Comparative credit risk in Islamic and conventional bank

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Abstract: In this paper, we consider the levels of credit risk in Islamic and conventional banks. One problem with existing studies is the use of accounting information alone to assess credit risk, and this could be especially misleading with Islamic banking. Using a market-based credit risk measure, Merton's distance-to-default (DD) model, we evaluate the credit risk of 156 conventional banks and 37 Islamic banks across 13 countries between 2000 and 2012. We also calculate the accounting information-based Z-score and nonperforming loan (NPL) ratio for the purpose of comparison. Our results show that Islamic banks have significantly lower credit risk than conventional banks as based on DD. In contrast, and as expected, Islamic banks display much higher credit risk using the Z-score and NPL ratio. These findings suggest that the measure chosen plays a significant role in assessing the actual credit risk of Islamic banks.

JEL classification: G21; G32

Keywords: Credit risk; distance-to-default; Z-scores; nonperforming loans; Islamic banking

1. Introduction

Financial institutions lay at the heart of every economy. Substandard banking systems may then have a severe impact on overall economic performance, and may even lead to widespread financial crisis. According to the Bank for International Settlements (2000), credit risk is a leading source of financial instability in the banking sector. The global financial crisis is just the most recent example of where poor credit risk management has had a dire effect on many economies. In response, the Bank for International Settlements (2000) states that to have proper credit risk management systems, banks should properly identify, measure, monitor and control credit risk. Appropriate measurement of credit risk provides the foundations for developing prudential monitoring and control mechanisms to manage credit risk. Therefore, measuring credit risk in banking systems is of vital concern for the full range of bank stakeholders, not least regulators.

Islamic banking is one of the fastest growing segments in the global financial market. Although the principles and concepts of Islamic banking date from the very founding of Islam, the application and practice of Islamic banking has only developed relatively recently [for a review of the basic principles of Islamic finance, see Gait and Worthington (2014). The strong growth of Islamic banking combined with fierce competition with conventional banks in the same markets raises some concern among regulators and practitioners about the stability and sustainability of Islamic banks in the long run (Elgari, 2003). Furthermore, because of the *Shariah* (Islamic law) principles by which Islamic banks operate, some Islamic financial products impose additional credit risk on practicing banks (Errico and Sundararajan, 2002; Kabir and Worthington, 2014)). Non-standardized financial contracts, different modes of financing and complexity in risk management associated with the implementation of *Shariah* pose additional threats to the stability of Islamic banking. Therefore, the study of credit risk is a major concern for the development of prudential risk management systems governing both Islamic and conventional banks.

From a risk management viewpoint, it is important for many different stakeholders (including regulators, but also investors and depositors) to know whether these competing banking systems exhibit different levels of credit risk. In principle, the basis of the conventional banking system is interest, whereas Islamic banks mainly rely on two alternative principles, namely profit-and-loss sharing (PLS) and markup financing. Consequently, a risk-avoiding borrower may choose an Islamic bank given the opportunity to share any losses with the bank (Hasan and Dridi, 2010). In addition, Islamic banks may face withdrawal risk if they share their losses with depositors (Ahmed and Khan, 2007; Siddiqui, 2008). Therefore, Islamic banks rarely have the option to use PLS on the liabilities side (sharing losses with depositors), given it significantly increases credit risk for Islamic banks. Given this scenario, and contrary to intuition, Islamic banks should have higher credit risk than conventional banks. That said, some argue that the risk-sharing practices of Islamic banks are very limited (Chong and Liu, 2009; Abdul-Rahman et al., 2014), with Islamic banks mainly relaying on sales-type products, which are much less risky than conventional debt-based products. Accordingly, the debate over the relative credit risk of Islamic banks remains open.

In response, a number of empirical studies have undertaken comparative analysis of the credit risk of conventional and Islamic banking. Following seminal work by Čihák and Hesse (2010), several other studies (Gamaginta and Rokhim, 2011; Pappas et al., 2012; Abedifar et al., 2013; Beck et al., 2013) have compared the relative stability of Islamic and conventional banks in different periods and across different countries. Some of this literature concludes that Islamic banks are more stable while others find no evidence of differences in credit risk across the alternative banking systems. Clearly, there is always some variation in findings resulting from the sample of banks in different countries and over time.

One more fundamental limitation of this existing research is that the methodological approach used to calculate the credit risk (or stability) of banks is mostly based on accounting information. Some studies have used the Z-score, as based on standard accounting information comprising the return on assets (ROA), the capital to assets ratio and the standard deviation of ROA. Others have used the nonperforming loans (NPL) ratio, loan loss reserve, and loan loss provision as proxies for credit risk. However, using accounting information alone to measure credit risk at the institutional level could pose a number of problems, especially for Islamic banks. For instance, being based on past performance, accounting values and ratios may not be informative in assessing future outcomes, actual asset values may differ from the historical value of assets because of conservative methods of recording (Altman and Saunders, 1997), and accounting figures may be manipulated by management (Agarwal and Taffler, 2008; Bharath and Shumway, 2008).

As alternatives, the extant literature proposes a number of risk measurement techniques using market information, notably Merton's distance-to-default (DD) model, the credit transition matrix, and the mortality rate model. Of these, the first is the most appealing as it is based on seminal work by Black and Scholes (1973) and Merton (1974). This method not only addresses many of the criticisms of accounting-based credit risk models, but also incorporates essential market information, including the share price, market capitalization, and equity volatility. To date, only a single study by Boumediene (2011) has used the DD to compare the level of credit risk in Islamic and conventional banks, specifically nine each conventional and Islamic banks over the period 2005–09. The results of this study suggested that Islamic banks display significantly lower credit risk than conventional banks. However, both the sample size and period are obviously very limited and some of the modifications used to calculate the DDs for Islamic banks could have invoked an upward bias.

