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The regulations–risk taking nexus under competitive pressure: What about the *Islamic* banking system?

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ABSTRACT

Does market power condition the effect of bank regulations and supervision on bank risk taking? We focus on three regulatory tools: capital requirements, the restriction of activities, and official supervisory powers. Employing 10 years of unbalanced panel data on 123 Islamic and conventional banks operating in the Middle East and Asia, we arrive at the following conclusions. First, banking market power strengthens the negative impact of capital regulation on bank risk taking. Second, our empirical results suggest that the negative effect of activity restrictions on stability is diminished when banks have greater market power. Finally, we do not find strong evidence that the negative effect of supervisory power on banks' risk taking is conditioned by their competitive behavior. In further analysis, we differentiate between Islamic and conventional banks regarding their competition, as well as their risk behavior. The results differ according to the banking business model. These findings could be useful for bank regulators in light of the accomplishment of Islamic banks' regulatory framework. Indeed, the adoption of Basel III represents a significant regulatory challenge, given that it does not take into account the specificities of Islamic banks.

1. Introduction

The global financial crisis (GFC) of 2007–2009 highlighted just how fragile the banking system had become. Previous regulations failed to instill financial and systemic soundness and stability (Admati, 2014). Regrettably, not much has changed in the way of vigorous banking regulation. The question herein is *why does banking regulation not work?* Banking regulation aims mainly to mitigate systemic risk resulting from bank failure (Deli and Hasan, 2016) and, hence, protect depositors' interests and maintain the financial health of the overall economy. Indeed, although regulators periodically set different levels of regulatory capital adequacy, the massive bank failures during the GFC and ensuing sovereign debt crisis revived the debate about regulatory norm effectiveness.

An adequate bank regulation framework requires great appreciation of the bank behavior in the face of risk. It is a widespread view that such a framework involves a trade-off between capital regulation and bank risk taking. In this context, Altunbas et al. (2007) and Lee and Hsieh (2013) argued that this relation should be explored through two opposing hypotheses, namely, the *moral hazard hypothesis* and the *regulatory hypothesis*. The former predicts a negative relationship between capital and risk by asserting that a

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decrease in the capital ratio is generally followed by an increase in bank risk. Moral hazard arises mainly (i)from agency problems between shareholders and managers, (ii) in response to regulatory actions, or (iii) in the presence of a financial safety net.[1] The latter, however, suggests a positive relationship between capital and risk, indicating that regulators induce banks to raise their capital proportionately to the level of risk taken (Shrieves and Dahl, 1992; Demirgüç -Kunt and Huizinga, 2000; Iannota et al., 2007). Bank regulators have always required banks to hold adequate levels of capital vis-à-vis their portfolio risk. Indeed, the riskier the loans a bank make the more capital it is supposed to hold.

At the same time, the impact of competition on banking risk taking is widely demonstrated in the literature. Two contradictory hypotheses have been proposed: the *competition–fragility* hypothesis and the *competition–stability* hypothesis, linking bank competition to banks' risk taking incentives. According to the first hypothesis, which implies a negative relationship between competition and risk, increased competition leads to financial institutions' loss of market power and, thus, lower profitability. Consequently, banks will cover their losses by investing in risky portfolios, which is an excessive risk taking behavior (Marcus, 1984; Keeley, 1990). The rival hypothesis, in contrast, implies that competition can instill more, rather than less, soundness and stability into the banking system. This opposing view has been advanced by Boyd and De Nicolo (2005), who contends that increased competition improves the soundness of the overall financial system. Accordingly, greater competition in banking markets decreases lending interest rates, improves banking profitability, and reduces credit risk levels.

Alternatively, bank competition can create serious pressure between regulation and bank decisions. The question of whether market power can affect the regulation–risk taking relationship has rarely been investigated. Keeley's (1990) seminal paper was the first to consider the *regulation–competition–risk* (RCR) nexus. Keeley showed how the US economy financial deregulation during the 1970s and 1980s eroded banks' charter value as a consequence of increased competition, which itself induced careless risk behavior and increased default risk.

Subsequently, a fierce debate on whether competition could affect the regulation–risk relationship emerged. The results of surveys by Hellmann et al. (2000) and Rupello (2004) challenged the idea that bank regulation could destroy banks' franchise value, reduce their incentive to behave prudently, and encourage gambling. These investigations also showed that bank regulation (i.e., capital requirements and deposit rate controls) are potent means of preventing banks' excessive risk taking behavior in the context of an explicit dynamic model of imperfect competition.

According to these studies, despite the impact of banking regulations on risk taking, banking market power can also be a critical factor. Several subsequent theoretical and empirical works further support this assumption. From a theoretical perspective, Hakenes and Schnabel (2011) assumed that capital regulations could weaken the banking sector, their effect being channeled through banking market power. The authors concluded that strict capital requirements reduce loan demand competition by increasing capital costs. Loan rates will subsequently rise, inducing banks to adopt excessive risk taking behavior. Such behavior can consequently increase banks' default probability. From an empirical perspective, Agoraki et al. (2011) argued that there is a close link between regulation, competition, and risk. According to the authors, although capital requirements reduce risk, banking market power can weaken and even reverse this effect. Furthermore, credit and default risk can be diminished due to greater restrictions on activities and increased market power.

In this paper, we propose revisiting the nexus between bank regulation and risk taking behavior, highlighting the effect of banking market power. In particular, we seek to address the following fundamental question: to what extent is banking competition involved in the relation between regulation and risk? Although substantial studies have tackled this critical issue, to our knowledge, none has covered different banking business models. In this context, this paper uses a sample of two different types of commercial banks, Islamic banks and conventional banks, to examine the differences in their behaviors under competitive pressure. This article contributes to the empirical literature related to competition and risk taking within the Islamic banking industry and focuses on the dual banking systems in 10 countries from the cooperation of Islamic countries (OIC).

Academics, scholars, and policymakers have recently started to focus on the Islamic banking system because its financial characteristics are entirely distinct from those of conventional banks (Lopez-Mejia et al., 2014). Although they play similar roles as financial intermediaries, Islamic banks differ from their conventional counterparts in that all their operations are governed by Islamic law. More specifically, as elaborated by Hussain et al. (2015), Islamic finance is guided by the principles of equity, participation, and ownership and a fundamental feature is that it be *interest free*. Islam ban Muslims from taking or receiving interest (*riba*), regardless of the purpose of the loan or the interest rate. The agreement between contracting parties must also be free from excessive uncertainty, or *gharar*.

The underlying contracts of Islamic instruments also differ from those of conventional banking in terms of structure (Doumpos et al., 2017; Ibrahim and Rizvi, 2017), since Islamic financing offers a large number of different products. Some of these are based on profit and loss sharing, such as *mudharabah* and *musharakah,* while others are based on markup, such as *murabahah, ijarah*, and *istisna*.

Nowadays, the Islamic financial industry is growing very quickly in many countries, particularly in the Middle East and in Asian regions (Kammer et al., 2015). The size of the Islamic finance market currently ranges from $1.66 trillion to $2.1 trillion and is

[1] Banks encounter three types of moral hazard problems. The first relates to agency problems. That is, in an unhealthy banking industry (i.e., lower capital levels, lower efficiency), managers tend to accept worse (riskier) loans to raise their expected returns (Gorton and Winton, 2017; Jebitschko and Jeung, 2005). The second type of moral hazard problem can arise when regulators require banks to increase their capital by increasing asset risk (Kahane, 1977; Koehn and Santomero, 1980). The last type of problem pertains to the presence of a deposit insurance system, which usually stimulates bank risk taking (Benston, 1986; Kane, 1985).

expected to reach $3.4 trillion in 2018 (ISRA[2] and Thomson Reuters, 2016). Although there are many differences between Islamic and conventional banks, the two entities compete with each other in most economies. Furthermore, there is widespread evidence that, during the GFC, Islamic banks did not suffer from the losses and problems of default of their conventional counterparts (Beck et al., 2013; Bitar et al., 2016; Doumpos et al., 2017).

