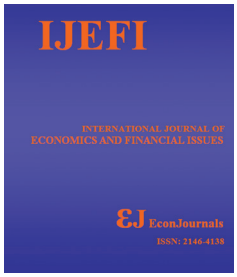

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Financial Stability and Bank Capital: The Case of Islamic Banks

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ABSTRACT

The purpose of this research is to empirically analyze Islamic Bank's financial stability, which consists in assessing the possible relationship between the risk of default (measured by z-score) and capital ratios while considering specific internal bank determinants. A regression analysis is derived on an unbalanced panel data including 405 observations of 81 Islamic banks established in 22 counties during the period of 2010-2014. To this purpose, our bank-specific data are collected from the websites of each bank and Bankscope database. The results show that almost all determinants estimated in the empirical models have statistically significant effect on the stability of Islamic Banks. The regression results show that two capital ratios (Non-risk-weighted capital ratio and Risk-weighted capital ratio), banks' Size, loans to total assets, total deposit to total assets and overhead cost to total assets represent important predictors of bank stability in Islamic banking industry. The empirical results contribute to the comprehension of the relationship between bank-specific variables as well as macroeconomic indicators and the financial stability of the banking system. On the basis of these findings, some proposals could be useful for bank regulators supervisors to enhance and maintain the strength and stability of the Islamic banking sector. Compared to other studies, that conducts a comparative analysis of Islamic and conventional banks, this paper focus only on Islamic banks, so any findings will be more relevant to their business. Hence, it attempts to fill a significant gap in the literature by better understanding the stability and soundness of Islamic banks.

Keywords: Financial Stability, Islamic Banks, Z-score, Capital Ratio
JEL Classifications: G21, G32

1. INTRODUCTION

The recent financial crisis has proven that a sound banking system is a necessity for some fundamental aspects of the economy and for its crucial contribution to financial and economic stability. As financial intermediaries, banks are important suppliers of funds and their stability represent a central and relevant concern for the financial system. In order to promote a sound financial system, regulators require banks to hold sufficient amounts of capital to absorb losses and limit moral hazard behavior. Prior literature revealed that Islamic Banks (IB) have shown a greater resilience during the financial crisis despite the non-existence of international prudential regulations that are based on the specific risks of Islamic financing industry (Farooq and Zaheer, 2015, Pappas et al., 2016). This resilience can be explained, firstly, by the main characteristics of the Islamic financial system, which are the backing of the transaction to real assets and the principle of profits and losses sharing. Second, an appropriate level of capital ensures that banks have sufficient capital to support its activities and that its net worth is sufficient to cover the depreciation of its assets without becoming insolvent. The compliance of IB with international standards and guidelines (Basel III capital requirements), while respecting the principles of Islamic Sharia, represents the most important challenges. Overall, capital regulatory is required to perform two main functions. First, their "risk-sharing function" acts as a buffer against losses, which protects depositors and limits the use of deposit insurance. Second, they limit the moral hazard problem of shareholders who are incited to take excessive risks in order to maximize share value.

Several studies have attempted to identify the determinants of bank stability, and they have been concentrated in several countries. The main finding from most of the research is that internal factors, specially capitalization, can have a significant effect on bank stability. Our study enriches the literature on IB stability by investigating the effect of prudential regulations in reinforcing the stability of IB using regulatory capital rather than a simple capital-to-assets.

The aim of this study is to analyze IB's financial stability, which consists in studying the possible relationship between the risk of default (z-score) and capital ratios and also examining the effect of specific internal bank determinants on bank stability.

The rest of this article is organized as follows: Section 2 provides the main previous studies related to the relationship between capitalization and bank stability. This section details the research hypotheses based on previous theories. Section 3 present the methodology and data sample. Moreover, the econometric model and the dependent and independent variables used in the regression analysis are described here. Section 4 presents and discusses the empirical finding of the study. The final section summarizes the conclusions.

2. LITERATURE REVIEW

Several empirical studies have studied the financial stability of Islamic and conventional banks (based on the z-score model), and following early studies edited by Čihák and Hesse (2010) who used a sample of 77 IB and 397 commercial banks over a period between 1993 and 2004. They found that (a) small IB are financially stronger than small commercial banks; (b) the big commercial banks are financially stronger than the big IB; and (c) small IB tend to be financially stronger than big IB, which may reflect the challenges in managing credit risk in big IB. Their results show that bank-specific factors and banking sector concentration represent the main determinants of Islamic and conventional bank stability.

A look at previous literature on financial stability of banking sector reveals two main study groups. Some studies consider panel of countries, others are country-specific.

