in the dataset.

We gather data from various sources. Bank-specific variables are drawn from the Eikon-Thomson Reuters database. Further, the macroeconomic data, such as GDP growth and inflation rate, are collected from the World Bank's World Development Indicators

Table 3
Summary statistics.

	N	Mean	Median	St.Dev	Min	Max
Full Sample						
lnzscore	3736	2.7	2.829	0.767	1.036	3.88
nim	3737	3.146	2.835	1.443	1.114	6.88
ib	4880	0.32	0	0.466	0	1
lerner	2851	0.02	−0.018	0.392	−0.585	0.772
conc	4158	62.846	61.064	18.513	29.488	93.934
car	2791	0.187	0.167	0.071	0.109	0.39
size	3809	8.201	8.147	1.711	5.177	11.168
diver	3718	0.331	0.317	0.172	0.042	0.706
nlta	3560	0.534	0.567	0.161	0.179	0.762
loang	3372	0.178	0.132	0.21	−0.123	0.735
gdpg	4355	4.802	5	2.342	0.2	9.6
inf	4610	5.617	4.7	4.277	0.1	16.3
actrest	4871	10.02	11	4.191	0	14
stringency	3998	4.692	5	1.635	2	7
suppower	3818	11.062	12	2.244	7	14
diverind	3672	1.154	1	0.649	0	2
depins	4879	0.508	1	0.5	0	1
CBs						
lnzscore	2580	2.683	2.777	0.771	1.036	3.88
nim	2529	3.169	2.845	1.494	1.114	6.88
ib	3320	0	0	0	0	0
lerner	1946	0.003	−0.019	0.389	−0.585	0.772
conc	2804	63.302	64.863	18.815	29.488	93.934
car	1872	0.189	0.167	0.072	0.109	0.39
size	2599	8.047	7.994	1.753	5.177	11.168
diver	2526	0.341	0.332	0.174	0.042	0.706
nlta	2425	0.515	0.544	0.164	0.179	0.762
loang	2282	0.174	0.126	0.214	−0.123	0.735
gdpg	2919	4.809	5	2.308	0.2	9.6
inf	3140	5.944	5.1	4.375	0.1	16.3
actrest	3313	9.791	11	4.412	0	14
stringency	2706	4.639	5	1.665	2	7
suppower	2586	11	12	2.241	7	14
diverind	2498	1.166	1	0.676	0	2
depins	3320	0.512	1	0.5	0	1
IBs						
lnzscore	1156	2.739	2.911	0.757	1.036	3.88
nim	1208	3.097	2.812	1.33	1.114	6.88
ib	1560	1	1	0	1	1
lerner	905	0.057	−0.015	0.397	−0.585	0.772
conc	1354	61.901	59.686	17.839	29.488	93.934
car	919	0.182	0.167	0.067	0.109	0.39
size	1210	8.533	8.527	1.567	5.177	11.168
diver	1192	0.31	0.278	0.165	0.042	0.706
nlta	1135	0.574	0.613	0.147	0.179	0.762
loang	1090	0.186	0.141	0.201	−0.123	0.735
gdpg	1436	4.789	5	2.411	0.2	9.6
inf	1470	4.918	3.8	3.972	0.1	16.3
actrest	1558	10.508	11	3.631	0	14
stringency	1292	4.803	5	1.565	2	7
suppower	1232	11.194	12	2.247	7	14
diverind	1174	1.129	1	0.585	0	2
depins	1559	0.5	1	0.5	0	1

This table includes the descriptive statistics of the dependent and independent variables for the sample of 204 CBs and 80 IBs over the period 2000–2019.

database. Moreover, data on deposit insurance is collected from Demirguc-Kunt et al. (2014). Finally, data on banking regulations are obtained from Barth et al. (2007). The final sample covers 284 banks, including 204 CBs and 80 IBs over the period 2000–2019. Table 2 shows the sample countries and the number of CBs and IBs in each country.

4. Methodology

In this paper, we examine the joint effect of competition and capital adequacy on bank stability using a sample of 284 banks (204

Table 4
Matrix of correlations.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) lnzscorew	1.000																
(2) nimw	−0.032	1.000															
(3) ib	−0.069	−0.014	1.000														
(4) lernerw	0.280	0.101	0.081	1.000													
(5) conc3w	0.138	−0.295	−0.027	0.442	1.000												
(6) carw	0.073	0.197	0.015	0.080	0.108	1.000											
(7) sizew	0.226	−0.237	0.161	0.513	0.350	−0.268	1.000										
(8) diverw	−0.006	−0.499	−0.062	0.099	0.057	−0.300	0.314	1.000									
(9) nltaw	0.013	0.110	0.084	0.084	−0.124	−0.088	0.035	−0.031	1.000								
(10) loangw	−0.068	0.151	0.073	−0.138	−0.136	0.151	−0.257	−0.099	0.088	1.000							
(11) gdpgw	0.006	0.044	−0.016	−0.243	−0.395	−0.119	−0.193	0.104	0.054	0.189	1.000						
(12) infw	−0.222	0.299	−0.062	−0.376	−0.349	−0.169	−0.263	0.037	−0.178	0.237	0.175	1.000					
(13) actrestw	−0.038	0.027	−0.012	−0.010	−0.090	−0.026	−0.205	0.099	−0.084	−0.006	−0.029	0.173	1.000				
(14) stringencyw	0.032	−0.294	0.052	0.112	0.142	−0.057	0.130	0.121	0.015	−0.140	−0.050	−0.255	−0.190	1.000			
(15) suppowerw	0.146	0.130	−0.005	0.015	0.096	0.194	0.039	−0.135	0.029	−0.020	0.111	−0.231	−0.106	−0.358	1.000		
(16) diverindw	−0.024	0.080	−0.097	−0.291	−0.410	−0.172	−0.340	0.050	−0.172	0.012	0.207	0.214	0.255	0.126	−0.096	1.000	
(17) depins	0.123	0.053	−0.091	−0.290	−0.216	−0.017	−0.283	−0.042	0.219	0.049	0.359	−0.115	−0.133	−0.063	0.343	0.234	1.000

This table depicts the correlations between our variables.