In addition, there is a misconception that Islamic institutions are risk free; however, Islamic banks' risk profile shows that, instead, it is the management of these risks that makes them secure. According to Yunus et al. (2018), in addition to traditional risks faced by conventional banks, Islamic banks can encounter specific risks such as displaced commercial risk and the risk of Shariah non-compliance, which would have an obvious impact on banks' financing and overall risk taking behavior.

Within this context, a growing number of studies have investigated the differences in stability, risk taking behavior, and market power between the two types of banks. For instance, Beck et al. (2013) and Rosman et al. (2014) indicated that Islamic banks managed their insolvency risk better because they are well funded and their assets are of good quality. In addition, Abedifar et al. (2013) found that small Islamic banks, as opposed to conventional banks, have lower credit risk and higher stability rates. However, the results of studies that have investigated the level of competition between Islamic and conventional banks have been mixed. For instance, Turk-Ariss (2010) argued that Islamic banks are less competitive than their conventional peers, whereas Weill (2011) showed no significant difference between the types of banks in terms of market power. In a recent survey, Nurul-Kabir and Worthington (2017) indicated that Islamic banks' Lerner index is significantly higher.

This paper fills the gap in the Islamic banking literature by examining whether regulations have any effect on banking system stability and risk and whether this effect is affected by different competitive conditions. We use different financial market regulation characteristics, such as capital requirements, supervisory power, and activity restrictions, based on the study of Agoraki et al. (2011). To investigate the extent to which market power can influence the regulation–risk relationship, we specify an interaction term between competition and each of these standard regulation instruments. Additionally, we use split sample analysis to check whether market power has a different impact on the regulation–risk relationship in Islamic banks compared to conventional banks.

We employ one-step dynamic panel estimation using the system generalized method of moments (GMM) estimator developed by Blundell and Bond (1998) and Roodman's innovative method on a heterogeneous sample of 123 banks—34 Islamic banks and 89 conventional banks—operating in the Middle East and Asia between 2005 and 2014.

Our empirical investigation yields two main results. On the one hand, capital regulations have a destabilizing effect on only conventional banks. This effect is significantly stronger for banks with greater market power. On the other hand, the direct effect of official supervisory power indicates that accurate supervision is an effective regulatory tool in enhancing conventional banks' stability. Among Islamic banks, however, this regulation mechanism has an adverse effect on banks with strong market power. These results, which are robust to random effect estimation tests, indicate that Islamic banks require additional or different regulatory and supervisory frameworks that consider their distinct operations and different risk profiles and balance sheet structure.

The remainder of this paper is structured as follows. Section 2 reviews the literature. Section 3 describes the data and presents the definitions and sources of all the variables. Section 4 describes the methodological framework. Section 5 discusses the findings, and the last section concludes the paper.

2. Literature review

The literature on the trade-off between competition and risk is remarkably controversial. The relationship is based on two predominant theories: *competition–fragility* (i.e., *concentration–stability*) theory and *competition–stability* (i.e., *concentration–fragility*) theory. While the first theory supports the idea that banking sector competition results in noticeable risk and instability, the second proposes that greater competition could enhance banking stability. Marcus (1984) and Keeley (1990) provided theoretical support for the *competition–fragility* hypothesis. They argued that, in competitive markets, banks cannot earn monopoly rents, resulting in lower charter values and, thus, lower profits. Consequently, bank managers engage in risky activities to increase their profits. Other empirical studies later emerged corroborating this view. Specifically, Turk-Ariss (2010) found that greater banking market power decreases risk potential and promotes overall banking stability. Similarly, Kabir and Worthington's (2017) comparative study of Islamic and conventional banks provided further support for the *competition–fragility* assumption for both banking business models.

The rival *competition–stability* view was introduced by Boyd and De Nicolo (2005), who highlighted that strong competition among banks decreases loan interest rates and moral hazard among borrowers, and thus credit risk. Lower default risk leads to fewer loan problems and greater bank stability. Boyd et al. (2006) as well as Schaeck et al. (2009) supported the *competition–stability* hypothesis by providing empirical evidence of a positive link between banking market concentration and bank risk taking incentives. Martinez-Miera and Repullo (2010); Tabak et al. (2012), and Jiménez et al. (2013) found a nonlinear, U-shaped relationship between competition and risk taking in banks. Liu et al. (2013) also identified an inverted U-shaped relationship between competition and risk and stated that both high and low competition intensify financial stability, whereas moderate competition notably hampers it.

Bank supervisors generally call for more rigorous risk-based capital measures to improve overall financial welfare. Nevertheless, the efficiency of these regulatory norms has been questioned. While the first line of research (Sharpe, 1978; Furlong and Keeley, 1989) argued that increasing capital requirements reduce the put option value and thus the excessive risk taking rate, the second line of research argued that, although it increases the overall portfolio risk, a rigorous capital requirement is an alternative measure of a risky bank portfolio (Kahane, 1977; Koehn and Santomero, 1980; Acharya, 2009).

[2] International Shari'ah Research Academy for Islamic Finance.

Additionally, the relationship between capital regulation and bank risk could be affected by the degree of banking market competition. Keeley (1990) literature review highlighted the remarkable loss in the US banking sector's market power and, therefore, equity capital due to its deregulation strategy. Moreover, Matutes and Vives (2000) and Rupello (2004) argued that capital requirements can be insufficient, and further regulations (i.e., deposit rate controls, deposit premiums, and asset restrictions) could be appropriate to reduce risk in a competitive context. In addition, Agoraki et al. (2011) highlighted the crucial role of competition plays in the relationship between banking regulations and risk taking. Indeed, the impact of these regulations is proportional to banking market power.

Furthermore, regulatory restrictions and banking safety measures have various effects on bank risk taking incentives, depending mainly on the bank's activities (Barth et al., 2004). Islamic banks have managed to coexist and interact with their conventional counterparts, despite notable pressure to apply conventional regulations. The implementation of international standards is actually crucial as a credibility- and growth-enhancing measure for Islamic banks. However, application of the same regulatory framework to Islamic banks could underestimate and even dismiss the types and nature of their specific risks (Ahmed et al., 2016). In this context, Ashraf et al. (2016) argued that the adoption of the new regulatory measures of the Islamic Financial Services Board, especially the net stable funding ratio, could further help enhance and sustain Islamic banks' financial position and stability.

3. Variable selection and data

3.1. Variable definition and measurement

We first describe the measurement of banking market power (i.e., competition) and then discuss proxies for bank stability and risk, as well as other control variables.

3.1.1. Bank competition

Based on the work of Beck et al. (2013); Fu et al. (2014); Louati and Boujelbene (2014), and Tan (2016), we estimate competition using the Lerner index as a measure of banking market power. In particular, higher index values imply greater market power. The Lerner index is

$$Lerner_{it} = (P_{it} - MC_{it})/P_{it}$$

where, for bank i in year t, $P_{it}$and MC_{it} are the price and marginal cost, respectively. The variable P_{it} is the price of the output (i.e., the bank's total assets), measured as the ratio of total revenue over total assets (e.g., Fungacova and Weill, 2013; Fiordelisi and Mare, 2014), and MC_{it} is calculated according to the translog cost function of Berger et al. (2009) and Beck et al. (2013) following the specification

$$TC_{it} = \alpha_0 + \alpha_1 lnQ_{it} + \frac{1}{2}\alpha_2 (lnQ_{it})^2 + \sum_{k=1}^{3} \beta_{kt} lnW_{k;it} + \sum_{k=1}^{3} \gamma_k lnQ_{it} lnW_{k,it} + \sum_{k=1}^{3}\sum_{j=1}^{3} lnW_{k,it} lnW_{j,it} + \varepsilon_{it}$$

where TC_{it} is the total cost; Q is the quantity of output, proxied by total assets; $W_{k,it}$ represents the input prices used in the production process$W_{1,it}$ is the fund price; $W_{2,it}$ indicates the capital price; $W_{3,it}$ stands for the labor price;[3] and α_0 and ε_{it} are the constant and error terms, respectively. The coefficients α, β, and γ are estimated via the maximum likelihood technique and then used to calculate the marginal cost (MC_{it}), using the same input prices. We can thus write MC_{it} as

$$MC_{it} = \frac{TC_{it}}{Q_{it}}\left(\hat{a}_1 + \hat{a}_2 lnQ + \sum_{k=1}^{3} \hat{\gamma}_k w_{k,it}\right)$$

Therefore, we can use the coefficient estimates from the translog cost function to estimate the marginal cost. Once the marginal cost is obtained and the output price is computed, we can calculate the Lerner index for each bank by inserting these values into Eq. (1).