For instance, the studies by Čihák and Hesse (2010), Abedifar et al. (2013), Altaee et al. (2013), Beck et al. (2013), Ghosh (2014), Chakroun and Gallali (2015), Pappas et al. (2016), Korbi and Bougatef (2016) and Tabak et al. (2016) are interested in a panel of countries. Some of these studies are interested in the comparison between the financial stability of Islamic and conventional bank and attempted to identify the determinants of bank's financial stability.

Altaee et al. (2013) selected a sample of 42 IB and 55 conventional banks in the Gulf Countries for a period from 2003 to 2010. They found that there was no difference between the financial stability of conventional banking and Islamic banking for the periods 2003-2010, 2003-2007 and 2008-2010. However, they noticed that conventional banks tend to be financially stronger than IB after the financial crisis.

Abedifar et al. (2013) compare the stability of Islamic and conventional banks from 24 countries over the period 1999 to 2009. They conclude that small IB are more stable then small conventional banks, which is explained by their higher level of capitalization. On the other hand Beck et al. (2013) find that IB seems to be closer to insolvency despite their higher capitalization levels.

Ghosh (2014) test the relation between z-score and capital of 100 GCC banks for 1996-2011.His study shows that in general banks decrease capital in response to a raise in risk, and not vice versa. Furthermore, IB increased their capital as compared to their conventional peers. Pappas et al. (2016) analyze the stability of Islamic and conventional banks in Middle and Far Eastern countries from 1995 to 2010. Their results show that IB have a lower probability of failure than their conventional counterparts. This higher degree of solidity is due to bank-specific determinants as well as macroeconomic and market structure factors.

Korbi and Bougatef (2016) compared the insolvency risk between 68 IB and 156 conventional banks in the MENA region from 1999 to 2014. Their empirical study reveals that conventional banks appear to be more stable than IB during this period. Therefore, they tried to determine the factors that affect the stability of these two types of banks. So the results show that regulatory capital represents the most important determinant of financial stability and it is positively associated to bank stability.

The second group of studies focuses on a specific country. In particular, some empirical research on bank stability were interested on country including Pakistan (Shahid and Abbas, 2012; Rashid et al., 2017 and Ullah et al., 2017), Malaysia (Rahim and Zakaria, 2013; Wahid and Dar, 2016; Odeduntan et al., 2016), Bangladesh (Abdullah, 2015), Indonesia (Gamaginta and Rokhim, 2011) and Turkey (Sakarya, 2016).

Gamaginta and Rokhim (2011) conduct an empirical study of 12 IB and 71 conventional banks in Indonesia between 2004 and 2009. The results show that IB have a low degree of stability (measured by z-score) compared to conventional banks. However, small IB have relatively the same degree of stability with small conventional banks. During the 2008-2009 crisis periods, IB and conventional banks tend to have the same relative degree of stability.

Shahid and Abbas (2012) inspected the impact of capital on the risk of default of 55 banks in Pakistan including 5 IB for the period from 2005 to 2010. They found that in Pakistan the small IB are financially stronger than conventional small banks and large IB. However, they found that large conventional banks tend to be financially stronger than large IB, and IB's market share has a significant effect on the financial strength of other banks.

Rahim and Zakaria (2012) examine the behavior of 17 IB and 21 traditional banks in Malaysia from 2005 to 2010. They found that IB are more stable than conventional ones. Using the Z-score to compare the solidity of Islamic and conventional banks, Sakarya (2016) find that IB in Turkey appear to have higher level of stability than conventional banks.

Aside from a specific country or a panel of countries-based study, a look at most prior study on banking stability divulge several factors which influence it. These determinants are classified in two principal groups, bank-specific factors (microeconomic) and environmental factors (macroeconomic).

In accordance with the type and the object of each study of the literature review, several explanatory variables have been suggested for both groups mentioned above.

The internal determinants of bank stability, in general, is interested on bank-specific variables such as capital ratio, bank size, risk, loans, deposits ratio and overhead cost. On the other hand, the external determinants are focused on the effect of economic growth, inflation and market capitalization. In the literature, bank stability is generally presented as a function of internal and external factors; however bank-specific variables have been exposed to be the most important in determining the stability of banks. The mixed results obtained in previous literature have led to a flux understanding of the effect of these variables on bank stability and then in the importance apropos this topic.

In this paper, we suppose that the bank stability can be explained by capital ratios, bank size, loan ratio, deposit ratio and the ratio of overhead cost. Referring to the existing literature, the proposed study attempts to test two hypotheses concerning the relationship between banking stability and capitalization.