The purpose of this paper is to address the following there key questions. First, do Islamic banks have higher credit risk than conventional banks? Second, does the level of credit risk across conventional and Islamic banks vary because of the chosen method? Finally, did the relative level of credit risk in Islamic and conventional banks change significantly during the recent financial crisis? To respond to these questions, we employ the DD model as a measure of market-based credit risk and the Z-score and NPL ratio as measures of accounting-based credit risk. Our sample comprises 193 banks across 13 countries for the DD, 417 banks from 21 countries for the Z-score, and 305 banks across 13 countries for the NPL, all over the period 2000–12. In so doing, our analysis departs from Boumediene (2011) in several respects. First, we employ a very large sample of 156 conventional and 37 Islamic banks to measure credit risk. Second, we decompose the results over both countries and time. Finally, we employ the same DD model for both the Islamic and conventional banking systems to ensure comparability and robustness.

Our results show that Islamic banks have significantly lower credit risk than conventional banks when measured by DD. In contrast, Islamic banks display higher credit risk when using the Z-score and NPL ratio. While these contrasting results appear ambiguous, they do emphasize the need to recognize the impact of the method of assessing credit risk when deciding which banking system is safer, at least from the perspective of credit risk. At the very least, we address the ongoing debate among regulators about whether Islamic banks should employ different risk management techniques or operate under different regulations than conventional banks, in suggesting that at this stage, separate regulation regarding credit risk management for Islamic banks does not appear necessary. Moreover, from the perspective of investors and depositors, and despite some suggestions to the contrary made by Islamic banks and their supporters, neither system is immune to credit risk.

The remainder of the paper is organized as follows. Section 2 provides a brief review of the literature on credit risk in Islamic banking and on credit risk measurement in

conventional and Islamic banks. Section 3 discusses our methodology and Section 4 presents the data and sample selection process. Section 5 discusses the results and findings. Section 6 concludes.

2. Literature review

2.1 Credit risk in Islamic banking products

Like any other financial product, Islamic financial products involve exposure to credit risk. Drawing on Islamic principles, a number of Islamic financial products have evolved over the time. Some of the more popular financial products are *Mudarabah, Musharakah, Murabaha, Istisna, Salam* and *Ijara*. The credit risk associated with each financial product of course varies depending on the nature of the product. As argued by Errico and Sundararajan (2002) and Rahman and Shahimi (2010), the nature of credit risk in Islamic banks differs markedly from that of their conventional counterparts as a result. In what follows, we briefly describe the credit risk in several main Islamic financial products.

In a *Mudarabah* (profit sharing) contract, the relationship between bank and *Mudarib* (borrower) involves a principal–agent relationship, such that an Islamic bank finances a project via a preagreed profit-sharing arrangement with the borrower. However, banks do not participate in the decision-making process and are not permitted to monitor the borrower. Hence, in a high information asymmetry environment, the Islamic bank is exposed to a high level of credit risk. Credit risk may also arise in the event borrower default, whether intentionally or unintentionally.

Musharakah (profit and loss sharing) is similar to a joint venture partnership where both banks and other partners provide capital and share the profit and loss on a pre-agreed upon ratio. Most *Shariah* scholars agree that *Musharakah* is the closest Islamic finance alternative to interest-based financing. However, because of asymmetric information, the bank is again exposed to a high level of credit risk with the partner investor (Errico and Sundararajan, 2002) along with significant capital impairment risk. This is because as the bank finances the partner, in the case of liquidation, the bank's share of invested capital will rank lower to debt and it may lose all its invested capital. The Islamic bank will also have to cover its share of any loss incurred due to the negligence of the partner.

The most popular Islamic financial product is *Murabahah* (sale of goods with markup), given it accounts for nearly 70–80% of all Islamic bank transactions. This is a sales-based contract where the buyer (borrower) provides necessary information to the bank regarding its purchasing requirements. The bank then purchases the product and sells it to the buyer with a margin for profit. Credit risk arises when customer fails to honor the payment obligation at the time of product delivery (Haron and Hock, 2007). Credit risk also may arise in nonbinding *Mudrabahah* if the customer refuses the delivery of the product purchased by bank at a later time because of, say, subsequent price variation or variation in product quality. (Ahmed and Mohamed, 2011; Iqbal and Mirakhor, 2011).

While *Ijarah* (leasing) is another popular financial product in Islamic banking with arguably lower credit risk than other Islamic financial products, banks are exposed to credit risk in the event of the default of the lessee when rent is due. Unlike conventional banks, Islamic banks cannot transfer the substantial risk and rewards of asset ownership to the lessee, as the bank needs to report the leased asset on their asset side throughout the lease term to comply with *Shariah*. Default can also arise because of variable lease rents that may distress the customer's ability to pay (loss of rental receivables). Boumediene (2011) discusses another source of credit risk in binding *Ijarah* corresponding to when the lessee may cancel the lease before the stipulated time. In this case, the bank (lessor) will find itself with an asset purchased

with expectation of no return.

Salam (forward sale) is where the buyer makes full payment on the day of contract whereas the seller delivers the products later. Islamic banks usually engage in two parallel *Salam* contracts at the same time, the first with the seller and the second with the buyer. Both contracts work independently. Islamic banks face credit risk here in the event of a failure to deliver the products at a specified time (Rahman and Shahimi, 2010). In addition, sometimes because of adverse price fluctuations, the seller may default and hence not deliver the products. In this case, the Islamic banks will need to purchase the products from an alternative source at a potentially higher price to meet delivery to the buyer. This increases credit risk for the Islamic bank.

Like *Salam, Istisna* (order to manufacture) is a forward sales-based mode of financing used in Islamic banking. Both of these financial products have similar types of characteristics, however unlike *Salam, Istisna* is mostly used for manufacturing goods. Islamic banks are exposed to credit risk in this financial contract in two ways. First, if the banks fail to deliver the products on the stipulated date to the buyer due to late delivery from the manufacturer. In this case, the bank will need to purchase from an alternative source at a potentially higher price. Second, if the bank sells this product in instalments to the buyer, the buyer may default in a subsequent period and this be reflected in a loss of receivables for the bank (Haron and Hock, 2007; Boumediene 2011).