CBs and 80 IBs) over the period 2000–2019. To do so, we estimate the following dynamic panel model:

$$fs_{i,j,t} = \beta_0 + \beta_1 fs_{i,j,t-1} + \beta_2 ib + \beta_3 comp_{i,j,t} + \beta_4 comp2_{i,j,t} + \beta_5 car_{i,j,t} + \beta_6 size_{i,j,t} + \beta_7 diver_{i,j,t} + \beta_8 nlta_{i,j,t} + \beta_9 loang_{i,j,t} + \beta_{10} gdpg_{j,t} + \beta_{11} inf_{j,t} + \beta_{12} gfc + \beta_{13} ib^{*}comp_{i,j,t} + \beta_{15} car_{i,j,t}{}^{*}comp_{i,j,t} + \beta_{16} reg_{j,t} + \beta_{17} ib^{*}comp_{i,j,t}{}^{*}car_{i,j,t} + \mu_i + \varepsilon_{ijt} \quad (6)$$

where fs_{ijt} denotes our measures of bank stability (*zscore, roa*) of bank *i* in country *j* at time *t*. The first lag of the dependent variable, fs_{ijt-1}, is introduced to capture the dynamic nature of financial stability. *ib* is a dummy variable equal to 1 in the case of an IB, and 0 otherwise. $comp_{ijt}$ denotes one of our measures of competition (*lerner, conc*), while car_{ijt} is the capital adequacy ratio. Bank-level control variables consist of 4 variables: the log of total assets as a proxy for size (*size*), the ratio of non-interest income to total income as a proxy of diversification (*diver*), the ratio of total loans outstanding as a proxy of liquidity (*nlta*), and the loan growth (*loang*). In terms of country-level variables, we use the GDP growth (*gdpg*) and inflation rate (*inf*) to control for the macroeconomic environment. *Gfc* is a dummy variable equal to 1 during the crisis (2008–2009) and 0 otherwise. We also introduce the interaction terms between ib. and competition and car and competition to capture the differential effects of the bank type and bank capitalization on the relationship between competition and stability. To test whether the effect of capitalization on the competition-stability nexus is different between CBs and IBs, we include a triple factor interaction term comprising ib., capitalization, and competition. *Reg* designates one of our measures of regulation, namely: activity restrictions, capital stringency, supervisory power, diversification index, and deposit insurance. Finally, μ_{ij} *and* ε_{ijt} are the unobservable bank-specific term and the error term, respectively.

Following Berger et al. (2009) and Kasman and Kasman (2015), we add the quadratic term of *lerner* to capture the likelihood of a nonlinear association between competition and stability. In our model (6), positive values of β_3 and β_4 would provide support for the franchise value paradigm whereby increased competition (lower *lerner*) hampers bank stability. On the contrary, negative values of these coefficients would corroborate the risk-shifting effect that states that higher competition (lower *lerner*) would enhance bank stability. If β_3 is negative and β_4 is positive, the results would provide support for the inverted U-shaped association between competition and bank stability proposed in the Matinez-Miera and Repullo (2010) model (henceforth MMR). However, if β_3 is positive and β_4 is negative, the evidence would still support a nonlinear relationship between competition and bank stability, but the model suggestions would be different from that of the MMR's model (Jimenez et al., 2013).

To mitigate the adverse effect of outliers on our estimations, all our variables (except dummies) are winsorized at the 5th and 95th percentile levels. Further, we employed the Wooldridge (2002) test and the modified Wald test to detect the presence of serial correlation and heteroscedasticity in the series of residuals, respectively. The results confirm the presence of heteroscedasticity and serial correlation in the residuals.

To tackle these econometric issues as well as the endogeneity of the independent variables, we employ the two-step system GMM estimator proposed by Arellano and Bover, 1995 and Blundell and Bond (1998). The system GMM estimator combines the equation in first differences with the equation in levels within a system. The estimator uses the lagged exogenous and endogenous variables prior or equal to (t-2) as instruments in the regression in first differences, and the lagged differences of the endogenous and exogenous variables as the instruments for the regression in levels. The competition measure is treated as endogenous as suggested by the literature (Jimenez and Saurina, 2004; Louzis et al., 2012; Schaeck and Cihák, 2010). Likewise, capital adequacy is assumed to be endogenous since the literature suggests that competition may increase bank risk-taking and, therefore, banks will be obligated to reduce their capital at risk by holding the minimum capital "buffer" (Hellman et al., 2000; Allen and Gale, 2004; Smaoui et al. (2020a)). All remaining explanatory variables are assumed to be exogenous.

To check the consistency of the system-GMM estimator, we use two specification tests: The Hansen test checks the overall validity of the instruments used, while the Arellano and Bond's (AR2) test examines the absence of second-order serial correlation in the series of residuals. Our system GMM estimator is consistent if we cannot reject the null hypotheses under both the Hansen and AR2 tests.

5. Empirical findings

5.1. Descriptive results

Table 2 lists the number of IBs and CBs in each country. The number of banks per country in our sample of 17 countries ranges from 6 banks in Palestine to 45 banks in Indonesia. Our sample includes 284 banks: 80 IBs and 204 CBs.

Table 3 reports the summary statistics for the dependent and independent variables. The average *zscore* in the sample is 2.7 and ranges from 1.04 to 3.88 reflecting a large disparity in bank stability. Similarly, the average net interest margin is 3.146 and ranges from 1.114 to 6.88. The average *lerner* is 0.02 and ranges from −0.585 to 0.772 reflecting large variations in bank competitiveness. The capital adequacy ratio is, on average, equal to 0.19 and ranges from 0.11 to 0.39. The banks included in our sample show different loan growth rates; the average loan growth rate is 0.18% and ranges from −0.12% to 0.73%.

The comparative descriptive statistics between CBs and IBs reveal some interesting observations. Compared with CBs, IBs are less risky, less competitive (a higher Lerner index), have quite similar capital adequacy ratios, and are on average larger. Finally, IBs have experienced higher loan growth.

Table 4 lists the correlations between the independent variables. There are no potential problems of collinearity.

5.2. Baseline regression results

Table 5 presents the system GMM estimation results for our baseline model based on a sample of 80 Islamic and 204 conventional

Table 5
Baseline regressions.

	(1)	(2)	(3)	(4)
	zscore	zscore	zscore	zscore
lzscore	0.880***	0.847***	0.884***	0.909***
	(0.037)	(0.036)	(0.006)	(0.026)
ib	−0.147**	−0.219***	−0.117***	−0.041**
	(0.071)	(0.073)	(0.014)	(0.020)
lerner	0.192***	0.098**	0.207***	0.433***
	(0.051)	(0.050)	(0.030)	(0.162)
lerner2	−0.210**	−0.167*	−0.143***	−0.216**
	(0.082)	(0.091)	(0.014)	(0.085)
car	0.752**	0.600*	0.698***	0.331*
	(0.315)	(0.321)	(0.056)	(0.187)
size	0.009	0.017	0.012***	−0.003
	(0.011)	(0.011)	(0.002)	(0.007)
diver	−0.013	−0.053	−0.007	0.012
	(0.058)	(0.062)	(0.017)	(0.047)
nlta	0.128	−0.033	0.074***	−0.030
	(0.143)	(0.145)	(0.025)	(0.089)
loang	−0.242***	−0.255***	−0.223***	−0.236***
	(0.080)	(0.081)	(0.019)	(0.058)
gdpg	0.009***	0.010***	0.009***	0.009***
	(0.003)	(0.003)	(0.001)	(0.002)
inf	0.002	0.003	−0.000	−0.001
	(0.004)	(0.004)	(0.001)	(0.003)
gfc	0.001	0.004	0.005	−0.010
	(0.020)	(0.020)	(0.004)	(0.019)
ib.*lerner		0.298**		−0.264
		(0.122)		(0.266)
car*lerner			−0.407***	−1.630**
			(0.120)	(0.811)
ib.*car*lerner				2.277*
				(1.321)
constant	0.119	0.281*	0.110***	0.277**
	(0.143)	(0.159)	(0.037)	(0.115)
Obs.	1652	1652	1654	1652
AR2	0.579	0.355	0.626	0.423
Hansen	0.297	0.542	0.167	0.486

banks over the period 2000–2019. The coefficients of the lagged dependent variable are positive and significant at the 1% level across all the specifications, which justifies our use of a dynamic panel model. This result indicates that the current level of bank stability is highly influenced by the previous information about bank stability. Moreover, the *p*-values of the AR2 and Hansen tests are all insignificant, thus confirming that the estimations are free from second-order correlation and that the instruments used are overall valid.