3. HYPOTHESES

The capital ratio have long been the most effective ratio, in the financial sector, as it reflects the strength of banking system and its ability to absorb losses in a crisis situation (Iqbal, 2001). Capitalization is one of the most important determinants of the bank's solidity (Demirguc-Kunt et al., 2010, Bourkhis and Nabi, 2013, Pappas et al., 2016, Farooq and Zaheer, 2015, Salami, 2018). The capital ratio is integrated in the regression model to investigate the relationship between stability and bank capitalization.

In literature review a positive relationship has been observed (Demirguc-Kunt et al., 2010, Beck et al., 2013 and Bourkhis and Nabi, 2013, Salami, 2018). In this case, capital allows to absorb losses and to dismiss the risk of bankruptcy during difficult periods. Thus, bank with higher capital has the lower risk of insolvency. Moreover, other prior studies showed a negative relationship between capital ratio and stability (Ahmed et al., 2016 and Kabir and Worthington, 2017). This may be explained by the fact that banks tend to take proportionate risk to gain adequate benefits. This motivation to engage in risky activities, sometimes excessive, increases the probability of insolvency.

Researchers broadly theorize that well capitalized banks face lower probable bankruptcy.

Demirguc-Kunt et al. (2010) and Beck et al. (2013) concludes that IB are better capitalized and have higher asset quality. This shows that IB is more resilient to financial shock than their conventional peer. In another study of banking stability, Abedifar et al. (2013) assess stability features of Islamic and conventional banks situated in 24 countries between 1999 and 2009. They conclude that the higher level of capitalization enable small IB to be more stable than their small conventional counterpart.

In contrast, Ahmed et al. (2016) find that IB are less stable than conventional banks. This finding is supported by Kabir and Worthington (2017) for a data from 16 developing economies over the period 2000-2012. On the other hand, using the Z-score to compare the solidity of Islamic and conventional banks during the financial crisis, Bourkhis and Nabi (2013) show no significant difference between the resilience of these two types of banks. The authors explain this by the divergence of Islamic banking from their theoretical business model. Similarly, the study of Abedifar et al. (2013) find that there is no significant difference between the stability of large Islamic and conventional banks. With respect to the studies mentioned above, we hypothesize that:
H_1. There is a positive relationship between non-risk-weighted capital ratio and bank stability

Several studies have focused on the capital-to-assets ratio to assess the relationship between the level of capitalization and bank soundness. However, through the literature review there are few studies that have investigated the effect of prudential regulations in reinforcing the stability of IB by using regulatory capital rather than a simple capital-to-assets.

With regard to banking supervision, whereas White (2006) finds that the best factors to achieve financial stability are supervision and regulation. However, Barth et al. (2012) showed that one cannot assure amelioration in financial performance ensues from better supervision. They explain that reinforcement supervision increases corruption in bank lending, decrease bank development and may lower the efficiency of financial intermediation.

According to Smolo and Kabir (2010), capital adequacy is a measure of the adequacy of an institution's capital relative to its current liabilities and the risks inherent in its assets. An appropriate level of capital ensures that the institution has sufficient capital to support its activities and that its net worth is sufficient to deal with the devaluation of its assets without becoming insolvent.

Estrella et al. (2000) assess the relationship between the capital regulations and the risk of subsequent bank distress. They use a sample of U.S. commercial banks during the period 1989-1993. They find that capital adequacy requirements are the most effective predictors of bank failure and they prove the superiority of the risk-weighted capital in predicting failure over long time horizons.

In the same study framework, Abou-el-Sood (2015) investigates the association between regulatory capital and failure of 560 US bank holding companies (BHC) during 2003-2009.

Her results show that Tier 1 capital ratio is significantly negatively related with bank distress only when BHC has a Tier 1 capital ratio less than 6 percent. Then, the author concludes that the resilience of the banking sector can be improved by increasing regulatory capital.

Mayes and Stremmel (2014) investigate bank distress for a large quarterly data set of FDIC-insured US banks during 1992-2012. They study the effects of risk-weighted and non-risk-weighted capital measures for various banking types on bank stability. These authors conclude that the non-risk-weighted capital measure explains bank distress and bankruptcy better. Salami (2018) assessed the potential of risk-based capital and risk-independent capital in predicting bank soundness (evaluated by bank's z-score) of Nigerian deposit money banks listed on the Nigerian Stock Exchange during 2012-2016. This empirical research shows the superiority of equity-to-assets ratio compared to other indicators of capital adequacy. This finding is supported by Chernykh and Cole (2015) and Hogan (2015). Therefore, for the majority of the previous literature mentioned above, the capital ratio should have a positive impact on the stability, as well-capitalized banks are considered more stable. Based on main previous studies, the following hypothesis is suggested:

H_2. There is a positive relationship between risk-weighted capital ratio and bank stability.