3.1.2. Bank risk taking

Two risk taking behavior proxies are adopted: the *Z-score* and the nonperforming loans (*NPLs*) ratio. The first proxy, initially developed by Boyd and Runkle (1993) and widely used as a bank stability measure (e.g., Hesse and Cihak, 2007; Beck et al., 2013; Fiordelisi and Mare, 2014), indicates the probability of bank insolvency (Lepetit and Strobel, 2013). In this paper, we apply Cihak and Hesse, 2010 method to calculate the *Z-score*, as follows:

$$\boldsymbol{Z_{it} = \frac{ROA_{it} + CAR_{it}}{\sigma ROA_{it}}}$$

where, for bank i in year t, ROA_{it} is the bank's return on assets (*ROA*); CAR_{it} is the bank's ratio of equity to assets; and σROA_{it} denotes the standard deviation of the *ROA*, calculated over the full sample period.[4] The *Z-score* is inversely related to the probability of bank

[3] Detailed definitions of the variables used to estimate the Lerner index are summarized in Table 2.

[4] For the empirical calculation of the *Z-score*, we use the standard deviation of the realized return over the full sample period, a common approach in the literature. However, some studies used rolling windows to obtain a time-varying estimate of the standard deviation of the *ROA*. In search of the best time-varying *Z-score* measure, Lepetit and Strobel (2013) compared the different existing approaches to the construction of this measure. They suggested that using the entire sample period is more robust. In addition, IJtsma et al. (2017) noted that rolling windows have a drawback, in

insolvency. A higher value implies a higher degree of bank solvency, and vice versa (Clark et al., 2018).

The *NPLs* ratio, in turn, reflects bank credit risk exposure (Nurul-Kabir et al., 2015; Louhichi and Boujelbene, 2016). We calculate the *NPLs* ratio by dividing the amount of impaired loans[5] by the total amount of loans. Accordingly, a higher ratio indicates higher credit risk. We provide a complementary analysis of the regulation–risk taking nexus by applying a second risk taking measure, taking into consideration this serious destructive factor of bank soundness. Credit risk that takes the form of *NPLs* is considered a primary source of banking system instability (Berger and DeYoung, 1997).

3.1.3. Regulatory indexes

Our study also considers five regulatory and supervisory instruments investigated in the previous banking literature (e.g., Agoraki et al., 2011; Lee and Hsieh, 2013). We mainly use the capital requirements index (*CAPR*), which accounts for initial and overall capital stringency.[6] We also use the official supervisory power index (*SPR*), which highlights the extent to which the supervisory authorities are liable for taking explicit actions against bank managers, shareholders, and auditors. In addition, we consider the level of restrictions imposed on bank activities in each country, as measured by the activity restriction index (*ACTR*). Furthermore, we use a market discipline index (*MDPM*) to indicate banks' degree of transparency vis-à-vis the public and whether any incentives persist to enhance market discipline. As a final regulation mechanism, we use deposit insurance (*DEP*) as an instrument to protect depositors from bankruptcy by providing them with deposit insurance as a part of the deposit amount. A detailed description of these variables is provided in Table A1 in the Appendix.

3.1.4. Control variables

First, we take into account bank-specific characteristics. We consider the natural logarithm of total assets a proxy for bank size (*Size*), which can be a major factor of greater risk taking, due to the effects of the "too big to fail" principle (Mishkin, 2006). In this context, many recent empirical studies have considered bank size a determinant of banking risk (e.g., Bertay et al., 2013; De Jonghe et al., 2015; Leaven et al., 2016). Leaven et al. (2016) argued that "*large banks tend to have lower capital ratios, less stable funding, and more exposure to potentially risky market-based activities*" (page 3). However, other studies underscored that large banks can diversify their activities and thus reduce their risk exposure.

We further integrate the ratio of equity to assets to account for bank capitalization (*EQA*), since the level of bank capitalization is a significant factor in banking stability. Berger and DeYoung (1997) argued that banks with lower capitalization provide riskier loans, which could lead to more *NPLs*. Indeed, many studies assume that capitalization can be considered a more important determinant of bank soundness (Gaganis et al., 2006; Bourkhis and Nabi, 2013).We also include the loan growth rate ($\Delta Credits$) as a control variable. The effect of bank loan growth is expected to be negative, since an increase in the credit amount reflects weak screening standards and, hence, higher risk (Abedifar et al., 2013; Srairi, 2013). Moreover, we use the *ROA* to proxy for bank profitability. This indicator reflects managerial strategies to allocate banks' financial resources to maximize welfare, reduce losses, and promote bank solvency (Hassan and Bashir, 2003).

Next, we incorporate country-specific control variables. We follow Schaeck and Hesse and Cihak, 2007and consider the inflation rate (*INF*) and the real gross domestic product growth rate (*GDPgr*). First, although the rise in the inflation rate increases bank profits, it can reduce the demand for loans and increase the loan interest rate, which can, in turn, increase banking risk (Chortareas et al., 2012). Second, *GDPgr* is considered a measure of total economic activity development. According to Vega et al. (2017), economic growth stimulates banks to reduce financial restrictions designed to expand lending, which, in turn, generates more risk. Finally, to detect the effect of the GFC, we include a dummy variable that takes the value of one for the years 2008 and 2009, and zero otherwise (Beck et al., 2013).

3.2. Data

The data were extracted from a cross-country sample provided by country members of the OIC. We selected ten countries whose banking system includes both Islamic banks and conventional ones. We exclude Iran and the Sudan, since they exclusively have a full-fledged Islamic banking system. Moreover, we focus on banks operating in the Middle East and Asia, where the Islamic banking industry is rapidly growing (Kammer et al., 2015). Our sample consists of an unbalanced panel data set of 123 banks, 34 of which are Islamic banks, during the period 2005–2015. Table 1 presents the distribution of these banks by country and type.

The data related to financial information are from DataStream. As indicated in Table 2, the information about regulations and the institutional environment are from several sources, including the World Bank database extracted from the Bank Regulation and Supervision Survey, developed by Barth et al. (2001) and further updated by Barth et al. (2006, 2008), and the macroeconomic variables gathered from the World Bank's World Development Indicators database.

(*footnote continued*)
that they require a relatively long sample to provide reliable estimates.

[5] Impaired loans, or so-called *NPLs*, are loans that are either at least 90 days past due or in nonaccrual status (Berger and De Young, 1997).

[6] The initial capital stringency indicates whether the source of funds that count as regulatory capital can include assets other than cash, government securities, or borrowed funds, as well as whether the regulatory or supervisory authorities verify these sources of capital. Overall capital stringency indicates whether the calculation of regulatory capital considers risk elements or value loss.

Table 1
Sample banks distributed by country and type.

Country	Islamic banks	Conventional banks	Sum
UAE	5	9	14
Kuwait	3	7	10
Saudi Arabia	2	9	11
Bahrain	4	7	11
Qatar	3	6	9
Jordan	2	9	11
Turkey	3	14	17
Bangladesh	2	9	11
Indonesia	3	6	9
Malaysia	7	13	20
Sum	34	89	123

Table 2
Variables description and data sources.