2.2. Theoretical evidence

One of the key principles of Islamic banking is that they operate their businesses using PLS modes of financing like *Murabaha* and *Muysharakah*. Using these modes, banks rely relatively more on their partners (borrowers) and there is a much greater chance of problems with severe asymmetric information in that banks have little influence on the decision-making of the funded business, and only limited access to its accounting information. In addition, as the banks are obliged to absorb any loss in full (*Mudarabaha*) or part (*Musharakah*), a risky borrower may tend to default. This increases the credit risk for Islamic banks, in sharp contrast to conventional banking systems, where banks typically do not share in the operating losses of the borrower (Errico and Sundararajan, 2002).

The limited practical usage of risk management techniques in Islamic banks could be another reason for their potentially higher credit risk. This is because under *Shariah*, Islamic banks are not permitted to use any debt-based instrument to mitigate credit risk, nor any speculative methods, including credit default swaps, futures, and options. Islamic banks also generally do not have access to collateral. Therefore, in the case of borrower default, Islamic banks are obliged to bear the full funding losses of the borrower, which makes Islamic banks riskier than conventional banks (Errico and Sundararajan, 2002; Iqbal and Llewellyn, 2002; Bourkhis and Nabi, 2013). The inability to take any legal action against the borrower upon default also raises a moral hazard problem among borrowers. Borrowers may take the opportunity to invest in risky projects or may misuse the funds, thereby increasing the credit risk for both themselves and the bank. In addition, despite *Shariah* dating from the first millennia, Islamic banking in its current and recognizable form has been operating for less than four decades, with most Islamic banks only emerging in last twenty years. Hence, we expect that many Islamic bank personnel lack the skills to manage credit risk efficiently, at least when compared with conventional banks.

In contrast, a few theoretical studies have suggested that Islamic banks could in fact have less credit risk than conventional banks. To start with, Islamic banks can share their losses with the depositors through the PLS mode of finance on the liabilities side, an option not available to conventional banks with their depositors (How et al., 2005). In addition, religiosity

is one factor that potentially lowers the credit risk of Islamic banks, in that because Islamic banks operate their business according to *Shariah*, only the highly religiously motivated may be involved in Islamic banking, and these may tend to default less (Baele et al., 2014; Abedifar et al., 2013). Moreover, Islamic banking is a relationship-type banking system, which helps the banks to understand better the individual borrower and the level of creditworthiness. Based on these theoretical arguments, it is clear that there is no simple answer to the question of whether Islamic banks in principle have greater credit risk than their conventional counterparts.

2.2. Empirical evidence

A number of empirical studies have compared the stability of conventional and Islamic banks in recent years. Most of these employed the Z-score or other accounting-based techniques such as the NPL and loan–loss reserve ratios. To start, Čihák and Hesse (2010) examined financial stability using Z-scores across Islamic and conventional banks in 20 countries over the period 1994–2004, classifying the banks as small or large. According to their results, small Islamic banks tended to be more financially stable than small commercial banks, large commercial banks were better at managing credit risk than large Islamic banks, and surprisingly, small Islamic banks were financially stronger than large Islamic banks. These results clearly show that as Islamic banks grow, risk management becomes more difficult, and Čihák and Hesse (2010) argued that this was because the credit risk monitoring systems in Islamic banks became more complex when operated on a larger scale.

Subsequently, Beck et al. (2013) compared the business orientation, efficiency and stability of conventional and Islamic banks, with the mean Z-scores showing that Islamic banks had significantly lower credit risk. However, when other factors were controlled, most of the results showed no significant difference between the two banking systems. Later, Beck et al. (2013) used NPL as a proxy for asset quality, and found that the NPLs of Islamic banks were consistently lower value, suggesting lower credit risk in Islamic banks. Elsewhere, Abedifar et al. (2013) compared the credit and insolvency risk of 553 banks from 24 countries between 1999 and 2009, employing three different accounting ratios to measure credit risk and several forms of the Z-score to measure insolvency risk. Similar to Čihák and Hesse (2010), they found that small Islamic banks were more stable than conventional banks.

Other studies in this area have tended to focus on a particular region. For instance, Faye et al. (2013) compared business orientation, efficiency, asset quality and stability in Africa, with a sample comprising 279 conventional and 11 Islamic banks from 45 African countries over the period 2005–10. The results indicated higher Z-scores but lower NPL ratios in Islamic banks. Rajhi and Hassairi (2014) also measured stability using Z-scores for Islamic and conventional banks in Southeast Asia and the Middle East and North Africa (MENA) over the period 2000–08 and found that while Islamic banks displayed consistently higher Z-scores, they were less robust once bank-specific, regional and macroeconomic factors were included in the regression model. Overall, large Islamic banks tended to be more stable than large conventional banks and small Islamic banks were less stable than small conventional banks. Elsewhere, in a single-country study, Gamaginta and Rokhim (2011) compared the credit risk of 12 Islamic and 72 conventional banks in Indonesia, and found that Islamic banks were generally less stable. In addition, small Islamic banks were found to have the same level of stability of small conventional banks, and like Čihák and Hesse (2010) small Islamic banks were more stable than large fully-fledged Islamic banks.

In an extension related to the current analysis, only two studies have compared the soundness of Islamic and conventional banks during a period of financial crisis. Bourkhis and Nabi (2013) investigated stability during the 2007–08 financial crisis using Z-scores, but found no significant difference, nor did Beck et al. (2013) in terms of credit risk. Finally, in the only

known study assessing credit risk in Islamic banks using Merton's DD, Boumediene (2011) concluded that Islamic banks had relatively lower credit risk along with a lower probability of default.

3. Methodology

We adopt a three-stage approach to respond to our three research questions. In the first stage, we measure credit risk in both banking systems. In the second stage, we test for group mean equality by country and by year for our three credit risk measures. In the third and final stage, we estimate regressions including the credit risk variables while controlling for bank-specific and macroeconomic factors.