Turning to our focal variable, Table 5 shows that *lerner* is positively and significantly associated with *zscore*, while the square of *lerner* (*lerner2*) loads negative and significant in 3 out of our 4 specifications. This finding lends support to the nonlinear relationship between banking market competition and bank stability proposed in the MMR (2010) model. The positive coefficient of *lerner* is supportive of the competition-fragility (or margin effect) paradigm and suggests that higher competition (lower *lerner*) forces banks to increase risk-taking behavior to offset the eroded franchise value, thus leading to lower bank stability (Keeley, 1990; Allen and Gale, 2004). On the other hand, the negative coefficient of *lerner2* provides support to the risk-shifting effect; that is, increased competition could lower loan rates, decrease borrower credit risk, and therefore enhance financial stability (Boyd and De Nicolo, 2005). Hence, a U-shaped relationship between competition and bank stability ensues. Moreover, when we introduce the interaction between *ib* and *lerner* in specification 2, an interesting result emerges. We found that the coefficient of the interaction term loads positive and significant at the 5% level. This means that the competition-fragility effect is more pronounced for Islamic banks than for conventional banks. This may be attributed to the differences between the two types of banks. Islamic banks are encouraged to operate based on the PLS model, in which they act as agents in investing the depositors' funds, while the depositors are the principals. The moral hazard problem that results from this relationship may induce IBs to take on more risk (Bashir, 1999). Moreover, to comply with Islamic rules, IBs must eliminate interest, gambling, speculation, and dealing in derivative instruments. Therefore, IBs cannot invest in interest-bearing securities or earn interest revenue and are prohibited from financing their assets with debt, which leads to limitations in investing, financing, and risk management activities (Abedifar et al., 2013; Bourkhis and Nabi, 2013). Hence, the complexity in their business model forces IBs to take excessive risks when faced with increased competition which makes them more fragile (Albaity et al., 2019).

With regard to bank capitalization, Table 5 shows that *car* is positive and significant in all the specifications. This result is in line with the “skin in the game” hypothesis and suggests that a higher capital ratio encourages banks to refrain from engaging in risk-taking

Table 6
Alternative measure of bank stability: nim.

	(1)	(2)	(3)	(4)
	nim	nim	nim	nim
lnim	0.708***	0.634***	0.616***	0.608***
	(0.044)	(0.048)	(0.023)	(0.023)
ib	−0.040	−0.121	−0.101**	−0.137***
	(0.065)	(0.214)	(0.043)	(0.052)
lerner	0.852***	0.921***	1.532***	1.273***
	(0.177)	(0.220)	(0.221)	(0.297)
lerner2	−0.923***	−1.463***	−1.087***	−1.355***
	(0.338)	(0.374)	(0.130)	(0.162)
car	−0.530	−0.776	0.095	−0.226
	(0.794)	(0.783)	(0.421)	(0.425)
size	−0.026	−0.116***	−0.061**	−0.080***
	(0.045)	(0.029)	(0.025)	(0.024)
diver	−1.945***	−2.177***	−2.114***	−2.139***
	(0.286)	(0.306)	(0.158)	(0.156)
nlta	0.464**	0.727*	0.633***	0.662***
	(0.201)	(0.420)	(0.112)	(0.112)
loang	−0.010	−0.115	0.469***	0.423***
	(0.194)	(0.225)	(0.118)	(0.129)
gdpg	0.070***	0.030***	0.030***	0.024***
	(0.023)	(0.008)	(0.006)	(0.007)
inf	0.041***	0.047***	0.042***	0.041***
	(0.011)	(0.010)	(0.004)	(0.004)
gfc	−0.049	−0.091**	−0.060***	−0.086***
	(0.065)	(0.046)	(0.023)	(0.024)
ib.*lerner		0.720**		0.537
		(0.357)		(0.464)
car*lerner			−2.835***	−3.213**
			(0.987)	(1.343)
ib.*car*lerner				2.322
				(2.007)
constant	1.197**	2.409***	1.769***	2.072***
	(0.485)	(0.467)	(0.288)	(0.295)
Obs.	1612	1675	1675	1675
AR2	0.371	0.171	0.191	0.145
Hansen	0.241	0.530	0.06*	0.072*

activities (Davis et al., 2020; Bitar et al., 2018). In addition, banks tend to hold higher capital ratios to be able to meet deposit withdrawals, thereby improving monitoring and screening and diminishing the risk of bailouts (Demirguc-Kunt et al., 2013). In specification 3, we introduce the interaction term between *lerner* and *car* to test the moderating effect of bank capitalization on the competition-bank stability nexus. The coefficient of the interaction term is negative and highly significant at the 1% level (−0.407). To the best of the authors' knowledge, this finding is novel and implies that better bank capitalization seems to moderate the negative effect of competition on bank stability. Faced with increased competition, banks with higher capital ratios are more able to absorb shocks, fulfill their liquidity requirements, and tend to behave prudently in selecting asset portfolios, thereby reducing the risk of failure. To test whether the moderating effect of capitalization on the relationship between competition and bank stability is different between CBs and IBs, we include in specification 4 the interaction term between the bank type (*ib*), capitalization (*car*), and competition (*lerner*). The results point to the absence of a differential effect of the bank type on the moderating effect of capitalization on the competition-stability nexus as evidenced by the insignificant coefficient of the triple factor interaction term at the 5% significance level.

For the bank-level control variables, the results point to a positive and significant association between bank size and stability in specification 3. This finding corroborates the previous results that large banks enjoy the opportunity of diversifying their assets compared with small banks (Tabak et al., 2012), and achieve cost efficiency by reaching economies of scale of production costs as well as gaining stable income without excessive risk-taking (Schaeck and Cihák, 2014). Furthermore, loan growth loads negative and highly significant at the 1% level in all four specifications, as expected. This implies that uncontrolled loan growth leads to a decrease in the bank capital ratio, increased non-performing loans, and an increase in the bank insolvency risk (Salas and Saurina, 2002; Foss et al., 2010; Amador et al., 2013).

Looking at the country-level controls, we notice that GDP growth is positively and significantly related to *zscore* across all the specifications. This finding is consistent with previous literature that suggests that higher economic growth is beneficial for banks as it usually stimulates business activities, thereby increasing bank profits and reducing their default risks (Smaoui et al., 2020c). The remaining control variables are not significantly related to bank stability.

Table 7
Alternative measure of competition: concentration.