Variable	Description	Source
Z-score components (Z-score)		
Return on Assets	Net income/Total assets	Datastream (2015)
Leverage ratio	Total equity/ Total assets	Datastream (2015)
Non-performing loans	Impaired loans/Gross loans	Datastream (2015)
Lerner Index components (Lerner)		
Total cost	Interest expenses + Non-interest expenses	Datastream (2015)
Bank output	Bank total assets	Datastream (2015)
Input Prices		
Price of funds	Non-interest expenses/Total funding	Datastream (2015)
Price of capital	Other non-interest expenses/ Fixed assets	Datastream (2015)
Price of labor	Personal expenses/Total assets	Datastream (2015)
Marginal Cost	Estimated using Eqs. (2) and (3)	Author calculation
Bank-specific variables		
Bank Size (size)	Natural logarithm of total assets	Datastream (2015)
Bank Capital (EQA)	Total equity/ Total assets	Datastream (2015)
Loan growth (ΔCredits)	Annual growth rate of gross loans	Datastream (2015)
Profitability (ROA)	Return on equity ratio	Datastream (2015)
Regulatory Environment		
CAPR	Capital requirements	*Barth et al., (2001, 2006, 2008)*
SPR	Supervisory power	
MDPM	Market discipline and private monitoring	
ACTR	Activity restrictions	
DEP	Explicit deposit insurance scheme.	*Demirgüç-kunt et al. (2005)*
Macroeconomic variables		
GDPgr	Annual Gross domestic product growth rate	World Bank
Inflation (INF)	Annual Inflation rate	World Bank
Global Financial Crisis	A dummy variable which takes the value of one for 2007 and 2008 years and zero otherwise.	–

4. Empirical approach

The framework used in this paper is based on the method of Agoraki et al. (2011), which compares Islamic banks to conventional banks. Our methodological framework uses the GMM technique proposed by Arrelano and Bond (1991) and developed by Arellano and Bover (1995) and Blundell and Bond (1998). In this context, Roodman (2009) argued that the GMM estimation method takes into account the problems of endogeneity, unobserved heterogeneity, and autocorrelation. We adopt a one-step dynamic GMM estimator[7] model. Judson and Owen (1999) and Tan (2016) emphasized that the one-step GMM estimator is more significant than the two-step estimator, because it produces a smaller bias and a smaller standard deviation of the estimates. We further construct the following equation:

$$Z-score/Risk_{it} = \alpha_i + \beta_1 Stab/Risk_{it} + \beta_2 Lerner_{it}^2 + \gamma REG_{it} + \varphi REG \times Lerner_{it} + \sum_{j=1}^{J} \eta_j X_{it}^j + \sum_{k=1}^{K} \delta_k Z_t^k + \psi Crisis_{it} + \vartheta_i + \varepsilon_{it}$$

where, for bank *i* in year *t*, $Stab/Risk_{it-1}$ is the first lagged dependent variable (*Z-score* or *NPLs*), measuring persistence over time; and $Lerner_{it}$ is bank competition, as measured by the Lerner index. Following Jimenez et al. (2013) and Kasman and Kasman (2015), we introduce a quadratic term for the competition measure (i.e., $Lerner^2$) to capture a possible nonlinear relationship between

[7] In particular, we used the XTABOND2 Stata command.

competition and risk. The terms **X** and **Z** are two explanatory variable vectors that include bank-specific and macroeconomic variables, respectively.[8] We also use the dummy variable $Crisis_{it}$ to account for the GFC, and REG_{it} is a vector of the three regulatory variables *CAPR*, *SPR*, and *ACTR*. Finally, ε_{it} is the error term.

5. Empirical analysis

5.1. Summary statistics

Table 3 presents summary statistics for all the variables, while Fig. 1 illustrates the trend of the three key variables. We aim to show the differences between Islamic or *riba-free* banks and conventional ones and therefore use the nonparametric Wilcoxon rank-sum test.

Overall, the Wilcoxon rank-sum tests show a statistically significant difference in all the specific bank variables. As for bank stability as measured by the *Z-score*, Table 3 demonstrates that conventional banks are more stable than Islamic banks. The *Z-scores* for the major conventional banks are statistically significant at the 1% level and higher than those of Islamic banks. Although several papers showed opposite results (Cihak and Hesse, 2010; Bourkhis and Nabi, 2013), our findings corroborate those of Beck et al. (2013) and Louati et al. (2016). Alternatively, the annual evolution of the *Z-scores* (Fig. 1a)[9] is consistently higher during the overall study period for conventional banks than for Islamic ones. Due to the GFC, the mean Z-index of conventional banks dropped slightly, from 24.43 in 2007 to 24.03 in 2008, whereas the mean *Z-score* for Islamic banks decreased significantly from 20.81 before the crisis to 18.56 during the crisis. Accordingly, there is no evidence that the GFC affected the soundness of the two types of banking business models differently. These results corroborate the findings of Bourkhis and Nabi (2013) stating that Islamic banks are imitating the commercial strategies of conventional banks and that, in practice; they distribute profits to investment depositors, even when they accrue losses, and pay the profits out of equity.

Regarding credit risk exposure, the average *NPLs* ratio for Islamic banks is 3.6%, compared to 4.4% for conventional banks. This result indicates that Islamic banks are not as exposed to credit risk as their conventional counterparts, in accordance with the studies of Ben Khediri et al. (2015) and Nurul-Kabir et al. (2015). Fig. 1b shows a significant drop in the average NPL ratio for both types of banks during the first quarter of the study period. Both banking types exhibit almost the same credit risk levels. However, the situation changes after 2009, with a remarkable rise in *NPLs* among conventional banks, with a subsequent decline in 2010.

As shown in Table 3, Islamic banks' mean Lerner index (0.4) is statistically and significantly higher than that of their conventional peers (0.37). Since the Lerner index reflects disparity between bank prices and marginal cost output, our results indicate that Islamic banks are more able to set a price above their marginal cost and thus benefit from greater market power. Our findings confirm the results of Turk-Ariss (2010). Fig. 1c, in turn, shows that the Lerner index of the two bank types displays a downward trend, until 2008. This period, from 2005 to 2008, reveals a clear divergence between both indexes. The conventional index exceeds the Islamic index because of the greater market power of conventional banks. After 2008, we observe sharp rises in both indexes, except in 2011. Most importantly, the two curves then converge, indicating no remarkable difference between Islamic and conventional banks.

Descriptive statistics show that the average size of Islamic banks is 15.39, compared to 16.14 for conventional banks. Moreover, unlike their conventional peers, Islamic banks have a larger credit supply. The average loan growth rates for Islamic and conventional banks are 26.2% and 18.5%, respectively, with a significant difference at the 1% level. Furthermore, the average equity-to-asset ratios are 12.3% and 14.9% for conventional and Islamic banks, respectively. This difference is statistically significant at the 5% level, showing that Islamic banks are better capitalized than their conventional peers. In terms of profitability, the difference between the two types of banks is statistically significant at the 5% level, with an advantage for Islamic banks, since their average ROA is 2.3%, compared to 1.8% for conventional banks.

We then use the correlation matrix in Table 4 to detect any possibility of highly correlated variables, to further avoid a multicollinearity bias. The results suggest that our analysis avoids the problem of multicollinearity.

5.2. Empirical results

This paper investigates the extent to which banking market power can alter the regulation–risk taking nexus. Since prudential regulations coincide for the two banking business models, we mainly intend to test if one solution fits both of them. To determine whether the quality of prudential regulations has an indirect effect on banking risk taking, as channeled through banking market power, we incorporate interaction terms that represent bank-level market power and three regulatory variables (i.e., *CAPR*, *SPR*, and *ACTR*).

Within the GMM framework, we use (i) the Sargan test, a test for overidentifying restrictions, to determine whether our instruments are valid, and (ii) the Arellano–Bond (1991) test for first-order autocorrelation (AR(1)) and second-order autocorrelation (AR(2)) (Arellano and Bover, 1995; Blundell and Bon, 1998). The Sargan test results reject the null hypothesis of the validity of overidentifying restrictions at the 1% level for all specifications, limiting the validity of exclusion restrictions. However, Cruces and

[8] More specifically, the controls of X and Z can be written, respectively, as $\sum_{\eta=1}^{4} \eta_j X_{it} = \eta_1 Size_{it} + \eta_2 Loangr_{it} + \eta_3 CAP_{it} + \eta_4 ROA_{it}$ and $\sum_{\delta=1}^{3} \delta_j Z_t = \delta_1 GDPgr_t + \delta_2 INF_t + \delta_3 MDPM_t + \delta_4 DEP_t$.

[9] Fig. 1 plots the evolution of the three key variables—that is, the Z-score, the NPL ratio, and the Lerner index—for both the Islamic and conventional bank subsamples.

Table 3
Summary statistics (in thousands of USD dollars).