3.1 Credit risk measurement

The last two decades have witnessed the development of a range of credit risk-measurement techniques, broadly grouped as follows: accounting based, external rating agencies, and market based (Altman and Saunders, 1997; Colquitt, 2007; Allen and Powell, 2011). The accounting-based credit risk measures include, but are not limited to, Altman's Z-score, the credit risk Z-score and NPL analysis. External rating agencies include Standard and Poor's, Moody's and other agency ratings for financial companies, including Islamic banks. The more recent and more sophisticated risk measurement methods draw on market-based indicators like Merton's probability of default, Value at Risk (VaR), and CreditMetrics™. Altman and Saunders (1997) and Crouhy, Galai, and Mark (2000) provide comprehensive surveys of current credit risk models. In this study, we use the DD model as a market-based measure, and the Z-score and NPL ratio as accounting-based measures to compare the level of credit risk in Islamic and conventional banks.

3.1 .1 Market based indicators: Distance-to-default and probability of default

There are a number of credit risk measurement techniques available for measuring a bank's default risk using market information, including distance to default, bond prices and credit default swaps (Čihák, 2007). In practice, market-based indicators are more accurate than accounting-based indicators, and more useful in predicting banking failures. The most popular market-based model used to measure credit risk is Merton's distance-to-default (DD) model (Agarwal and Taffler, 2008; Harada et al., 2010; Allen and Powell, 2012).

Originally, Moody's KMV (1993) developed an approach to estimate the default probability of a particular firm at any given point of time based on Merton's approach. This model states that a bank defaults when the market value of its assets falls below the book value of its liabilities. In order to calculate the probability of default, we subtract the face value of a firm's debt from the estimated market value of the firm and divide the difference by the estimated volatility of the firm, resulting in a Z-score, often referred to as the distance-to-default (DD) score. In other words, the DD is the number of standard deviations of market value a firm is away from the point of default (Harada et al., 2010).

The Merton (1974) model assumes that the equity of a firm is equivalent to a call option on the firm's assets, given the equity holders are the residual claimants on the firm's assets after all liabilities have been met. In this model, the strike price of the call option is the book value of the firm's liabilities. If the value of the firm's assets is lower than the strike price, the value of equity is zero. The Merton model has two important assumptions. First, the total market value of the firm's underlying assets follows a geometric Brownian motion,

$$dV_A = \mu V_A dt + \sigma_A V_A dW \quad (1)$$

where, V_A is the firm's assets value, μ is the expected instantaneous periodic rate of return on assets, σ_A is the instantaneous standard deviation of the rate of return on assets, or asset volatility, and dW is a standard Weiner process.

The second assumption in this model is that the firm has issued a single discount bond maturing in T periods. Under this assumption, the equity of the firm is a call option on the underlying value of the firm's asset with a strike price, denoted by V_A, equal to the face value of firm's debt, X and a time-to-maturity of T. The current market value of equity, V_E, can be expressed by using Black and Scholes (1973) option pricing formula for call options:

$$V_E = V_A N(d_1) - X_e{}^{-rT} N(d_2) \quad (2)$$

where

$$d_1 = \frac{\ln\left(\frac{V_A}{X}\right) + \left(r + 0.5\sigma_A{}^2\right)T}{\sigma_A\sqrt{T}} \quad (3)$$

and $d_2 = d_1 - \sigma_A\sqrt{T}$ where r is the risk free rate, σ_A is the instantaneous standard deviation of the rate of return on the value of assets of banks (asset volatility) and N is the cumulative density function of the standard normal distribution.

In order to calculate the DD, two equations are required. The first is equation (2), which states that the value of the firm's equity is a function of the value of the firm. The second relates to the volatility of the firm's equity. Another assumption by Merton is the value of equity is a function of the value of the firm and time,

$$\sigma_E = \left(\frac{V_A}{E}\right)\frac{\partial E}{\partial V}\sigma_v \quad (4)$$

In the Black–Scholes–Merton model, we show that $\frac{\partial E}{\partial V} = N(d_1)$, such that under the assumption of Merton's model, the relation between the volatilities of the firm and its equity is:

$$\sigma_E = \left(\frac{V_A}{E}\right) N(d_{1)}\sigma_A \quad (5)$$

and the DD and probability of default are:

$$DD_t = \frac{\ln\left(\frac{V_{A,t}}{X_t}\right) + \left(\mu - \frac{1}{2}\sigma_A^2\right)T}{\sigma_A\sqrt{T}} \quad (6)$$

$$PD = N(-DD) \quad (7)$$

where DD = distance to default, PD = probability of default, V_A= value of assets, σ_A = volatility of assets, X_t= total liabilities, μ = expected ROA, T = time period, and N = cumulative probability distribution.

As we do not ordinarily have information on the market value of the asset (V_A), the volatility of the asset (σ_A) and the expected return on the asset (μ), we compute them using equations (2) and (5). We use the following steps to measure DD and the probability of default.

The first element to compute to solve the equation (6) is the volatility of equity (σ_E) which we calculate from the historical stock price of any publicly listed firm for a particular period. Following the Hull (1999) methodology, we calculate the volatility of equity.

$$R_i = \ln(pr_t - prt_{t-1})$$

where R_i is the daily return on the stock price and pr_i denotes the stock price at the end of the day i = 1.2.3…..n. Annualized volatility is then estimated as:

$$\sigma_E = \frac{1}{\sqrt{\frac{1}{n}}}\sqrt{\frac{1}{n-1\sum_{i=1}^{n} r_i^2}} - \frac{1}{n(n-1)}\left(\sum_{i=1}^{n} r_i\right)^2$$

where n is the number of observations in the year (the number of trading days). We calculate the market value of equity (V_E) by multiplying the number of shares outstanding by the stock price. Liabilities(X_t) are short term liabilities plus half of the long-term liabilities. The risk-free rate (r) is the yield on a Treasury bond. Including these variables in equations (2) and (5), we estimate the market value of assets and volatility of assets and expected asset growth to include in equation 6 to calculate the DD score.