4. DATA AND METHODOLOGY

In this section, first, we present data, sample selection, dependants and independents variables. Then, the research methodology is detailed.

4.1. Data and Sample Selection

Our sample includes an unbalanced panel data of 81 IB in 22 countries from 2010 to 2014. Our bank-specific data are gathered from the websites of each bank and Bankscope database (which represent the most exhaustive database for studies in banking sector).

Annual growth rates in percentage of GDP are extracted through the World Bank database. We exclude IB that do not have data, from annual balance sheets and income statements, in Bankscope database during the period of investigation. Table 1 shows that the best countries represented in terms of number of banks are Bahrain, Malaysia and Pakistan.

4.2. Dependent Variable (Banking Stability Measure)

The feedback from the literature on bank stability shows that z-score is a good proxy to investigate the determinants of bank failure and its demands less data compared to the CAMELS variables (Laura et al., 2015). Furthermore, z-score can be calculated utilizing the return on assets and the capital-asset ratio. Indeed, it simply requires banks' accounting information (Pappas et al., 2016). Another characteristic of z-score is that it represents an objective measure of bank solidity, whatever the type of bank (Islamic or conventional) and whatever its decisions (high risk and returns or moderate risk and returns) (Čihák and Hesse, 2010).

The measurement of the risk of default as proposed by Roy (1952), Boyd and Graham (1986), Goyeau and Tarazi (1992) is used in our study. According to these authors, the insolvency of a bank is defined as the probability that losses become greater than its equity.

$$probabilityofinsolvency=probability(-\varpi)>K \quad (1)$$

Where $(-\pi)$ represents the loss of the bank and K its equity.

Table 1: Sample selection by country

Region	Country	Number of IB
Middle East/ MENA	Saudi Arabia	5
	Bahrain	14
	Egypt	2
	United Arab Emirates	5
	Britain	2
	Iraq	3
	Iran	1
	Jordan	2
	Kuwait	2
	Qatar	3
	Yemen	1
SoutheastAsia	Indonesia	2
	Malaysia	11
	Thailand	1
	Brunei	1
South Asia	Pakistan	10
	Sri lanka	1
	Bangladesh	6
	South Africa	1
	Turkey	4
	Sudan	3
	Djibouti	1
Total	22	81

Source: The author's selection based on the data availability

By adopting an asset return approach (Boyd and Graham, 1986), this risk indicator becomes:

$$probability\ ofinsolvency = Prob\left(\frac{-\pi}{TA} > \frac{K}{TA}\right) \quad (2)$$

$$= Prob(ROA < \frac{-K}{TA}) \quad (3)$$

Where ROA represents the rate of return on assets and TA the total assets of bank.

By posing $\lambda = \frac{K}{TA}$ and whereas the rates of return are normally distributed with mean μ_{ROA} and standard deviation σ_{ROA}, we obtain:

$$probabilityofinsolvency = Prob\left(\frac{ROA-\mu_{ROA}}{\sigma_{ROA}} < \frac{-\lambda-\mu_{ROA}}{\sigma_{ROA}}\right) \quad (4)$$

$$= Prob\left(\frac{ROA-\mu_{ROA}}{\sigma_{ROA}} < -\left(\frac{\lambda}{\sigma_{ROA}} + \frac{\mu_{ROA}}{\sigma_{ROA}}\right)\right) \quad (5)$$

$$= Prob(\frac{ROA-\mu_{ROA}}{\sigma_{ROA}} < -Z) \quad (6)$$

$$= Prob(\frac{ROA-\mu_{ROA}}{\sigma_{ROA}} > Z) \quad (7)$$

Where:
$$Z = \frac{\mu_{ROA}}{\sigma_{ROA}} + \frac{\lambda}{\sigma_{ROA}} = z_1 + z_2 \quad (8)$$

Z is the indicator of bank stability.

Goyeau and Tarazi (1992) suggest a decomposition of Z-score in $z_1(\frac{\mu_{ROA}}{\sigma_{ROA}})$ which measures the risk-adjusted performance (also called Sharpe ratio) and $z_2(\frac{\lambda}{\sigma_{ROA}})$ is a hedging component of portfolio risk through equity.