	All banks			Conventional banks			Islamic banks			
	Obs.	Mean	Std.Dev	Obs.	Mean	Std.Dev	Obs.	Mean	Std.Dev	WRS
Z-score	***958***	23.67	13.53	***712***	24.96	13.17	***246***	19.95	13.91	***5.706*** ***
NPLs	***998***	0.043	0.043	***772***	0.044	0.042	***226***	0.036	0.039	***3.296*****
Lerner	***1014***	0.379	0.166	***770***	0.373	0.139	***244***	0.401	0.231	***−2.400****
Size	***1022***	15.96	1.395	***776***	16.14	1.404	***246***	15.39	1.205	***7.591*** ***
ΔCredit	***966***	0.203	0.221	***736***	0.185	0.194	***230***	0.262	0.282	***−4.191*****
EQA	***1022***	0.129	0.061	***776***	0.123	0.043	***246***	0.149	0.096	***−2.389*** **
ROA	***1022***	0.019	0.028	***776***	0.018	0.012	***246***	0.023	0.053	***2.320****
GDPgr	***1022***	0.053	0.042	–	–	–	–	–	–	–
INF	***1022***	0.050	0.037	–	–	–	–	–	–	–

***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

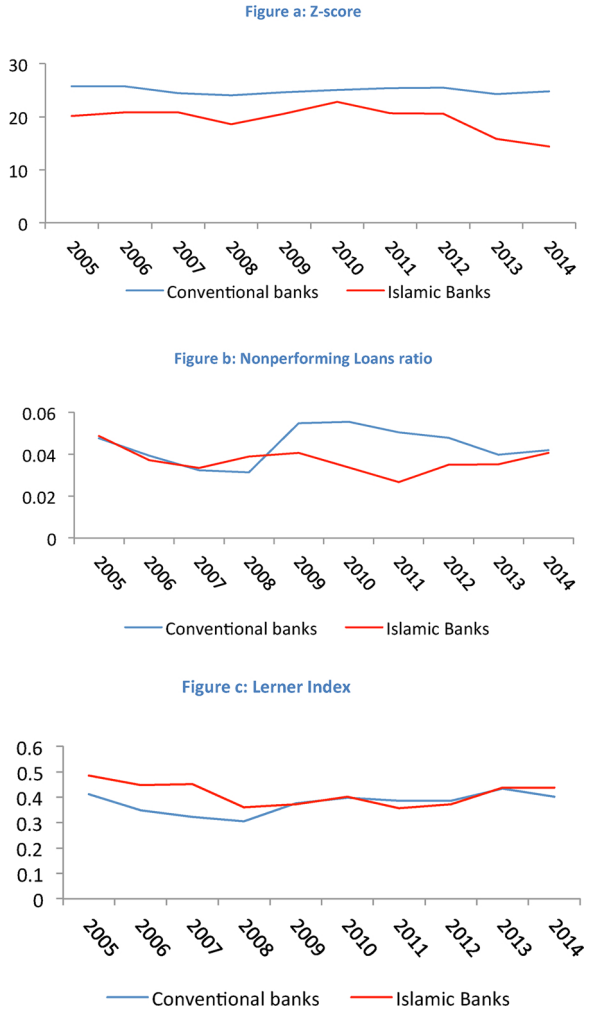

Fig. 1. Key variables: Islamic vs. Conventional banks.

Galianai (2007) argued that the Sargan tests are not very powerful in finite samples. The same conclusion was found by Athanasoglou et al. (2008) and Tan and Floros (2012). The second-order autocorrelation was rejected by the test for AR (2), indicating the consistency of the estimators. The lagged dependent variables are also positive, with highly significant coefficients across all specifications, demonstrating the dynamic character of the model specification (Daher et al., 2015; Tan, 2016).

The regression results are presented in Tables 5 and 6. Table 5 shows the estimated results taking into account banking insolvency risk and Table 6 exhibits the results with the NPL ratio as the dependent variable. We first evaluate the RCR nexus without

Table 4
Correlation matrix.

	Z-score	NPLs	Lerner	ΔCredits	Size	ROA	EQA	GDPgr	INF	CAPR	SPR	MDPM	ACTR	DEP
Z-score	1													
NPLs	−0.115***	1												
Lerner	0.090***	−0.029	1											
ΔCredits	−0.033	−0.198***	−0.096***	1										
Size	0.046	−0.201***	0.022	−0.085***	1									
ROA	−0.066**	−0.169***	0.266***	0.252***	−0.023	1								
EQA	−0.004	−0.033	0.215***	0.006	−0.216***	0.379***	1							
GDPgr	0.093***	−0.185***	0.108***	0.271***	−0.083***	0.170***	0.101***	1						
INF	0.066**	−0.042	−0.239***	0.275***	−0.116***	−0.002	−0.111***	0.181***	1					
CAPR	−0.218***	0.228***	−0.082***	−0.093***	0.118***	−0.033	0.096***	−0.324***	−0.230***	1				
SPR	−0.011	−0.176***	−0.103***	0.095***	0.139***	0.051	−0.160***	−0.191***	0.005	−0.197***	1			
MDPM	−0.189***	−0.129***	0.278***	0.098***	0.136***	0.159***	0.219***	0.130***	−0.248***	0.092***	0.116***	1		
ACTR	−0.039	0.064**	−0.071**	−0.100***	−0.161***	−0.117***	−0.256***	−0.120***	0.094***	0.119***	0.094***	−0.410***	1	
DEP	0.327***	0.098***	−0.419***	−0.020	−0.271***	−0.170***	−0.283***	−0.106	0.247***	−0.215***	0.097***	−0.468***	0.377	1

***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

Table 5
RCR: One-step system GMM estimation (Dependent variable = *Z-score*).

	All banks		Conventional banks		Islamic banks	
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***
Z-score (-1)	0.673***	0.753***	0.643***	0.646***	0.814***	0.747***
CAPR	−0.223***	−0.074	−0.128***	−0.022	0.052	0.635***
SPR	0.188***	0.134***	0.058**	0.019	−0.052	0.114
ACTR	−0.108***	0.028	−0.046*	−0.040*	0.145**	0.002
Lerner	1.040***	2.923**	0.603**	0.425	3.689***	17.48***
Lerner^2	−0.319	−0.512*	0.051	−0.161	−3.382***	−5.96***
CAPRlern		−0.064**		−0.259***		−1.060***
SPRlern		−0.045		0.090		−0.438***
ACTRlern		−0.099*		0.063		−0.058
ΔCredits	−0.196***	−0.191***	−0.165***	−0.176***	−0.035	−0.134
Size	−0.031	0.015	0.029*	0.039***	0.084	0.044
ROA	−0.235	0.100	1.956**	1.882**	−4.325***	0.202
EQA	0.830	1.28***	1.913***	2.254***	0.827	1.584*
GDPgr	0.830	0.123	−0.164	−0.239	1.235*	0.919
INF	−1.130***	−0.190	−0.214	0.114	1.305*	0.733
Crisis	0.057***	0.021	0.041**	0.029*	0.019	0.014
MDPM	0.452***	−0.131	−0.127	−0.022	0.452**	−0.054
DEP	−0.350**	0.034	0.173	−0.276***	0.787**	0.333
No.Obs.	***797***	***797***	***592***	***592***	***193***	***193***
Sargan test	***102.55***	***224.67***	***84.38***	***107.84***	***57.06***	***79.00***
AR (1) test	***−8.55***	***−9.01***	***−6.54***	***−7.14***	***−3.18***	***−2.34***
p-value	***(0.000)***	***(0.000)***	***(0.000)***	***(0.000)***	***(0.001)***	***(0.019)***
AR (2) test	***1.45***	***0.85***	***−1.18***	***−1.50***	***1.36***	***0.46***
p-value	***(0.147)***	***(0.396)***	***(0.236)***	***(0.133)***	***(0.174)***	***(0.647)***

***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

Table 6
RCR: One-step system GMM estimation (Dependent variable = *NPLs*).