As stated earlier, DD is the number of standard deviations that the bank's asset value must fall in order to reach the default point. A higher DD score then indicates that the value of the firm is far from the default point, thus lowering the probability of default. For example, if a bank's expected market value of its assets in one year is 100 and the default point is 20, then an 80 percent drop in the market value of assets would make the bank default. The probability of the market value of assets falling from 100 to 20 depends on the volatility of the bank's asset value. For example, if the volatility of the bank's asset value is 10 percent, then 8 standard deviation points would be needed to reach a default point of 20. Theoretically, if DD is zero for a particular bank at a particular time, the bank should already be in default position. However, if a bank can continue to rollover its short-term liabilities, it may survive on a cash flow basis, even though the bank is technically insolvent. All other things being equal, the closer the default point to zero, the more vulnerable the position of the bank, whereas the higher the default point, the lower the probability of default of a particular bank (Bharath and Shumway, 2008).

Overall, there are several advantages of using market information to measure credit risk for banks. First, the availability of equity prices at high frequencies. Most banks are exchange listed and therefore we can extract their daily prices easily. In addition, in an efficient market, equity prices incorporate investor's expectations and forward-looking assessments. Moreover, all the relevant data are publicly available and there is no issue of confidentiality, which makes the measurement more transparent and verifiable. However, market-based indicators also have some limitations. Primarily, if the bank's stock is untraded, it is difficult to measure the default risk of that particular bank. Further, to predict the default probability accurately, the market in which the firm's stock trades should be transparent and liquid. Finally, market-based indicators have a number of assumptions that in practice may not hold. For example, the DD assumes that asset values follow a lognormal process, which will not capture extreme events adequately.

3.1.2 Accounting based measurement: Financial stability Z-score

One of the most commonly used techniques to measure bank soundness or stability using accounting data is the Z-score. Recent studies have used the Z-score extensively to measure the financial stability of the bank as it incorporates the banks' buffers, both profit and

capital and the standard deviation of profit, to measure the theoretical riskiness of banks (Boyd and Runkle, 1993; McAllister and McManus, 1993; Čihák, 2007; Čihák and Hesse, 2010; Beck et al., 2013). In other words, the Z-score measures how many standard deviations a bank is from exhausting its capital base. The calculation of the Z score is as follows:

$$\text{Z score} = (\text{ROA} + \text{E/A}) \,/\, \text{S.D of ROA}$$

where *ROA* = return on assets, being net profit divided by total assets, *E/A* = Total equity divided by total assets, and *SD* of *ROA* = Standard deviation of ROA over a three-year period

Generally, a three-year window for the standard deviation of ROA is sufficient to allow for variation in the Z-score, reducing the chance that variation in the levels of capital and profitability drive the Z score. A number of reasons account for the popularity of the Z-score as a measure of bank soundness among both academics and practitioners. First, we easily show that the Z-score to the probability of bank default are inversely related. If we assume that returns follow a distribution with (finite) first moments μ and σ^2_r, we can estimate the upper bound of the probability of insolvency

$$p(r \leq K) \leq \frac{\sigma^2 r}{(\mu+K)^2} \tag{8}$$

Based on the definition of the insolvency risk Z-score, $z = \mu + k/\sigma_r$, inequality (8) becomes

$$P(r \leq K) \leq \frac{1}{Z^2} \tag{9}$$

Inequality (9) provides a fair estimation of the bank's probability of insolvency and does not require strong assumptions. From inequality (9), we can establish the relationship between the Z-score and bank insolvency.

$$P(r \leq K) = \frac{P(r-\mu)}{\sigma r} \leq \frac{k-\mu}{\sigma r} = P\left(\frac{r-\mu}{\sigma r} \leq -Z\right) = P(r \leq \mu - Z\sigma r) \tag{10}$$

We note that (9) and (10) illustrate the negative relation between the Z-score and probability of bank insolvency. In effect, the Z-score measures the number of standard deviations a bank's ROA needs to drop below its expected value before depleting its equity and the bank becoming insolvent, such that a higher (lower) Z-score indicates that a bank is more (less) solvent.

Specifying the distribution of bank return in equation (10) allows the measurement of the exact insolvency of the bank as follows

$$P(r \leq -K) = P(r - \mu)/\sigma r \leq Z) = \theta r(-Z) \tag{11}$$

where θr denotes the distribution of the bank's standardized returns.

Second, compared to market-based techniques for measuring default risk, the calculation of the Z-score is easy, as little accounting information is required. In addition, this technique is superior to other accounting measures like the NPL or leverage ratio in that neither of these incorporate bank return or its capital structure, and most importantly, the criteria to classify the NPL varies from country to country, making it generally difficult to compare internationally.

Third, the Z-score is popular as a measure of credit risk because of its good prediction power. In evidence, Čihák and Hesse (2010) examined the power of the Z-score in predicting bank failure using bank-level data for 29 countries where 12 countries had experienced

systemic failure. According to their findings, banks that failed during the crisis had significantly lower Z-scores. A similar result is evidence in the US where bankrupted banks had, on average, one quarter the Z-score of solvent banks. This clearly indicates that the Z-score is a powerful measurement tool for measuring bank stability or soundness. Finally, the Z-score is useful for comparing the stability of banks across the groups, such as a high risk/high return strategy vs. a low risk/low return strategy in that it provide an objective measure of soundness.

Nonetheless, while the Z-score has a number of benefits as a measure of default risk, it also has a number of drawbacks. To start with, it is based purely on accounting data and the quality of these data may vary depending on a country's accounting regulations (Beck et al., 2009). Moreover, accounting information is backward looking, such that measures constructed using these data may not fully capture the ongoing condition of the bank, resulting in a misleading measure of default risk.

3.1.3 NPL ratio

Lastly, a number of researchers have used a simple NPL ratio as a proxy for credit risk in banking (Berger and DeYoung, 1997; Ahmad and Ariff, 2007; Das and Ghosh, 2007; Jiménez et al., 2010; Fiordelisi et al., 2011). We measure the NPL ratio by dividing the total amount of impaired loans held by the bank by the net amount of loans, such that a high NPL ratio indicates the increased probability of bank insolvency. While simple, one of the advantages of the NPL ratio is that it is a direct measurement of bank solvency and one difficult for management to manipulate.