	(1)	(2)	(3)	(4)
	zscore	zscore	zscore	zscore
lzscore	0.873***	0.867***	0.870***	0.866***
	(0.011)	(0.011)	(0.011)	(0.011)
ib	−0.011	0.378***	−0.006	0.333***
	(0.010)	(0.105)	(0.010)	(0.112)
conc	0.623**	1.145***	0.996***	1.583***
	(0.306)	(0.386)	(0.318)	(0.417)
conc2	−0.471*	−0.721**	−0.388	−0.689**
	(0.244)	(0.288)	(0.247)	(0.298)
car	0.329***	0.044	2.049***	1.664***
	(0.120)	(0.142)	(0.400)	(0.434)
size	−0.014*	−0.031***	−0.020**	−0.035***
	(0.008)	(0.010)	(0.008)	(0.010)
diver	0.088***	0.113***	0.139***	0.146***
	(0.025)	(0.029)	(0.027)	(0.030)
nlta	0.183***	0.205***	0.211***	0.209***
	(0.026)	(0.030)	(0.027)	(0.034)
loang	−0.358***	−0.352***	−0.378***	−0.395***
	(0.027)	(0.027)	(0.030)	(0.034)
gdpg	0.011***	0.010***	0.011***	0.011***
	(0.001)	(0.001)	(0.001)	(0.001)
inf	−0.002*	−0.003**	−0.002*	−0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
gfc	0.006	0.001	0.003	−0.002
	(0.006)	(0.007)	(0.006)	(0.008)
ib.*conc		0.631***		0.678***
		(0.171)		(0.196)
car*conc			−2.729***	−2.893***
			(0.601)	(0.716)
ib.*car*conc				0.717
				(0.505)
constant	0.133	0.110	−0.107	−0.118
	(0.108)	(0.125)	(0.122)	(0.139)
Obs.	1844	1844	1844	1844
AR2	0.151	0.160	0.101	0.104
Hansen	0.274	0.412	0.381	0.518

This table shows the results of the regressions estimated with the system GMM procedure of Blundell and Bond (1998) for our sample of 80 IBs and 204 CBs for the period 2000–2019. The dependent variable is the log of zscore denoted *zscore* and the measure of competition is concentration (conc). The definitions of our variables appear in Table 1. The standard errors appear in parentheses below the estimated coefficients. A two-step system GMM estimator is used. Windmeijer (2005) finite-sample correction to the two-step covariance matrix is employed. Robust standard errors consistent in the presence of heteroskedasticity and autocorrelation within the panel are reported. The Hansen (1982) test tests the overall validity of our instruments, while AR2 is the Arellano and Bond (1991) test of the absence of second-order autocorrelation in the differenced residuals. ***, **, * refer to the 1, 5, and 10% levels of significance respectively.

5.3. *Robustness checks*

To further assess the reliability of our findings, we conduct a series of robustness checks.

5.3.1. *Alternative measure of bank stability*

Following Angbazo (1997), we use the net interest margin (*nim*) as an alternative measure of bank stability. Overall, the results that appear in Table 6 concur with our original findings. We provide further evidence of the U-shaped association between competition and bank stability. Consistent with our earlier results, the interaction term between *ib* and *lerner* is positive and significant at 1%, thus confirming that the competition-fragility nexus is stronger for IBs than CBs. The moderating effect of capitalization on the relationship between competition and stability is confirmed as evidenced by the significant coefficient of the interaction between *lerner* and *car* in specification 3. Once again, we find no evidence that the moderating effect of capitalization on the association between competition and bank stability is different between CBs and IBs (specification 4). It is worth noting that the crisis variable *gfc* loads negative and significant across all the specifications, implying that the 2008/09 financial crisis has harmed bank stability (Khan et al., 2017; Dahir et al., 2018).

5.3.2. *Alternative measure of competition*

In this test, we employ the bank concentration ratio (*conc*) as an alternative measure of competition. The concentration ratio is calculated by the sum of the total assets of the three largest banks divided by the total assets of the banking industry in each country. Again, Table 7 illustrates consistent and robust findings concurring with our previous results. In particular, we confirm the U-shaped

Table 8
Control for bank regulation and supervision.

	(1)	(2)	(3)	(4)	(5)
	zscore	zscore	zscore	zscore	zscore
lzscore	0.877***	0.926***	0.914***	0.912***	0.835***
	(0.038)	(0.031)	(0.032)	(0.034)	(0.039)
ib	−0.153**	−0.106**	−0.109**	−0.125***	−0.180***
	(0.067)	(0.045)	(0.049)	(0.047)	(0.068)
lerner	0.174***	0.159***	0.173***	0.173***	0.225***
	(0.050)	(0.047)	(0.049)	(0.047)	(0.045)
lerner2	−0.182**	−0.174**	−0.169**	−0.187**	−0.140*
	(0.082)	(0.085)	(0.076)	(0.089)	(0.084)
car	0.783**	0.620**	0.418	0.592*	0.573*
	(0.315)	(0.289)	(0.306)	(0.336)	(0.307)
size	0.013	0.005	−0.002	0.002	0.018
	(0.012)	(0.009)	(0.009)	(0.010)	(0.012)
diver	−0.021	−0.007	−0.009	−0.019	−0.074
	(0.057)	(0.050)	(0.053)	(0.054)	(0.063)
nlta	0.133	0.159	0.173	0.110	0.032
	(0.147)	(0.119)	(0.122)	(0.125)	(0.086)
loang	−0.251***	−0.248***	−0.306***	−0.249***	−0.203***
	(0.091)	(0.093)	(0.090)	(0.083)	(0.074)
gdpg	0.009***	0.007**	0.009***	0.010***	0.005
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
inf	0.002	0.006	0.001	0.001	0.001
	(0.004)	(0.005)	(0.003)	(0.004)	(0.004)
gfc	0.008	−0.014	−0.011	−0.009	0.011
	(0.020)	(0.018)	(0.019)	(0.018)	(0.018)
actrest	0.006**				
	(0.003)				
stringency		−0.006			
		(0.014)			
suppower			0.011***		
			(0.003)		
diverind				0.005	
				(0.017)	
depins					0.115**
					(0.055)
constant	0.018	0.036	0.033	0.123	0.218*
	(0.173)	(0.144)	(0.117)	(0.158)	(0.131)
Obs.	1648	1488	1474	1450	1652
AR2	0.467	0.382	0.412	0.385	0.563
Hansen	0.266	0.389	0.353	0.420	0.989

This table shows the results of the regressions estimated with the system GMM procedure of Blundell and Bond (1998) for our sample of 80 IBs and 204 CBs for the period 2000–2019. The dependent variable is the log of zscore denoted *zscore*. The definitions of our variables appear in Table 1. The standard errors appear in parentheses below the estimated coefficients. A two-step system GMM estimator is used. Windmeijer (2005) finite-sample correction to the two-step covariance matrix is employed. Robust standard errors consistent in the presence of heteroskedasticity and autocorrelation within the panel are reported. The Hansen (1982) test tests the overall validity of our instruments, while AR2 is the Arellano and Bond (1991) test of the absence of second-order autocorrelation in the differenced residuals. ***, **, * refer to the 1, 5, and 10% levels of significance respectively.

relationship between competition and bank stability as shown by the positive and significant coefficients of *conc* and the negative and significant coefficients of the square *conc*. Furthermore, the interaction between *ib* and *conc* is positive and significant, corroborating earlier results. Moreover, the interaction between *conc* and *car* in specification 3 is negative and significant, thus confirming the moderating effect of bank capitalization on the competition-stability nexus. Finally, consistent with our earlier findings, we find no evidence that the moderating effect of capitalization is different between CBs and IBs.