We can write Z-score as follows:

$$Z_{it} = \frac{K_{it} / TA_{it} + \mu ROA_{it}}{\sigma ROA_{it}} \quad (9)$$

And:

$$ROA_{it} = \frac{NetIncome_{it}}{TA_{it}} \quad (10)$$

Where: Z_{it} is a proxy variable of bank's probability of insolvency, ROA_{it} is the return on assets, K_{it}/TA_{it} is the ratio of equity to total assets, μROA_{it} is the mean of ROA and σROA_{it} is the estimated Standard deviation of the return on assets as a proxy for the volatility of returns, all of which are calculated on the basis of accounting data (Boyd et al., 2006).

The z-score is inversely associated to the probability of failure of a bank. Thus, higher value of z-score signifies that probability of failure is low and vice versa.

4.3. Independent Variables

In this paragraph, we present the independent variables selected for our research on bank stability. As determining factors of bank stability, we retain only six bank-specific independent variables as well as macroeconomic factors. Our study does not include all possible internal and external determinants but it is restricted to the following variables.

The internal determinants used are: capitalization level (measured by two ratios; the non-risk-weighted capital [CAP] and the risk-weighted capital [CAR]), bank's size (TA), loans to total assets (LTA), total deposit to total assets (DPOA) and overhead cost (which practically all represent the personnel expenses) to total assets (PETA). In line with prior literature, we consider the GDP (as proxy for economic growth) which represent one of the most important external determinants of bank failure.

- Capital ratios (CAP and CAR): These ratios should be the most explanatory variables of bank insolvency. We construct two capital ratios; CAP (the non-risk-weighted capital ratio) is equal to capital divided by total unweighted assets (which represents on-book assets) and CAR is capital adequacy ratio (the risk-weighted capital ratio) and is equal to capital (Tier1+Tier2) divided by risk-weighted assets (RWA) (Beck et al., 2013 and Anginer et al., 2014). According to the IFSB standard (2013) these two elements of the capital of an Islamic bank are defined as follows: "*Tier 1 capital consists of: common equity share capital, retained earnings and some other reserves, Shariah-compliant instruments (MusharakahSukuk) and some reserves (minus regulatory adjustments/deductions applicable to Tier 1). Tier 2 capital consist of instruments issued by IIFS (Muḍarabah or WakalahSukuk), general provisions or reserves held against future, presently unidentified losses on financing, any premium paid on issue of Tier 2 capital instruments, and instruments or qualifying capital issued by consolidated subsidiaries of an IIFS to third-party investors that meet the criteria of Tier 2 capital (minus regulatory adjustments/deductions applicable to Tier2).*"[1] In the prior literature, the ratio of capital CAP (non-risk-weighted capital ratio), is also referred to Risk-independent capital, risk-neutral capital or non-risk- weighted capital (Mayes and Stremmel, 2014; Chernykh and Cole, 2015, Hogan, 2015)
- Bank size: Generally, the impact of rising size on z-score has been examined to be positive to a certain extent. Thus, larger banks benefit scale economies and diversification tools which lead to an amelioration in the levels of stability. In contrast, the impact of size on z-score could be negative due to the difficult to manage bigger bank. We use the natural log of total assets of a bank to control bank size (TA)
- Ratio of net loans to total assets (LTA): Is included as independent variable to survey bank insolvency. Overall, LTA ratio is a measure of credit risk: the higher the ratio, the larger the number of loans provided by the bank and the higher the risk of default and credit risk. For Islamic banks, loans are defined as Islamic banking operations and include Murabaha receivable, Mudaraba investments, Musharaka investments, loans without interest (Qardhasan), loans with service charge and other short operations (e.g., investment in Ijara assets: leasing) (Archer et al., 1998; Zahar and Hassan, 2001; Rosly, 2005 and Srairi, 2009). A higher LTA ratio doesn't signify that Islamic banks are raising their lending, but it means that banks have more investments and any increase in this ratio may increase risk, which has a negative impact on bank stability (Hesse and Čihák, 2007). On the other hand, this finding is in contrast to the finding of Mokhtar et al., 2006, Shahid and Abbas, 2012 and Rashid et al., 2017 that show that banks with high loan to asset ratio (LTA) tend to be more stable
- Ratio total deposit to total assets (DPOA): Deposits represent the principal source of bank funding, and their relationship with bank stability is designated by the deposits to total assets ratio. Higher Deposits to Total Asset ratio may be associated with greater risk taking. Thus, the specific nature of different types of deposit (profit sharing investment accounts [PSIA]) creates new types of risks (displaced commercial risk [DCR]) and can be a source of excessive risk-taking in IB (Abedifar et al., 2014, Hamza and Saadaoui, 2015). As regards to insolvency risk, IB could support losses in addition to, operational limitations on investment and risk management activities because of the exceptional relationship with depositors and this could make them less stable than their conventional banks. On the other hand, the respect of sharia directives by Islamic banking sector may incite greater loyalty and limit default (we mainly cite the deposit withdrawal risk).