3.2 Estimation Techniques

After measuring credit risk in the first stage using the aforementioned techniques, in the second stage we run a group mean comparison test. We use the nonparametric Wilcoxon rank-sum test to compare the level of credit risk between Islamic and conventional banks. As a robustness check, we also use the Student t-test.

Then following Beck et al. (2013), Abedifar et al. (2013) and Čihák and Hesse (2010) we specify the following equation in the third stage to capture the differences in credit risk while controlling for other factors thought to influence credit risk.

$$CR_{ijt} = \alpha + \beta B_{ijt} + \gamma I_i + \delta M_{it} + \lambda R_i + \tau R_i I_i + \phi C_{it} + \psi I_{it} C_{it} + \pi X_k + \Psi Y_t + \varepsilon_{it} \quad (12)$$

where the dependent variable is the *CR* (DD, DP, Z-score and NPL) for bank *i* in country *j* at time *t*, $B_{i,j,t}$ is a vector of bank-specific variables, I_i is a dummy variable taking a value of one if an Islamic bank and otherwise zero, M_{it} are country-level explanatory variables, R_i is a dummy variable which takes a value of one if the country is in MENA otherwise zero, $R_i I_i$ is the interaction between MENA countries and Islamic banks, C_{it} is a dummy variable taking a value of one if the year is in the crisis period 2007–09, $I_{it}C_{it}$ is the interaction between Islamic banks and the crisis period, X_k and Y_t are the country and yearly dummy variables respectively, and ε_{it} is the residual.

The bank specific and country specific variables used as control variables in the regression equation are as follows and in Table 1.

- Log of total assets as a proxy of size. Islamic banks are usually smaller given most commenced operations only relatively recently. Previous studies (Čihák and Hesse, 2010; Abedifar et al., 2013; Bourkhis and Nabi, 2013) have identified the significant

impact of bank size on different risk attributes in that larger banks usually have more opportunity to diversify risk through their branch network, experience and skill; hence credit risk is expected to have a negative relation with the size of a bank.

- Growth of assets is a significant determinant of credit risk and an indicator of moral hazard. Banks usually relax their screening criteria when they wish to increase their market share rapidly. Relaxing screening criteria leads to an adverse selection problem for the bank, hence an increase in credit risk. Abedifar et al. (2013) used this same variable to investigate the impact on insolvency risk. Asset growth is expected to have a negative relationship with credit risk
- Cost to income ratio is included to capture cost inefficiency across the banks. Kwan and Eisenbeis (1997) and Abedifar et al. (2013) find that cost inefficiency has a positive impact on credit risk. A higher ratio indicates that management is not efficient and prudent enough to monitor the risk. Therefore, we expect a positive relation between credit risk and cost inefficiency.
- Loan to assets ratio is another significant determinant of credit risk, with Bourkhis and Nabi (2013) finding the net loan to asset ratio has a significant negative impact on bank stability.
- The model also includes ROA as a measurement of profitability. If the banks' profitability increases, credit risk should be lower.
- Diversification, as measured by the ratio of noninterest income to total revenue, has a significant impact on credit risk in that diversification helps banks to collect more information from different product or business lines to help lower credit risk. On the other hand, banks that focus more on nontraditional activities have higher credit risk because of lack of experience in noncore activities (Čihák and Hesse, 2010; Rajhi and Hassairi, 2014).
- We also include four macroeconomic variables to control for cross-country variation in GDP, inflation and governance and concentration. The GDP growth rate should have a negative relationship with credit risk, while inflation will have a positive relationship with credit risk. Overall, good governance will lower the credit risk. Higher competition in the market also usually increases credit risk.
- We add a regional dummy by dividing the sample into MENA and non-MENA countries to control for regional effects as different regions have different rules, regulations, and cultures that affect credit risk. Furthermore, we interact the regional dummy with the Islamic dummy to compare the credit risk of Islamic banks across regions.
- Finally, we use another dummy variable to investigate the impact of crisis on the credit risk. The crisis period is 2007–09. We also interact the Islamic dummy with the crisis dummy to see whether the credit risk of Islamic banks significantly differs from conventional banks during the crisis period.

<INSERT TABLE 1 HERE>

To estimate the equation, we use the generalized least squares (GLS) random effects model as this has the ability to capture time invariant variables (such as the Islamic dummy variable) in the model. In addition, the differences across countries may have influence on the dependent variable credit risk, which is another reason to use the random effects model. To check the robustness of the results, we also use ordinary least squares (OLS) estimation.

4. Sampling and Data

We select 21 countries that have at least one Islamic bank from the 57 member countries of the Organization of Islamic Countries (OIC). We exclude the other 36 countries because of data unavailability or an insignificant Islamic banking sector. From these 21 countries, we consider only commercial banks and banks that have observations for at least three consecutive years. We include 444 banks in total, of which 142 are Islamic banks and the remaining 302 are conventional banks. We have 4,653 bank-year observations in total, 1,325 of which are for Islamic banks and 3,328 for conventional banks. We also create a restricted sample consisting of banks for which we are able to calculate all of the measures (DD, DP, Z-score, and NPL ratio). The banks in this restricted sample are from 13 countries. Table 2 details the countries included in the study along with the number of banks and the total number of bank-year observations. We describe some data issues regarding the calculation of each of the credit risk measures below:

- As the calculation of DD requires stock data, we only consider economies with a stock exchange. Of the 21 countries initially considered, Brunei, Mauritania and Yemen do not have any stock exchanges and we therefore exclude banks in these countries from our sample. Of the remaining 18 countries, market data on Sudan and Iran are not available in our chosen database, while we excluded Syria, Iraq, and Palestine as they have stock data for less than three years. This leaves a final sample of banks in 13 countries.
- In these 13 countries, there are 193 conventional banks and 37 Islamic banks. We eliminate outliers for the DD by winsorizing at the 1st and 99th percentiles. This produces 1,466 and 292 bank-year observations, spanning the period 2000–12. This sample is consistent with Beck et al. (2013). Of these 13 countries, Indonesia, Malaysia, and Lebanon have no listed Islamic banks.
- Data are available to calculate the Z-score for all banks included in the initial sample. After eliminating outliers from the sample, we obtain 4,055 bank-year observations, of which 1,087 are for Islamic banks
- Among the 21 initially sampled countries, Iran, Iraq, Mauritania, Lebanon and Sudan have no reported NPL ratio in the BankScope database, therefore these countries are not included in NPL analysis. We eliminate outliers obtaining 3,114 bank-year observations, of which 575 observations are for Islamic banks.