5.3.3. Control for bank regulation and supervision

The effect of competition on bank stability might be influenced by the extent of the country's bank regulation and supervision. Following Agoraki et al. (2011) and Lee and Hsieh (2013), we control for bank regulation and supervision using the following indicators from Barth et al. (2013): activity restrictions (*actrest*), capital stringency (*stringency*), supervisory power (*suppower*), and diversification index (*diverind*). We also control for the presence of deposit insurance with a dummy variable equal to 1 if the country adopts an explicit deposit insurance scheme, and 0 otherwise. The results are reported in Table 8. The evidence confirms the nonlinear relationship between competition and bank stability, whatever the specification. We can see from Table 8 that *actrest* is positive and significant as expected, indicating that preventing banks from being involved in certain types of activities will lead to more bank stability. Similarly, *suppower* loads positive and significant at the 5% level, implying that the capacity of the official supervisory authorities to take appropriate actions to prevent and correct problems fosters the stability of the banking system. This finding concurs with Saif-Alyousfi et al. (2020) who show that greater supervisory power leads to a decrease in bank risk-taking and, hence, an increase

Table 9
Low vs high capitalization.

`	(1)	(2)	(3)	(4)
	Low-cap	High-cap	Low-cap	High-cap
lzscore	0.963***	0.907***	0.955***	0.858***
	(0.040)	(0.044)	(0.020)	(0.026)
ib	0.033	−0.053	0.007	−0.019
	(0.062)	(0.036)	(0.012)	(0.023)
lerner	0.153***	0.147*		
	(0.047)	(0.080)		
lerner^2	0.203*	−0.213*		
	(0.106)	(0.121)		
conc			1.167***	1.454*
			(0.427)	(0.781)
conc^2			−0.846**	−1.067*
			(0.342)	(0.624)
size	−0.015	−0.002	−0.024**	−0.043***
	(0.010)	(0.024)	(0.011)	(0.016)
diver	0.054	−0.018	0.106**	0.017
	(0.094)	(0.084)	(0.045)	(0.053)
nlta	−0.114	0.463**	0.213***	0.249***
	(0.181)	(0.190)	(0.042)	(0.066)
loang	−0.319***	−0.290***	−0.293***	−0.527***
	(0.087)	(0.104)	(0.068)	(0.076)
gdpg	0.008**	0.007**	0.011***	0.010***
	(0.003)	(0.004)	(0.002)	(0.003)
inf	0.002	−0.005	−0.000	0.001
	(0.004)	(0.006)	(0.002)	(0.002)
gfc	−0.011	−0.058	−0.028***	−0.045***
	(0.021)	(0.050)	(0.010)	(0.016)
constant	0.241**	0.126	−0.184	0.221
	(0.113)	(0.201)	(0.154)	(0.257)
Obs.	909	1065	974	1433
AR2	0.217	0.975	0.123	0.129
Hansen	0.447	0.510	0.332	0.359

This table shows the results of the regressions estimated with the system GMM procedure of Blundell and Bond (1998) for our sample of 80 IBs and 204 CBs for the period 2000–2019. The dependent variable is the log of zscore denoted *zscore*. The definitions of our variables appear in Table 1. We split the sample into "low-cap" versus "high-cap" banks based on the sample median of *car*. The standard errors appear in parentheses below the estimated coefficients. A two-step system GMM estimator is used. Windmeijer (2005) finite-sample correction to the two-step covariance matrix is employed. Robust standard errors consistent in the presence of heteroskedasticity and autocorrelation within the panel are reported. The Hansen (1982) test tests the overall validity of our instruments, while AR2 is the Arellano and Bond (1991) test of the absence of second-order autocorrelation in the differenced residuals. ***, **, * refer to the 1, 5, and 10% levels of significance.

in their financial stability. Finally, in specification 5, *depins* is positively associated with *zscore*, indicating that the presence of deposit insurance prevents potential bank runs and promotes stability by providing a warranty for depositors, thereby increasing public confidence and stabilizing market expectations (Diamond and Dybvig, 1983).

5.3.4. *Low vs high capitalization*

In this test, we further investigate whether the impact of competition on bank stability is dependent on the level of bank capitalization. To do so, we split the sample into "low-cap" versus "high-cap" banks based on the sample median of *car*. The results are displayed in Table 9. In specifications 1 and 2, we use *lerner* as our measure of competition, whereas, in specifications 3 and 4, competition is measured by bank concentration (*conc*). We notice from Table 9 that the nonlinear relationship between competition and stability is confirmed for "low-cap" banks as evidenced by the significant coefficients of *lerner* (*conc*) and *lerner2* (*conc2*) in specification 1 (3). However, for "high-cap" banks (specifications 2 and 4), the coefficients of these variables display the correct signs but are only marginally significant (at 10%). These results provide support to our original findings (Table 5) and suggest that better bank capitalization seems to moderate the negative effect of competition on bank stability.

5.3.5. *Alternative estimation methods*

We assess the reliability of our results by estimating our model (6) with the following alternative estimation methods: dynamic ordinary least squares, dynamic fixed effects, dynamic random effects, and static system GMM. Table 10 shows consistent and robust findings concurring with our original results.

To sum up, the evidence in this paper shows a nonlinear association between competition and bank stability as suggested by Matinez-Miera and Repullo (2010), although the relationship is convex rather than concave. This finding confirms the conclusions of Jimenez et al. (2013) and Albaity et al. (2019) and suggests that the risk-shifting effect of competition dominates the margin effect in both highly concentrated and highly competitive banking systems, thereby leading to more stability. On the other hand, the margin

Table 10
Alternative estimation methods.