	All banks		Conventional banks		Islamic banks	
	(1)	(2)	(3)	(4)	(5)	(6)
NPLs (-1)	0.649***	0.627***	0.693***	0.679***	0.540***	0.703***
CAPR	−0.013***	−0.010	−0.006**	−0.010**	−0.008*	0.006
SPR	0.010**	−0.003	0.003*	−0.011***	0.019***	0.010
ACTR	−0.004	−0.002	0.002	−0.007**	−0.006*	−0.011***
Lerner	−0.029	−0.381*	−0.086**	−0.562***	0.014	0.167
Lerner^2	0.003	−0.014	0.002	−0.054	−0.003	−0.018
CAPRlern		0.006		0.009		−0.009
SPRlern		0.021**		0.033***		−0.015
ACTRlern		0.005		0.007		0.009*
ΔCredits	−0.031***	−0.041***	−0.043***	−0.038***	−0.028***	−0.026***
Size	−0.007***	−0.004**	−0.003	−0.005***	−0.006**	−0.005**
ROA	−0.074*	−0.076	−0.397**	−0.428**	−0.591***	−0.467**
EQA	0.016	0.066	0.112	−0.004	0.047	−0.020
GDPgr	−0.147***	−0.110***	−0.136***	−0.155***	0.051	0.029
INF	−0.061	−0.006	−0.014	−0.024	−0.044	0.008
Crisis	−0.002	−0.003	−0.006***	−0.005***	0.007**	0.006**
MDPM	−0.025*	−0.005	0.002	−0.012	−0.007***	−0.026**
DEP	−0.048***	−0.019	−0.017	−0.028***	−0.081***	−0.036**
No.Obs.	***838***	***793***	***606***	***606***	***174***	***174***
Sargan test	***117.69***	***210.15***	***124.11***	***201.58***	***51.90***	***93.65***
p-value	***(0.000)***	***(0.000)***	***(0.000)***	***(0.000)***	***(0.289)***	***(0.052)***
AR (1) test	***−6.25***	***−5.68***	***−7.12***	***−7.10***	***−2.99***	***−3.17***
p-value	***(0.000)***	***(0.000)***	***(0.000)***	***(0.000)***	***(0.003)***	***(0.002)***
AR (2) test	***−1.42***	***−1.63***	***0.19***	***0.12***	***0.47***	***0.86***
p-value	***(0.156)***	***(0.102)***	***(0.851)***	***(0.906)***	***(0.640)***	***(0.390)***

***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

distinguishing between Islamic and conventional banks (regressions (1) and (2)).[10] We then perform a split sample analysis to determine whether the RCR relations between the two types of banks are different. In particular, regressions (3) and (4) report the results for conventional banks, while regressions (5) and (6) provide the results for Islamic banks.

The first column in Table 5 indicates the direct impact of market power and the regulation variables on risk. The results show that the effect of banking market power on banking insolvency risk is consistently positive, with a high level of significance. In other words, greater market power enhances banking stability. We thus support the *competition–fragility* hypothesis. Put differently, increased competition can induce managers to engage in risky activities on behalf of shareholders to compensate for potential losses caused by a decline in market power. The quadratic term often appears to be nonsignificant in almost all the specifications, showing no nonlinear relationship between competition and risk.

Once we take into account the regulatory variables, the estimated coefficients show that the capital requirement index has a direct negative impact on banking stability. Indeed, the adoption of more rigid regulation can reduce the amount of credit available for banks to lend and their ability to diversify, which, in turn, can force them to assume additional risk and thus jeopardize their stability. We thus contradict Barth et al. (2004) and Agoraki et al. (2011). However, we are consistent with Koehn and Santamero (1980) who affirmed that capital adequacy requirements can lead to higher risks and, hence, greater fragility. Our results are also in line with the findings of Besanko and Kanatas (1996).

The interaction term of the capital requirement index with the Lerner index has a significant negative effect on *Z-score* (regression (2)). This finding indicates that a stringent capital requirement stimulates risk taking among banks with strong market power, and thus reduces bank soundness. Our result supports the findings of Hakenes and Schnabel (2011), which showed that stringent capital requirements can decrease competition for loans, which, in turn, leads to higher loan rates. Consequently, banks will engage in greater risk taking behavior, which increases the risk of single loans. Such circumstances can lead to an increase in the bank default probability.

Furthermore, Table 5 indicates that the supervisory power index is positive and statistically significant, suggesting that the presence of influential official supervisors decreases risk. This finding is consistent with many previous empirical studies (Lepetit et al., 2008; Agoraki et al., 2011) that have demonstrated that well-qualified supervisors are capable of preventing managers from engaging in excessive risk taking behavior, thereby promoting banking and financial stability. The coefficient of the interaction term with the Lerner index is statistically nonsignificant. The interaction between the supervisory power and Lerner indexes is unrelated to insolvency risk. Hence, this result shows that supervisory power has a direct and independent effect on banking soundness.

Moreover, our results show that restrictions in activity have a direct negative impact on banking stability. Sum (2016) demonstrated that stringent regulations induce banks to opt for more profitable activities, which can result in greater risk taking (Barth et al., 2004). Nevertheless, the interaction between the Lerner index and activity restriction has a negative coefficient (regression (2)), while higher-profit market power can considerably reduce the impact of activity restriction on bank stability. In this context, Agoraki et al. (2011) explained that when banks face restrictions on activities, they are more likely to focus more on the loan market to compensate for the potential loss of non-interest income. However, due to the increased competition, banks' charter value erodes and their tendency to assume more risks increase; with a negative effect on financial stability.

We next evaluate whether RCR relations differ between the two types of banks. The results in Table 5 support the *competition–fragility* view within both Islamic and conventional banks. Interestingly, Kabir and Worthington (2017) obtained the same result when assessing the competition–stability/fragility nexus for Islamic and conventional banks in 16 countries.

As far as our regulatory tools are concerned, no significant differences between the sample and conventional bank outcomes are found. The estimated coefficients of the basic model specification are also found to have the same sign and identical level of statistical significance. Interestingly, flexible capital requirements and influential official supervisors enhance banking stability for all our sample banks. Moreover, the interaction between competition and supervisory power does not influence insolvency risk, and activity restrictions have an independent effect on banking soundness.

Table 5 shows further particular outcomes for the Islamic bank subsample. For instance, regression (5) shows that the coefficient of the capital requirements index is statistically nonsignificant, indicating that capital requirements have no direct effect on the *Z-score*. However, the interaction of the capital requirements index with market power has a negative and significant coefficient. This outcome is similar to that for the conventional bank subsample. It implies that stringent capital requirements increase the risk of insolvency of Islamic banks with too much market power, and that capital regulation does not eliminate the insolvency risk of Islamic banks with strong market power.

The results also show a negative yet nonsignificant association between *SPR* and *Z-score,* but the coefficient of their interaction with the Lerner index is significantly negative (regression (6)). This result indicates that, unlike for conventional banks, powerful official supervisors decrease the soundness of Islamic banks with greater market power, since, under certain conditions, especially in emerging markets, supervisors are unable to achieve their goal easily. Authoritative banks can influence supervisors to act in favor of their particular interests instead of those of society. In this context, Al-Jarhi (2005) demonstrated the weakness of the supervisory power in developing economies, due to the shortage of human skills and low pay.

The activity restriction index we find for Islamic banks contrasts with that of conventional banks and shows that activity restrictions have a direct positive impact on Islamic banking stability. This finding corroborates the results of Alam (2014), who argued that Islamic banks take on less risk as compared to conventional bans, even when their activities are restricted in the financial market.

[10] We estimate two regressions. The first regression shows the direct impact of the Lerner index, as well as the regulation variables. The second regression reports the interaction effect highlighting if the effect of the regulation variables depends on the degree of banking power.

The author explained that Islamic banks avoid many risky ventures by following the inherent Shariah regulations and restrictions. Nevertheless, the interaction term between the Lerner index and activity restriction has a negative yet nonsignificant coefficient (regression (6)). The greater market power of Islamic banking could weaken the positive impact of activity restriction on bank stability.

The results in Table 6, where the bank NPL ratio is the dependent variable, show that the competition–fragility assumption holds only for conventional banks. Interestingly, no impact of the Lerner index is found in the Islamic banking industry.

As far as the regulatory tools are concerned, the results show that capital requirements are effective in reducing the number of bad loans. The negative coefficients of CAPR in almost all the regressions indicate that credit risk decreases with stringent capital regulations. This result supports the findings of Barth et al. (2004), Kopecky and Vanhoose (2006), and Agoraki et al. (2011). Conversely, the interaction effect is nonsignificant. In particular, this result shows that capital regulations do not influence banking credit risk under such competitive conditions.