<INSERT TABLE 2 HERE>

5. Empirical results

5.1 Descriptive statistics

In the first stage, we measure the credit risk of both Islamic and conventional banks. Table 3 presents descriptive statistics of the credit risk variables along with the other variables included in the regression. Most of the variables are significantly different between the two banking systems. In the restricted sample, DD is significantly higher for Islamic banks than for conventional banks. This also makes default probability higher for conventional banks than Islamic banks at the 5% significance level. In contrast, the Z-score in the restricted sample is significantly higher for conventional banks than Islamic banks, suggesting that Islamic banks face higher credit risks. Comparison of the NPL suggests that Islamic banks have higher NPL ratios than conventional banks, but the difference is not significant. The result is quite consistent with the Z-score in the full sample. However, the average NPL of Islamic banks is 8%, compared to 9% for conventional banks, indicating that Islamic banks have lower credit

risk.

<INSERT TABLE 3 HERE>

As for the other control variables, the average size of individual Islamic and conventional banks across the sample countries is quite similar and there is no statistically significant difference. However, we do observe significant differences in some of the other variables. For example, the average asset growth of Islamic banks is 34% compared to 21% for conventional banks. Hasan and Dridi (2010) also reported higher asset growth for Islamic banks than conventional banks during and after the financial crisis period. The cost to income ratio is also significantly higher for Islamic banks than conventional banks, suggesting higher cost inefficiency. Similarly, the loan to asset ratio, ROA and the level of diversification are also significantly higher for Islamic banks than for conventional banks.

5.2 Group mean comparison test.

In the second stage, we compare the group mean of our credit risk measures, namely, DD, DP, Z-score, and NPL by country and year. Tables 4–11 detail the results. Decomposition of the DD by geographic location (Table 4) shows that most of the countries do not exhibit any significant difference in credit risk between Islamic and conventional banks, except Egypt, Pakistan, Qatar, and Turkey. Islamic banks in Egypt have significantly higher credit risk than Egyptian conventional banks whereas Islamic banks in Pakistan, Qatar, and Turkey have significantly lower credit risk than their conventional counterparts. Bahrain, Bangladesh, Saudi Arabia, and the UAE suggest relatively higher credit risk for Islamic banks, while Jordan and Kuwait imply relatively lower credit risk for Islamic banks, but the differences are not statistically significant in any of these countries. Among the sample countries, banks in Qatar present the highest average DD score for Islamic banks and banks in Malaysia the highest average DD score for conventional banks.

<INSERT TABLE 4 HERE>

We further classify all the sample countries into MENA and non-MENA groups. Islamic banks in MENA countries have significantly lower credit risk than their counterpart conventional banks while Islamic banks in non-MENA countries have significantly higher credit risk than conventional banks. We expect some cross-country variations in credit risk due to variation in the level of Islamic banking development, stock market performance, etc. According to Table 5, throughout the sample period, Islamic banks generally have lower credit risk, except in 2000, 2003 and 2010. However, the difference between the two banking systems is only significant in 2006 and 2007. Lastly, although Islamic banks have higher DD scores during the crisis, the differences in credit risk between Islamic and conventional banks are not statistically significant.

<INSERT TABLE 5 HERE>

Tables 6 and 7 provide the results of the mean comparison test of default probability by country and year. According to Table 6, Islamic banks in Bahrain and Egypt have a significantly higher probability of default than conventional banks in Bahrain and Egypt. Conversely, Islamic banks in Pakistan have a significantly lower probability of default than conventional banks in Pakistan. No other countries exhibit any significant difference in the probability of default between the two banking systems. We also do not find any significant difference in the

probability of default in MENA and non-MENA countries. As shown, the probability of default was significantly higher for Islamic banks in 2010 and significantly lower in 2012. Once again, our results provide no evidence that the probability of default differed significantly between these two banking systems during the financial crisis (see Table 7).

<INSERT TABLE 6 HERE>

<INSERT TABLE 7 HERE>

The t-tests of the accounting-based Z-score show that Islamic banks on average have significantly higher credit risks than conventional banks (Table 8). Similar to the results of the DD model, there is also large cross-country variation observed among the sample countries. As shown in Table 8, among the sample countries, Islamic banks in Bahrain, Bangladesh, Jordan, Kuwait, Lebanon, Palestine, Qatar have significantly higher credit risk than their conventional counterparts, Islamic banks in Brunei, Mauritania, Pakistan and Turkey have significantly lower credit risk. Furthermore, Islamic banks in the MENA have lower stability than conventional banks in these countries, but there is no significant difference in MENA countries between the two banking systems. Table 9 also compares the Z-scores for Islamic and conventional banks for each year. As shown, in most years, Islamic banks had significantly higher credit risk, but during the crisis period, Islamic banks had significantly lower Z-scores than conventional banks.

<INSERT TABLE 8 HERE>

<INSERT TABLE 9 HERE>

The third measure of credit risk used in this analysis is the NPL ratio. According to the results in Table 10, t-tests of the NPL ratio shows that average NPL ratio of Islamic banks is 8% and 9% for conventional banks, indicating that Islamic banks have lower credit risk. The NPL ratio is also significantly higher for Islamic banks in Brunei, Indonesia, Jordan and Kuwait, and for conventional banks in Malaysia, Pakistan, Qatar and Yemen. MENA countries do not show any significant difference in credit risk between these two banking systems, while non-MENA countries show higher credit risk for conventional banks than Islamic banks at the 5% significance level. However, a NPL ratio comparison by year reveals that Islamic banks have significantly lower credit risk than conventional banks in only 2008 and 2009. During the crisis period, the average NPL ratio for Islamic banks was 5% and 7% for conventional banks and the difference is statistically significant (Table 11).