	(1)	(2)	(3)	(4)
	Dynamic OLS	Dynamic FE	Dynamic RE	Static GMM
lzscore	0.963***	0.515***	0.954***	
	(0.008)	(0.029)	(0.009)	
ib	−0.015		−0.017*	−0.535*
	(0.009)		(0.010)	(0.285)
lerner	0.066***	0.207***	0.070***	0.520***
	(0.017)	(0.028)	(0.018)	(0.167)
lerner^2	−0.068**	−0.135***	−0.074***	−0.495*
	(0.028)	(0.036)	(0.028)	(0.296)
car	0.204**	1.695***	0.256**	2.786**
	(0.103)	(0.227)	(0.117)	(1.366)
size	0.006	−0.029**	0.006	0.133**
	(0.004)	(0.013)	(0.004)	(0.055)
diver	−0.042	0.159**	−0.031	−0.280
	(0.033)	(0.069)	(0.030)	(0.275)
nlta	0.053	0.446***	0.059	−0.092
	(0.033)	(0.087)	(0.036)	(0.791)
loang	−0.247***	−0.174***	−0.245***	−0.596
	(0.031)	(0.030)	(0.035)	(0.632)
gdpg	0.009***	0.001	0.008***	0.012
	(0.002)	(0.002)	(0.002)	(0.027)
inf	0.003**	0.002	0.003**	0.010
	(0.001)	(0.002)	(0.002)	(0.012)
gfc	−0.012	−0.010	−0.012	0.055
	(0.017)	(0.014)	(0.015)	(0.050)
constant	−0.004	1.028***	0.007	1.629***
	(0.047)	(0.126)	(0.051)	(0.520)
Obs.	1713	1713	1713	1680
R^2	0.943	0.839	0.943	
AR2				0.069*
Hansen				0.437

This table shows the results of the regressions estimated with the dynamic OLS, dynamic fixed effects, dynamic random effects, and static GMM methods for our sample of 80 IBs and 204 CBs for the period 2000–2019. The dependent variable is the log of zscore denoted *zscore*. The definitions of our variables appear in Table 1. The standard errors appear in parentheses below the estimated coefficients. The Hansen (1982) test tests the overall validity of our instruments, while AR2 is the Arellano and Bover (1995) test of the absence of second-order autocorrelation in the differenced residuals. ***, **, * refer to the 1, 5, and 10% levels of significance.

effect seems to outweigh the risk-shifting effect when the competition is moderate, thus resulting in lower stability. Moreover, our results show that the competition-fragility hypothesis is more pronounced for IBs than for CBs. Further, better bank regulation and supervision enhance the financial stability of the banking system. Importantly, we found that higher bank capital ratios reduce the negative impact of competition on bank stability in dual banking countries, while this moderating effect of capitalization is not significantly different between CBs and IBs.

6. Conclusion

In this paper, we analyzed the effect of bank competition on bank stability, measured by the *z*-score and net interest margin. We showed that controlling for capital adequacy, there is a U-shaped relationship between competition and bank stability, thus highlighting the dual importance of the franchise value and the risk-shifting paradigms in dual banking systems. The comparative analysis of IBs and CBs revealed that the fragility effect is more pronounced for IBs than for CBs. Thus, while the effect of competition on stability is nonlinear for both types of banks, competition has a larger detrimental impact on the stability of IBs. Importantly, our analysis revealed that better bank capitalization has a *moderating* effect on the relationship between competition and bank stability in dual banking systems. Faced with increased competition, banks with higher capital ratios are more able to absorb shocks, fulfill their liquidity requirements, and tend to behave prudently in selecting asset portfolios, thereby reducing the risk of failure. This result is of paramount importance as it underlines the dual importance of competition policy and capital regulation and the need to coordinate between these two pillars of regulation to foster the stability of the banking system. Our findings suggest that there is no evidence that this moderating effect is different between IBs and CBs implying that capital is equally important for both types of banks in mitigating the effect of competition on bank risk.

Our findings point to the importance of competition policy and capital regulations in dual banking countries. Focusing on capital requirements without looking at competition policy will lead to suboptimal regulation. Finally, regulatory authorities need to pay special attention to banks with low capital as they are most vulnerable to the forces of competition.

CRediT authorship contribution statement

Indria Ernaningsih: Data curation, Writing – original draft, Visualization, Investigation, Software, Validation. **Houcem Smaoui:** Conceptualization, Methodology, Software, Supervision. **Akram Temimi:** Writing – review & editing.

Appendix A. Appendix 1

The table below shows the summary statistics of the inputs and outputs of the trans-log cost function used to calculate the lerner index. TC_{it} is the total costs of bank i at the time t, which is equal to the sum of interest expenses and non-interest expenses, while TA_{it} is the bank's total assets. We compute $W_{1,it}$ as the ratio of interest expenses to total assets; $W_{2,it}$ as the ratio of personnel expenses to total assets; and $W_{3,it}$ as the ratio of administrative and other operating expenses to total assets. MC_{it} denotes the marginal cost bank i at the time t. We add a trend variable to control for technological changes. We also control for bank risk with $lnzscore_{it}$ and for bank capitalization with the ratio of equity to total assets ($eqta_{it}$).

	N	Mean	Median	St.Dev	Min	Max
LnTC	3692	5.249	5.253	1.655	2.255	8.329
LnTA	3809	8.201	8.147	1.711	5.177	11.168
LnTA2	3809	35.093	33.188	14.129	13.399	62.363
LnW1	3713	−3.647	−3.505	0.775	−5.321	−2.575
LnW2	3205	−4.559	−4.548	0.447	−5.406	−3.735
LnW3	3756	−5.522	−5.508	0.709	−6.797	−4.21
LnTAW1	3713	−15.011	−14.358	4.609	−24.462	−8.086
LnTAW2	3205	−18.836	−18.538	4.729	−27.506	−10.612
LnTAW3	3756	−22.769	−22.463	6.217	−33.806	−12.283
LnW12	3713	6.952	6.141	3.018	3.316	14.155
LnW22	3205	10.492	10.342	2.047	6.976	14.615
LnW32	3756	15.501	15.167	3.922	8.891	23.098
LnW1W2	3162	16.936	16.093	4.527	10.686	26.789
LnW1W3	3669	20.253	19.382	5.385	12.181	31.228
LnW2W3	3181	25.091	24.676	5.044	16.243	34.675
MC	3132	0.052	0.046	0.032	0.007	0.537
Trend	4880	10.5	10.5	5.767	1	20
Eqta	3803	0.136	0.113	0.083	0.053	0.396
Lnzscore	3736	2.7	2.829	0.767	1.036	3.88