1 IFSB (2013); ExpositionProjet-15 "Revised Capital Adequacy Standard for Institutions Offering Islamic Financial Services [Excluding Islamic Insurance (*Takāful*) Institutions and Islamic Collective Investment Schemes" P6-P10

Furthermore, literature review show that IB generally use Non-PLS contracts to elude moral hazard problem related to PLS financing and it which may be the highest part in any Islamic banking activities (Aggarwal and Yousef, 2000)

- Overhead cost: Is represented by the ratio overhead (total operating expenses) to total assets (PETA). Practically, operating expenses represent total of personnel and administrative expenses. In general, a high level of staff costs enables IB to have qualified personnel, which can reduce the risk of IB failure (where reputation and customer relationship management are a priority) (Pappas et al., 2016). However, effective monitoring and control is essential for the execution of PLS contracts (Iqbal and Mirakhor, 1999) and for the management of Islamic financial services in accordance with Sharia law. Nevertheless, banks that allocate a relatively larger proportion of the value of their assets to personnel costs can opt for riskier assets as they mobilize more resources to monitor and supervise their operations (Anginer et al., 2014). Therefore, the impact of the PETA variable on default risk is unclear
- Economics growth (GDP): Is the growth rate of the Gross Domestic Product. The economic activity of a country is an important factor influencing z-score. A positive relationship is expected between GDP and bank stability (Čihák and Hesse, 2010, Shahid and Abbas, 2012, Rajhi and Hassairi, 2013 and Rashid et al., 2017).

Table 2 describes the dependent and independent variable used in the empirical analysis and presents the predicted impacts of the determinants on bank stability based on the prior literature.

We use a linear regression model to analyze the relationship between bank stability and bank-specific factors. Several previous studies on bank stability used linear model, such as Demirguc-Kunt et al., 2010, Beck et al., 2013, Bourkhis and Nabi, 2013, Salami, 2018 and Korbi and Bougatef, 2016.

As with prior studies, we estimate a simple linear equation using panel data techniques for a sample of IB in the period 2010-2014.

The regression model adopted in our study is formulated as follow:

$$Z_{i,j,t}=\alpha_0+\alpha_1 CAP_{i,j,t}+\alpha_2\ CAR_{i,j,t}+\alpha_3\ TA_{i,j,t}+\alpha_4\ LTA_{i,j,t}+\alpha_5\ DPOA_{i,j,t}+\alpha_6\ PETA_{i,j,t}+\alpha_7\ GDP_{j,t}+\varepsilon_{i,j,t} \quad (11)$$

Where *i, j, t* refer to bank, country and year respectively; $Z_{i,t}$ represent an indicator of bank stability at time *t*; $\varepsilon_{i,j,t}$ is an error term.

Equation (11) is estimated through panel data regression. We used the Hausman specification test to choose the fixed effects model or the random effects one and a test of homogeneity to check for the existence of individual effects. And we used also a test to examine the residual heteroskedasticity.

5. RESULTS AND DISCUSSION

This section presents descriptive statistics, correlation matrix and regression analysis results in Tables 3-5.

5.1. Descriptive Analysis

Table 3 reports the descriptive statistics of all the variables used in the empirical analyses.

Z-score has significant dispersion in the score. The amount of Z-score ranges from -3.548 to 357.292, and the highest standard deviation for Z-score is 40.711. The difference between the mean and the standard deviation shows large differences between the stability of banks in our sample. The average of z-sore of IB in our sample displays 29.589 during the period 2010-2014, which is significantly higher than the average World Bank z-score (Global Financial Development Database, 2013–15 data[2]) 12.9%. These statistics suggest that Islamic banking systems in the selected regions are considerably stable compared to the rest of the world. The value of risk-weighted capital ratio changes among banks, with a low standard deviation (0.191) (as well as the unweighted capital ratio), indicating a slight change in the values. The best-capitalized bank in our sample has a capital ratio of 1.442, while for the least-capitalized bank this ratio is equal to –0.773.

5.2. Regression Analysis

Prior to regression analysis, we have verified the independence of the variables to ensure that there are no multicollinearity problems that could affect our results. The correlations between the variables identified in the model are presented in Table 4. The results show no collinearity problems between the independent variables, as

2 Global Financial development report 2017-2018, downloaded from:https://www.cbd.int/financial/2017docs/wb-banking2017.pdf.