As for the supervisory power index, Table 6 shows a positive direct effect on credit risk in all the regressions. Its interaction with market power shows the same effect in almost all the regressions, except regression (6), that is, the Islamic bank subsample. This outcome indicates that supervisory power could increase the number of impaired loans of banks with greater market power.

Concerning the activity restriction index, neither a direct nor an indirect impact on credit risk is detected among any of the sample banks, including the conventional bank subsample. However, the results show a negative but weak association with Islamic banks' credit risk (regression (6)). The findings also show a positive coefficient for the interaction of *ACTR* with the Lerner index. Indeed, stricter restrictions on bank activities can significantly reduce Islamic banks' credit risk. Nonetheless, activity regulations increase the credit risk of banks with greater market power.

Returning to our control variables, we find that credit growth has a negative and highly significant coefficient for the *Z-score* in almost all the regressions, except those specific to the Islamic banking subsample. Our findings support the argument that a strategy of excessive lending impedes banking stability (Khemraj and Pasha, 2009; Tehulu and Olana, 2014). On the other hand, credit expansion is negatively associated with credit risk. This outcome is proven in all specifications, indicating that increased credit expansion can diminish the amount of toxic loans. In addition, bank size enhances the stability of conventional banks, but not that of Islamic banks. It can also improve bank asset quality by reducing toxic loans. As for the effect of bank profitability, the *ROA* positively affects the *Z-score* of conventional banks and negatively affects that of Islamic banks. In the *NPLs* regressions, however, the *ROA* exhibits a consistent and negatively significant relationship with credit risk. This result is expected, since improved banking profitability generally reflects efficient monitoring and supervision, along with a well-organized risk management strategy (Louzis et al., 2012), which can result in a sounder bank lending strategy and, hence, a smaller amount of impaired loans. This result was also confirmed by Makri et al. (2014), Tehulu and Olana (2014), and Chaibi and Ftiti (2015).

This study shows a positive association between bank capitalization and credit risk for conventional banks, since strong capitalization encourages them to engage in risky activities, resulting in more risky assets and higher numbers of bad loans. This result corroborates the findings of Louhichi and Boujelbene (2016). Accordingly, Altunbas et al. (2007) attributed the positive correlation between capital and risk to the regulator hypothesis, which assumes that regulators usually encourage banks to increase their capital proportionally to the amount of risk taken.

Regarding the macroeconomic control variables, *GDPgr* reduces the amount of *NPLs*. This result is consistent with previous empirical literature suggesting that economic development improves borrowers' ability to repay their debts (Chaibi and Ftiti, 2015; Louhichi and Boujelbene, 2016), which, in turn, can reduce banks' insolvency risk and number of bad loans. On the other hand, the inflation rate exhibits a positive and statistically significant association with conventional banks' *Z-score*. Nevertheless, no considerable impact of *INF* on credit risk is observed.

As for the crisis dummy, the results demonstrate that crisis encourages the enhancement of the regulations in place. Financial booms are actually associated with regulatory and supervisory inadequacy.

The market discipline index exhibits a somewhat positive impact on the *Z-index* for Islamic banks only (regression (5)). In this context, Agoraki et al. (2011) showed that improvements in information disclosure requirements positively impact bank risk taking behavior and financial stability. The results with the *NPLs* ratio as the dependent variable further reaffirm earlier results, since the market discipline index, *MDPM*, is negatively associated with credit risk.

Finally, a deposit insurance scheme has an adverse effect on conventional banking stability (regression (4)). Conventional banks protected by a deposit insurance system tend to engage in highly risky activities. In this context, Almarzoqi et al. (2015), finding the same result, reported that a deposit insurance scheme can protect banks in the case of failure. Consequently, banks are likely to engage in excessive risk taking behavior because they benefit from such an insurance service. Along the same lines, Keeley (1990) argued that a deposit insurance system can provide banks with a risk taking incentive by inducing moral hazard. Moreover, we can observe from regression (5) that deposit insurance, *DEP*, has a significant positive coefficient, indicating that deposit insurance enhances Islamic banking stability. Deposit insurance represents an explicit guarantee for depositors' savings (Sum, 2016). We should also mention that the majority of Islamic bank depositors (except in Malaysia and Turkey) do not benefit from such a guarantee (Grira et al., 2016). Indeed, conventional banks' insured depositors are likely to be in a more reassuring situation, since they can get their funds back, even in the case of serious financial turmoil. However, Islamic banks depositors are unable to get their money back, because of the absence of an explicit deposit insurance system.

Table 7
RCR: Random effect estimation results (Dependent variable = *Z-score*).

	All banks		Conventional banks		Islamic banks	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	1.443	2.103	1.233	0.835	−2.680	−1.033
CAPR	−0.125**	−0.159***	−0.120**	−0.095*	−0.145	−0.306**
SPR	0.0004	−0.030	−0.031	−0.014	0.016	−0.032
ACTR	0.021	0.007	−0.011	−0.023	0.193*	0.203*
Lerner	0.744***	−0.869***	0.709***	1.158***	0.579***	−2.559**
Lerner^2	−0.722***	−0.817***	−1.100***	−1.018***	−0.482**	−0.372
CAPRlern		−0.082**		−0.058**		−0.381***
SPRlern		−0.069		−0.050		−0.097
ACTRlern		−0.038*		0.042		−0.024
ΔCredits	0.028	0.035	0.023	0.008	0.020	−0.005
Size	0.020*	0.017	0.051***	0.052***	−0.0009	−0.028
ROA	0.605***	0.490**	5.542***	5.764***	0.811***	0.444
EQA	5.779***	5.841***	7.452***	7.434***	3.899***	3.829***
GDPgr	0.244**	0.191	0.049	0.088	0.698**	0.646**
INF	−0.037	−0.003	0.182	0.216*	0.236	0.023
Crisis	0.008	0.008	−0.011	−0.012	0.075**	0.071**
MDPM	0.046	0.057	0.082	0.101	0.383	0.413
DEP	0.679***	0.689***	0.752***	0.768***	0.869	0.846
No.Obs.	***903***	***903***	***674***	***674***	***229***	***229***
R-sq	***0.733***	***0.738***	***0.857***	***0.861***	***0.748***	***0.782***

***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

Table 8
RCR: Random effect estimation results (Dependent variable = *NPLs*).

	All banks		Conventional banks		Islamic banks	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.364***	0.353***	0.407***	0.484***	0.451**	0.375*
CAPR	−0.009***	−0.012***	−0.009***	−0.005	−0.014**	−0.019**
SPR	−0.0009	−0.001	−0.0005	−0.004	0.001	0.007
ACTR	−0.005***	−0.004**	−0.005***	−0.003	−0.008	−0.014**
Lerner	−0.024	0.012	−0.064*	−0.161	−0.011	0.079
Lerner^2	0.037	0.029	−0.092**	−0.072*	−0.050	−0.098**
CAPRlern		−0.005		0.009		−0.014
SPRlern		0.0009		0.011*		−0.021**
ACTRlern		−0.001		−0.007		0.018**
ΔCredits	−0.027***	−0.027***	−0.030***	−0.028***	−0.005	−0.007
Size	−0.011***	−0.011***	−0.012***	−0.012***	−0.017***	−0.016***
ROA	−0.148***	−0.147***	−0.810***	−0.853***	−0.230*	−0.164
EQA	−0.027	−0.028	−0.039	−0.039	−0.093*	−0.072
GDPgr	−0.086***	−0.085***	−0.080***	−0.086***	−0.013	−0.019
INF	0.054	0.054	0.048	0.043	0.015	0.015
Crisis	−0.011***	−0.011***	−0.014***	−0.014***	0.003	0.001
MDPM	−0.015**	−0.015**	−0.014**	−0.017**	−0.018	−0.015
DEP	−0.012	−0.011	−0.015	−0.018	−0.014	−0.010
No.Obs.	***950***	***950***	***727***	***727***	***212***	***212***
R-Sq	***0.144***	***0.145***	***0.245***	***0.251***	***0.134***	***0.181***

***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

5.3. Robustness check

To check the validity of our results, we apply a random effect panel model[11] to examine the RCR nexus. The results for the *Z-score* and *NPLs* are reported in Tables 7 and 8, respectively.