References

Abdulkarim, M., Kabir, M., Hasan, T., Mohamad, S., 2014. Capital adequacy and lending and deposit behavior of conventional and Islamic banks. Pac. Basin Financ. J. 28, 58–75.
Abedifar, A., Molyneux, P., Tarazi, A., 2013. Risk in Islamic banking. Rev. Finance 17, 2035–2096.
Acharya, V., Naqvi, N., 2012. The seeds of a crisis: a theory of bank liquidity and risk-taking over the business cycle. J. Financ. Econ. 106 (2), 349–366.
Agoraki, M.E., Delis, M.D., Pasiouras, F., 2011. Regulation, competition and bank-risk-taking in transition countries. J. Financ. Stab. 7 (1), 38–48.
Akins, B., Li, L., Ng, Jeffrey, Rusticus, T.O., 2016. Bank competition and financial stability: evidence from the financial crisis. J. Financ. Quant. Anal. 51 (01), 1–28.
Alam, N., Abdul Hamid, B., Tan, D.T., 2019. Does competition make banks riskier in dual banking system? Borsa Istanbul Rev. 19-SI, 34–43.
Albaity, M., Malek, R.S., Noman, A.B., 2019. Competition and bank stability in the MENA region: the moderating effect of Islamic versus conventional banks. Emerg. Mark. Rev. 38 (C), 310–325.
Alessi, L., Detken, C., 2011. Quasi-real-time early warning indicators for costly asset price boom/bust cycles: a role for global liquidity. Eur. J. Polit. Econ. 27 (3), 520–533.
Allen, F., Gale, D., 2004. Competition and financial stability. J. Money Credit Bank. 36 (3), 453–480.
Alqahtani, F., Mayes, D.G., Brown, K., 2017. Islamic bank efficiency compared to conventional banks during the global crisis in the GCC region. J. Int. Financ. Mark. Inst. Money 51, 58–74.
Amador, J.S., Gomes-Gonzales, J.E., Murcia, A., 2013. Loan growth and bank risk: new evidence. Finance Market Portfolio Manage. 27, 365–379.
Amidu, M., Wolfe, S., 2013. Does the competition and diversification lead to greater stability? Evidence from emerging markets. Rev. Dev. Fin. 3 (3), 152–166.
Angbazo, L., 1997. Commercial bank net interest margins, default risk, interest-rate risk, and off-balance sheet banking. J. Bank. Financ. 21 (1), 55–87.
Anginer, D., Demirguc-Kunt, A., Zhu, M., 2014. How does competition affect bank systemic risk. J. Financ. Intermed. 23 (1), 1–26.
Arellano, M., Bover, O., 1995. Another look at the instrumental variable estimation of error-components models. J. Econ. 68 (1), 29–51.
Azmi, W., Ali, M., Arshad, S., Rizvi, S.A.R., 2019. Intricacies of competition and diversification: evidence from dual banking economies. Econ. Model. 83, 111–126.
Baele, L., Farooq, M., Ongena, S., 2014. Of religion and redemption: evidence from default on Islamic loans. J. Bank. Financ. 44, 141–159.
Barth, J.R., Caprio, G., Levine, R., 2007. Bank supervision and regulation. What works best. J. Financ. Intermed. 13, 205–248.
Barth, J.R., Caprio Jr., G., Levine, R., 2013. Bank regulation and supervision in 180 countries from 1999 to 2011. J. Financ. Econ. Policy 5 (2), 111–219.
Bashir, A.M., 1999. Risk and profitability measures in Islamic banks: the case of two Sudanese banks. Islam. Econ. Stud. 6 (2), 1–24.
Beck, T., Laeven, L., 2006. Institution building and growth in transition economies. J. Econ. Growth 11, 157–186.
Beck, T., Demirguc-Kunt, A., Levine, R., 2006. Bank concentration, competition and crises: first results. J. Bank. Financ. 30 (5), 1581–1603.
Beck, T., Demirgüç-Kunt, A., Merrouche, Q., 2013. Islamic vs. conventional banking: business model, efficiency and stability. J. Bank. Financ. 37 (2), 433–447.
Berger, A.N., Bouwman, C., 2009. Bank liquidity creation. Rev. Financ. Stud. 22 (9), 3779–3837.
Berger, A.N., Klapper, L., Turk-Ariss, R., 2009. Bank competition and financial stability. J. Financ. Serv. Res. 35 (2), 99–118.