Table 2: Definition of variables used in the regression model

Variables	Description	Measure	Expected effect on stability
		Dependent variable	
Z	**Z-score**	$\frac{(Totalequity\ /\ Total\ Assets)+\mu ROA}{\sigma ROA}$	**NA**
		Independent variables	
CAP	Non-risk-weighted capital ratio	Equity/total assets	+
CAR	Risk-weighted capital Ratio	(Tier1+Tier2)/Risk-weighted assets	+
SIZE	Bank size	Natural logarithm of total assets	±
LTA	Loan ratio	Loan to asset=net loan/total assets	±
DPOA	Deposits ratio	Total deposits/Total assets	±
PETA	Overhead cost ratio	Total operating expenses/ Total assets	±
GDP	Economics growth	Growth rate of the Gross Domestic Product	+

multicollinearity can be a concern when the correlation is >0.80 (Kennedy, 2008). In this regard, the estimation is valid and robust.

Table 5 shows the regression models results for Z-Score, Z_1 and Z_2. The Hausman test validates the significance of individual effects and the fixed effects model is most appropriate for all regression analysis (full or subdivided sample). Overall, the independent variables have the expected sign and the statistically significant effect on the Z-score.

The models have an adequate explanatory capacity, the *R-squared* value varying from 0.1065 to 0.4562. The R-squared value reaches its maximum in the model 2, indicating that approximately 45% of the variation in the Z-score is due to the independent variables in the model.

In terms of hypothesis testing, the results reveal that the capital ratio (CAP) is positively and statistically highly significantly related to bank stability indicator in all models. In this case, bank with higher capital has the lower risk of insolvency and is more resilient to financial shock. This finding is in line with previous research by Demirguc-Kunt et al. (2010) and Beck et al. (2013) and Abedifar et al. (2013).

Our results about risk-weighted capital ratio (CAR) show a positive but insignificant effect on IB stability in Model 3-5. This suggests that it is possible to improve the resilience of the banking sector by increasing regulatory capital, but the insignificant relationship means that the effect is inconclusive. On the contrary, in the case where z-score was used as dependent variable for full sample (Model 1) and sub-sample of small IB (Model 2), CAR has a positive and significant effect on bank stability as found by Estrella et al. (2000), Abou-el-Sood (2015) and White (2006). Therefore, regarding CAP and CAR, our hypotheses (H1 and H2) are supported by the finding.

It can be concluded that the non-risk-weighted capital ratio (CAP) is superior to the risk-weighted capital ratio (CAR) in predicting bank soundness, as confirmed by findings from other studies; Chernykh and Cole (2015), Hogan (2015), Mayes and Stremmel (2014) and Salami (2018).

The variable size (TA) has a negative and significant effect on IB stability. The negative coefficient is statistically significant in model referred to small and large IB. This result confirms prior evidence of Čihák and Hesse (2010). There finding reveal that Big IB tend to be financially stronger than Small IB, which may reveal that IB have adequate risk management tools and system

Table 3: Summary statistics for IB

Variables	Mean	Std. Dev	Min.	Max.
Z-SCORE	29.589	40.711	–3.548	357.292
CAP	0.193	0.234	0.000	1.007
TA	6.382	0.772	4.097	7.963
CAR	0.205	0.191	–0.733	1.422
LTA	0.548	0.283	0.000	0.993
DPOA	0.544	0.312	0.000	0.949
PETA	0.016	0.022	0.0003	0.272

Table 4: Correlations matrix

Variables	z-score	CAP	TA	CAR	GDP	LTA	DPOA	PETA
z-score	1.000							
CAP	–0.0363	1.000						
TA	0.0848	–0.1968	1.000					
CAR	0.0147	0.3250	–0.1912	1.000				
PIB	0.0435	–0.0070	0.0806	–0.0003	1.000			
LTA	0.0706	0.0123	0.0181	–0.1550	–0.1129	1.000		
DPOA	0.0569	–0.1645	0.1089	–0.1260	–0.0454	0.6620	1.000	
PETA	–0.0287	0.0562	–0.3338	–0.0019	–0.0438	0.1899	0.1883	1.000