The results reaffirm the *competition–fragility* hypothesis for both Islamic and conventional banks. They also suggest a significant negative influence of *CAPR* on conventional banks' *Z-score*, and a nonsignificant effect for Islamic banks. Moreover, as in earlier findings, if we take banking market power into account, a negative effect is observed. Furthermore, unlike previous results, Table 7

[11] We initially applied both fixed effects and random effects models, with our choice of random effects models based on the Hausman specification test, which clearly and consistently accepts the null hypothesis.

indicates significant effects of *SPR* and *ACTR* on *Z-score*. Finally, we also find evidence that supervisory power has a direct and independent effect on banking soundness.

6. Conclusion

Using 123 Islamic and conventional banks operating in 10 OIC countries, this study examines whether the effect of regulatory frameworks on bank risk taking differs according to banking market power and whether this effect varies across the two banking business models. Initially, we show that the results differ by banking type. First, capital regulations are found to have a destabilizing effect on conventional banks only. This effect is significantly stronger for banks with greater market power. However, stringent capital requirements are effective at reducing banking credit risk, regardless of the level of banking market power. Second, the direct effect of official supervisory power shows that accurate supervision is an effective regulatory tool in enhancing conventional bank stability. However, this regulation mechanism has an adverse effect on Islamic banks with strong market power. Notably, supervisory control has both a direct and an indirect impact on credit risk, which underscores the impaired loans of Islamic banks, except those with strong market power.

The study has a number of policy implications for the development of risk management among Islamic and conventional banks, potentially benefiting risk managers, practitioners, and policymakers. Its findings can help improve the risk management practices of Islamic as well as conventional banks.

This study has, furthermore, considerable implications for both regulators and policymakers. It highlights a sharp contrast in risk taking behavior between Islamic and conventional banks. The two banking models display different behaviors, thus raising the issue of the regulatory framework of Islamic banks and whether Islamic banks should be regulated in the same way as conventional banks. Islamic regulatory organizations such as the Islamic Financial Services Board and the Accounting and Auditing Organization for Islamic Financial Institutions released several regulatory guidelines that fit the Basel I and II frameworks to the specificities of Islamic bank. The Basel III framework represents a significant regulatory challenge, since it does not take into account the particularities of the Islamic banking system.

This study provides evidence that deposit insurance schemes have a positive and consistently significant association with the *Z-score* as well as the *NPLs* ratio of conventional and Islamic banks. Accordingly, the underlying principles of the Islamic banking system prevent Islamic banks from implementing a conventional deposit insurance system. Unlike Turkish and Malaysian Islamic bank depositors, who benefit from guarantees on their saving/deposits, most Islamic banks depositors in other countries receive no explicit guarantees. In case of a severe liquidity shock, insured depositors (mainly in conventional banks) receive their money back—at least the guaranteed portion of it—from a deposit insurance fund, whereas Islamic banks depositors (except in Turkey and Malaysia) do not necessarily benefit from such a repayment mechanism, since their banks are not members of an explicit deposit insurance system. To conclude, Islamic banks must adapt their deposit insurance system to Islamic finance principles to provide their depositors with guarantees for their savings. Consequently, a universal Islamic deposit insurance system must be designed and implemented.

Appendix A

Table A1
Regulation variables computation.

Classification	Variable	Description	Sources
Financial Market Regulations	*Capital requirements (CAPR)*	This variable is determined by adding 1 id the answer is yes to questions 1-6 and 0 otherwise, and the opposite occurs for questions 7 and 8 (i.e., yes = 0, no = 1). The questions are: (1) Is the minimum required capital-asset ratio (risk weighted) in line with Basel guidelines? (2) Does the ratio vary with market risk? (3–5) Before determining minimum capital adequacy, are any of the following deducted from the book value of capital? (a) Market value of loan losses not realized on the financial statements, (b) unrealized losses on securities portfolios, and (c) unrealized foreign exchange losses. (6) Have regulatory/ Supervisory authorities verified the sources of funds to be used as capital? (7) Can assets other than cash or government securities provide the initial or subsequent injections of capital? (8) Can borrowed funds provide the initial disbursement of capital? Thus, CAPR is an index of capital requirements that accounts both for initial and overall capital stringency. CAPR takes values between 0 and 8, with higher values indicating greater capital stringency.	Bank Regulation and Supervision Database, World Bank; Barth et al. (2001, 2006, 2008)

(*continued on next page*)

Table A1 (*continued*)

Classification	Variable	Description	Sources
	Supervisory Power (SPR)	This variable is determined by adding 1 if the answer is yes and 0 otherwise, for each of the following 14 questions: (1) Does the supervisory agency have the right to meet with external auditors to discuss their report without the approval of the bank? (2) Are auditors legally required to communicate directly to the supervisory agency any presumed involvement of bank directors or senior managers in illicit activities, fraud or insider abuse? (3) Can supervisors take legal action against external auditors for negligence? (4) Can the supervisory authorities force a bank to change its internal organizational structure? (5) Does the institution disclose off-balance-sheet items to supervisors? (6) Can the supervisory agency order the bank(s directors or management to constitute provisions to cover actual or potential losses? (7) Can the supervisory agency suspend directors' decisions to distribute dividends? (8) Can the supervisory agency suspend directors' decisions to distribute bonuses? (9) Can the supervisory agency suspend directors' decisions to distribute management fees? (10) Can the supervisory agency supersede bank shareholder rights and declare the bank insolvent? (11) Does banking law allow a supervisory agency or any other government agency (other than a court) to suspend some or all ownership rights at a problem bank? (12) Regarding bank restructuring and reorganization, can the supervisory agency or any other government agency (other than a court) supersede shareholder rights? (13) Regarding bank restructuring and reorganization, can the supervisory agency or any other government agency (other than a court) remove and replace management? (14) Regarding bank restructuring and reorganization, can the supervisory agency or any other government agency (other than a court) remove and replace directors? Thus, SPR is a measure of the power of supervisory agencies indicating the extent to which these authorities can take specific actions against bank management and directors, shareholders, and bank auditors. This index takes values between 0 and 14 with higher values indicating more SPR.	Bank Regulation and Supervision Database, World Bank; Barth et al. (2001, 2006, 2008)
	Market Discipline and Private Monitoring (MDPM)	This variable is determined by adding 1 if the answer is yes to questions 1-7 and 0 otherwise, and the opposite occurs for questions 8 and 9 (i.e., yes = 0, no = 1). (1) Is subordinated debt allowed (or required) as capital? (2) are financial institutions required to produce consolidated accounts covering all bank and any non-bank financial subsidiaries? (3) are off-balance sheet items disclosed to the public? (4) Must bank disclose their risk management procedures? (5) Are directors legally liable for erroneous/ misleading information? (6) Do regulations require credit ratings for commercial banks? (7) is an external audit by a certified /licensed auditor mandatory for banks? (8) Does accrued, unpaid interest/ principal on non-performing loans appear on the income statement? (9) Is there an explicit deposit insurance protection system? Thus, MDPM is an indicator of market discipline and shows the degree to which banks are forced to disclose accurate information to the public and whether there are incentives to increase market discipline. This index ranges between 0 and 8 with higher values indicating greater MDPM.	Bank Regulation and Supervision Database, World Bank; Barth et al. (2001, 2006, 2008)
	Activity Restriction (ACTR)	The score for this variable is determined on the basis of the level of regulatory restrictiveness for bank participation in: (1) securities activities, (2) insurance activities, (3) real estate activities, and (4) bank ownership of non-financial firms. These activities can be unrestricted, permitted, restricted, or prohibited and receive values of 1, 2, 3, or 4, respectively. We create an overall index by calculating the summation value of the four categories. ACTR ranges from 4 to 16, with higher values indicating higher restrictions.	Bank Regulation and Supervision Database, World Bank; Barth et al. (2001, 2006, 2008)
Institutional Developement	*Deposit insurance Sheme (DEP)*	Deposit Insurance explicit = 1; Otherwise = 0.	Demirgüç-Kunt et al. (2005)

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