Bitar, M., Pukthuanthong, K., Walker, T., 2018. The effect of capital ratios on the risk, efficiency and profitability of banks: evidence from OECD countries. J. Int. Finan. Markets. Inst. Money 53, 227–262.
Blundell, R., Bond, S., 1998. Initial conditions and moment restrictions in dynamic panel data models. J. Econ. 87, 115–143.
Bolton, P., Chen, H., Wang, N., 2011. A unified theory of Tobin's q, corporate investment, financing, and risk management. J. Financ. 66 (5), 1545–1578.
Bourkhis, K., Nabi, M., 2013. Islamic and conventional bank's soundness during the 2007-2008 financial crisis. Rev. Financ. Econ. 22 (2), 68–77.
Boyd, J.H., De Nicolo, G., 2005. The theory of bank risk taking and competition revisited. J. Financ. 60, 1329–134.
Boyd, J.H., De Nicolo, G., and Al Jalal, A., 2006. Bank risk-taking and competition revisited: New theory and new evidence. IMF Working Paper 297, International Monetary Fund, Washington, D.C.
Čihák, M., Hesse, H., 2010. Islamic banks and financial stability: an empirical analysis. J. Financ. Serv. Res. 38, 95–113.
Cubillas, E., Gonzales, F., 2014. Financial liberalization and bank risk-taking. International evidence. J. Financ. Stab. 11, 32–48.
Cupian, Abduh, M., 2017. Competitive condition and market power of Islamic banks in Indonesia. Int. J. Islam. Middle East. Financ. Manag. 10 (1), 77–91.
Dahir, A.M., Mahat, F., Ali, I., 2018. Funding liquidity risk and bank risk-taking in BRICS countries: an application of system GMM approach. Int. J. Emerg. Mark. 13 (1), 231–248.
Davis, E.P., Karim, D., Noel, D., 2020. The bank capital –competition-risk nexus - A global perspective. J. Int. Finan. Markets. Inst. Money 65, 1–22.
Demirguc-Kunt, A., Martinez-Peria, M.S., 2010. A Framework of Analyzing Competition in Banking Sector: An Application to the Case of Jordan. World Bank Research Working Paper, no 5499.
Demirguc-Kunt, A., Detragiache, E., Merrouche, O., 2013. Bank capital: lessons from the financial crisis. J. Money, Credit, Bank. 45, 1147–1164.
Demirguc-Kunt, A., Kane, E., Laeven, L., 2014. Deposit Insurance Database. The World Bank (Policy Research Working Paper; No. 6934).
Diamond, D.W., 1984. Financial intermediation and delegated monitoring. Rev. Econ. Stud. 51 (3), 393–414.
Diamond, D.W., Dybvig, P., 1983. Bank runs, deposit insurance and liquidity. J. Polit. Econ. 91, 401–419.
Fazio, D.M., Tabak, B.M., Cajuero, D.O., 2015. Inflation targeting: is IT to blame for banking system stability? J. Bank. Fin. 59, 76–97.
Fiordelisi, F., Mare, D.S., 2014. Competition and financial stability in European Cooperative banks. J. Int. Money Fin. 45 (C), 1–16.
Foss, D., Norden, L., Weber, M., 2010. Loan growth and riskiness of banks. J. Bank. Financ. 34 (12), 2929–2940.
Fu, Z., Lin, Y., Molyneux, P., 2014. Bank competition and financial stability in Asia Pacific. J. Bank. Financ. 38, 64–77.
Hansen, L.P., 1982. Large sample properties of generalized method of moments estimators. Econometrica 50 (4), 1029–1054.
Hellmann, T.F., Murdock, K.C., Stiglitz, J.E., 2000. Liberalization, moral Hazard in banking, and Prudential regulation: are capital requirements enough? Am. Econ. Rev. 90, 147–165.
Hesse, H., Cihak, M., 2007. Cooperative banks and financial stability. Intern. Monetary Fund (IMF) 07 (02), 1–38. Working Paper.
Hugonnier, J., Malamud, S., Morellec, E., 2017. Bank capital, liquid reserves, and insolvency risk. J. Financ. Econ. 125 (2), 266–285.
Ianotta, G., Nocera, G., Sironi, A., 2007. Ownership structure, risk and performance in the European banking industry. J. Bank. Financ. 31 (7), 2127–2149.
Jimenez, G., Saurina, J., 2004. Collateral, type of lender and relationship banking as determinants of credit risk. J. Bank. Financ. 28 (9), 2191–2212.
Jimenez, G., Lopez, J., Saurina, J., 2013. How does competition affect bank risk-taking? J. Financ. Stab. 9 (2), 185–195.
Jorda, O., Schularick, M., Taylor, A.M., 2011. Financial crises, credit booms, and external imbalances: 140 years of lessons. IMF. Econ. Rev. 59, 340–378.
Kasman, S., Kasman, A., 2015. Bank competition, concentration and financial stability in the Turkish banking industry. Econ. Syst. 39, 502–517.
Keeley, M.C., 1990. Deposit insurance, risk, and market power in banking. Am. Econ. Rev. 80, 1183–1200.
Khan, M.S., Scheule, H., Wu, E., 2017. Funding liquidity and bank risk-taking. J. Bank. Financ. 82, 203–216.
Kim, D., Santomero, A.M., 1988. Risk in banking and capital regulation. J. Financ. 43, 1219–1233.
Lapteacru, I., 2014. Do more competitive banks have less market power? The evidence from central and Eastern Europe. J. Int. Money Financ. 46 (C), 41–60.
Lee, C., Hsieh, M., 2013. The impact of bank capital on profitability and risk in Asian banking. J. Int. Money Financ. 32 (2), 251–281.
Leroy, A., Lucotte, Y., 2017. Is there a competition-stability trade-off in European banking? J. Int. Financ. Mark. Inst. Money 46, 199–215.
Liu, H., Molyneux, P., Nguyen, L.H., 2012. Competition and risk in southeast Asian commercial banking. Appl. Econ. 44 (28), 3627–3644.
Liu, H., Molyneux, P., Wilson, J.O.S., 2013. Competition and stability in European banking: A regional analysis. Manch. Sch. 81 (2), 176–201.
Louzis, D.P., Vouldis, A.T., Metaxas, V.L., 2012. Macroeconomic and bank-specific determinant of non-performing loans in Greece: A comparative study of mortgage, business and consumer loan portfolios. J. Bank. Financ. 36 (4), 1012–1027.
Matinez-Miera, D., Repullo, R., 2010. Does competition reduce the risk of bank failure? Rev. Financ. Stud. 23 (10), 3638–3664.
Matutes, C., Vives, X., 1996. Competition for deposits, fragility and insurance. J. Financ. Intermed. 5 (2), 184–216.
Milne, A., Whalley, A.E., 2001. Bank Capital Regulation and Incentives for Risk-Taking. Academia, pp. 1–53. WBS Finance Group Research Paper.
Nurul Kabir, Md., Worthington, A.C., 2017. The competition-stability/fragility nexus: A comparative analysis of Islamic and conventional banks. Int. Rev. Financ. Anal. 50 (C), 111–128.
Peura, S., Keppo, J., 2006. Optimal bank capital with costly recapitalization. J. Bus. 79 (4), 2163–2201.
Repullo, R., 2004. Capital requirements, market power, and risk-taking in banking. J. Fin. Int. 13, 156–182.
Risfandy, T., Tarazi, A., Trinugroho, I., 2020. Competition in dual markets: implications for banking system stability. Glob. Financ. 52, 1–14.
Rossi, S., Schwaiger, M., Winkler, G., 2009. How loan portfolio diversification affects risk, efficiency and capitalization. A managerial of behavior model for Austrian banks. J. Bank. Financ. 33, 2218–2226.
Saif-Alyousfi, A., Saha, A., Md-Rus, R., 2020. The impact of bank competition and concentration on bank risk-taking behavior and stability: evidence from GCC countries. N. Am. J. Econ. Financ. 51, 100867.
Saksonova, S., 2014. The role of net interest margin in improving Banks' asset structure and assessing the stability and efficiency of their operations. Procedia Soc. Behav. Sci. 150, 132–141.
Salas, V., Saurina, J., 2002. Credit risk in two institutional regimes: Spanish commercial and saving banks. J. Financ. Serv. Res. 22, 203–224.
Salas, Y., Saurina, J., 2003. Deregulation, market power and risk behavior in Spanish banks. Eur. Econ. Rev. 47 (6), 1061–1075.
Schaeck, K., Cihák, M., 2010. How well do aggregate prudential ratios identify banking system problems? J. Financ. Stab. 6 (3), 130–144.
Schaeck, K., Cihák, M., 2014. Competition, efficiency, and stability in banking. Financ. Manag. 43 (1), 215–241.
Schaeck, K., Cihak, M., Wolfe, S., 2009. Are competitive banking systems more stable? J. Money, Credit, Bank. 41 (4), 711–734.
Schularick, M., Taylor, A.M., 2012. Credit booms gone bust: monetary policy, leverage cycles, and financial crises, 1870–2008. Am. Econ. Rev. 102, 1029–1061.
Smaoui, H., Bensalah, I., Diallo, B., 2020a. The determinants of capital ratios in Islamic banking. Quart. Rev. Econ. Finance 77, 186–194.
Smaoui, H., Mimouni, K., Miniaoui, H., Temimi, A., 2020b. Funding liquidity risk and banks' risk-taking: evidence from Islamic and conventional banks. Pac. Basin Financ. J. 64, 101436.
Smaoui, H., Mimouni, K., Temimi, A., 2020c. The impact of Sukuk on the insolvency risk of conventional and Islamic banks. Appl. Econ. 52, 806–824.
Soedarmono, W., Machrouh, F., Tarazi, M., 2013. Bank competition, crisis, and risk-taking: evidence from an emerging market in Asia. J. Int. Financ. Mark. Inst. Money 23, 196–221.
Tabak, B.M., Fazio, D.M., Cajuero, D.O., 2012. The relationship between banking market competition and risk-taking: do size and capitalization matter? J. Bank. Financ. 36 (12), 3366–3381.
Tenjo, J., López, M., 2010. Early warning indicators for Latin America. Ensayos Sobre Política Econ. 63, 232–259.
Wagner, J., 2007. The liquidity of bank assets and banking stability. J. Bank. Financ. 31 (1), 121–139.
Weill, L., 2011. Do Islamic banks have greater market power. Comp. Econ. Stud. 53 (2), 291–306.
Windmeijer, F., 2005. A finite sample correction for the variance of linear efficient two-step GMM estimators. J. Economet. 126 (1), 25–51.

Wiyono, S., Rahmayuni, S., 2012. The effect of credit risk to Islamic bank profitability with Islamic income and profit sharing ratio as moderating variable. GSTF J. Bus. Rev. (GBR) 2, 45–50.
Wooldridge, J.M., 2002. Econometric Analysis of Cross Section and Panel Data. MIT Press, Cambridge, MA.
Yeyati, E.I., Micro, A., 2007. Concentration and foreign penetration Latin American banking sectors: impact on competition and risk. J. Bank. Financ. 31, 1633–1747.