Table 5: Regression analysis

	Modele1	Modele2	Modele3	Modele4	Modele5
	(Full sample)	(Small IB)	(Large IB)	(Full sample)	(Full sample)
Variables	Z-Score	Z-Score	Z-Score	Z_1	Z_2
CAP (α_1)	12.10 (8.340)***	17.726 (1.94)**	24.788 (6.22)***	0.004 (0.01)	20.412 (11.54)***
CAR (α_2)	4.704 (1.31)*	5.928 (2.00)**	1.576 (0.67)	0.089 (0.37)	5.734 (0.98)
TA (α_3)	–0.611 (–0.27)	–8.421 (–1.84)*	–9.647 (–2.66)***	0.338 (1.16)*	–10.72 (–1.23)*
LTA (α_4)	–6.160 (–1.66)*	0.425 (0.11)	–1.796 (–0.47)	–0.81 (–0.22)	–17.255 (–1.93)**
DPOA (α_5)	–3.842 (–0.94)*	–11.835 (–1.95)**	–3.136 (–1.05)	0.072 (0.24)	–19.828 (–2.63)***
PETA (α_6)	–6.056 (–2.16)**	–14.13 (–2.63)***	0.541 (0.01)	–2.63 (–0.79)	10.078 (1.25)*
GDP (α_7)	14.481 (3.42)***	0.073 (0.07)	0.151 (0.95)**	0.011 (0.65)	–0.006 (–0.02)
Constant	18.385 (1.17)	7.031 (0.35)	62.049 (2.38)**	5.213 (2.75)**	13.172 (0.85)
Observations	405	97	308	405	405
R-squared	0.2417	0.4562	0.2387	0.1065	0.3594
Hausman Test					
χ^2 (7)	95.48	43.38	73.08	3.95	99.88
P-value	0.00	0.00	0.00	0.78	0.00

Robust P in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%. Definition of variables: Z-Score=[(Average return on bank assets + Equity to total assets ratio)/Standard deviation of the rate of return on assets]; CAP=Equity/Total Assets; CAR=(Capital to total Risk–Weighted Assets); TA=Log of total assets; LTA=Loans/Total Assets; DPOA=(Deposits/Total Assets); PETA=(Personnel Expenses/Total Assets); GDP=The growth rate of the Gross Domestic Product; $Z_1=\mu$ ROA/σROA and $Z_2=\lambda/\sigma$ROA

adapted to their business model, as a result, they tend to be more stable when working on a large scale.

The coefficient of LTA is negative and significant for the full sample, which suggests that IB with a high loan to asset ratio are likely to have a low z-score. This result is consistent with the study of Hesse and Čihák (2007). In other word, increasing in lending (Investment in the IB case) may increase risk and which can negatively impact bank stability. This is due to the specificity of Islamic financial intermediation: indeed, loans granted by IB (based only on its funds in real assets as a guarantee) present more risks than those of their traditional counterparts. Islamic loans which are based on the PLS principle and not on risk transfer, exposes IB to greater risk.

Our results about (DPOA) show that it is negatively and significantly related to Z.score. Banks that use deposits the most (relative to equity) have a higher risk of default. This may be justified in case of investment deposits by the Displaced commercial risk (DCR) that the IB runs when it is under pressure to pay its depositors (investment accounts) a higher rate of return than what should be payable under the "real" terms of the investment contract.

Turning to the other independent variable, the ratio of overhead cost to total assets (PETA) has a negative and significant impact on bank stability. This indicates that banks with greater expertise and sophisticated risk management tools may be encouraged to take on more risk.

Regarding macroeconomic factor, GDP is found to have a significant positive impact on banks' stability. The sign of this variable is consistent with the results of Čihák and Hesse, 2010, Shahid and Abbas, 2012, Rajhi and Hassairi, 2013 and Rashid et al., 2017. As expected, best macroeconomic conditions may help to have an intensive environment for bank stability.

6. CONCLUDING REMARKS

The purpose of this paper is to empirically investigate the determinants of IB stability. The estimation of the panel data was conducted on 81 Islamic banks located in 22 countries during the period 2010-2014. The empirical results of different model show that all bank-specific variables have been exposed to be statistically the most important in determining the stability of banks measured by z-score. The result indicates that capital strength measured by non-risk-weighted capital ratio (CAP) is the main determinant of IB stability, supporting the argument that well-capitalized IB has the lower risk of insolvency. The finding show also the superiority of the non-risk-weighted capital ratio (CAP) compared to risk-weighted capital ratio in explaining bank distress and bankruptcy. The finding reveals that size is negatively and significantly related to Z.score. IB tend to be less stable when working on a large scale. In addition, loan ratio, deposit ratio and the ratio of overhead cost were found to negatively impact the soundness of IB. Overall the findings of the paper have some research implications. Given the positive relationship between the non-risk-weighted capital ratio and bank stability, it would be useful for bank regulators and supervisors to consider integrating non-regulatory measures as part of the bank's regulatory regime.

Future research can be conducted by adding more Islamic banks to the analysis or by incorporating other internal variables, such as other regulatory indicators, corruption or non-performing loans.

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