<INSERT TABLE 10 HERE>

<INSERT TABLE 11 HERE>

5.3 Correlation analysis

Table 12 presents the pairwise correlation coefficients between the independent variables, for which we observe no strong correlation. As expected, there is a negative relationship between DD and NPL, Z-score and NPL, DD and DP, and Z-score and DP. Of the bank-specific variables, total assets have a positive and significant relationship with both DD and Z-score and a negative relationship with NPL and DP, indicating that an increase in asset lowers the credit risk. Both the growth of assets and the loan to asset ratio negatively correlate

with Z-score, NPL and DP, and positively correlate with DD. ROA positively correlates with both Z-score and DD and has very strong negative correlation with NPL and DP, suggesting that profitable banks have lower credit risk. Contrary to theory, there is a negative correlation between diversification and credit risk.

<INSERT TABLE 12 HERE>

5.4 Regression results

To compare the level of credit risk further between these two banking systems (Islamic and conventional), we estimate equation (12) using a GLS random effects model. We present the main empirical results based on the restricted sample in Table 13. The results in columns (1)–(3) correspond to the specification of distance-to-default (DD) as the dependent variable, columns (4)–(6) the probability of default (DP), columns (7)–(9) the Z-score and columns (10)–(12) the NPL. Columns (1), (4), (7) and (10) include only the bank-specific independent variables, (2),(5), (8) and (11) both bank-specific and macroeconomic variables, and columns (3), (6), (9) and (12) bank-specific, macroeconomic and some dummy variables, as explained earlier.

<INSERT TABLE 13 HERE>

The estimated coefficient for the Islamic bank dummy is significant where DD is the dependent variable, signifying that that DD is significantly higher for Islamic banks than for conventional banks. However, the default probability (DP) does not show any significant difference between Islamic and conventional banks in any of the regressions. Both accounting based credit risk measures show that Islamic banks have significantly higher credit risk. The Z-score is significantly negatively associated with the Islamic dummy in all regressions, even after controlling for both bank-specific and macro-specific variables. The other variable capturing the credit risk, namely, the NPL ratio, presents similar results to the Z-score. In all regressions (Table 13, columns 10–12), the NPL ratio is significantly negatively lower for Islamic banks.

These results largely confirm the findings of the Wilcoxon rank-sum test, where we found that credit risk was lower in Islamic banks when measured by the DD model, but higher when measured by the Z-score and NPL ratio. This clearly suggests that methodology plays a significant role in deciding which banking system has higher or lower credit risk. We find no evidence of a significant interaction between credit risk, the crisis period, and Islamic banks, as also in Beck et al. (2013) and Bourkhis and Nabi (2013). This finding plainly refutes the claim of the better performance of Islamic banks during the recent financial crisis at least as far as credit risk is concerned.

To identify further the differences in the level of credit risk between market- and accounting-based measures, we investigate the relevant components of each measure. In the case of DD, one of the important components is equity volatility. A t-test of equity volatility (results not shown) between Islamic and conventional banks indicates that Islamic banks have significantly lower volatility than conventional banks, and this serves to improve the DD score for Islamic banks. One of the plausible explanations for lower equity volatility in Islamic banks is that the listing of Islamic banks on stock markets is only a recent phenomenon (2005 onwards). This corresponded to a time when investors were looking for an alternative to conventional banks, subsequently justified by the global financial crisis. Islamic banks appeared as a safer alternative investment opportunity for investors.

To investigate further the reason for higher credit risk in Islamic banks when measured

by accounting-based credit risk measures, we consider the components of the Z-score, namely ROA, the equity to asset ratio, and the standard deviation of ROA. ROA does not show any significant difference between Islamic and conventional banks in the sample period. However, Islamic banks have significantly higher equity to asset ratios as well as higher standard deviations of ROA. This implies that the volatility of earnings in Islamic banks is higher, resulting in a lower Z-score. We speculate three reasons. First, Islamic banks have a relatively shorter history of operations than conventional banks, and thus lack the managerial skills needed in identifying and appropriate investment strategy; this may hinder the profitability growth of Islamic banks. Second, *Shariah* complexity in Islamic financial products may also create an obstacle to proper portfolio investment and diversification for Islamic banks. Third, the high earnings volatility could be because Islamic banks typically have large exposures to real estate and construction, industries that faced sharp declines in profitability in 2009 in many of the sample countries (Hasan and Dridi, 2010).

Our remaining measure of credit risk, the NPL ratio, also shows that Islamic banks have higher credit risk. We postulate that Islamic banks face a higher asymmetric information problem in choosing creditworthy partners especially in the case of *Mudarabah* and *Musharakah* financial contracts. These two products bear relatively higher credit risk compared to other Islamic financial products and most Islamic banks offer these risky products. Furthermore, we investigate the growth of the gross loan ratio between Islamic and conventional banks and find that the growth of gross loans is significantly higher for Islamic banks (40%) than conventional banks (25%). This indicates that Islamic banks may have relaxed their lending criteria in order to increase market shares, which attracted riskier borrowers on average to Islamic banks, thus causing the NPL ratio to increase. In addition, the inability to instigate legal action against the borrower in the case of 'honest' default raises a moral hazard problem among borrowers, and this may have caused the NPL ratio for Islamic banks to increase.

Among the control variables, some of the bank-specific and macroeconomic variables display a significant impact on credit risk. The log of total assets positively correlates with the DD and Z-score and negatively correlates with the probability of default and the NPL ratio. Consistent with our hypothesis as well as previous findings, this indicates that larger banks appear to have lower credit risk. One possibility is that large banks usually have the benefit of economies of scale, which helps them to better manage credit risk (Beck et al., 2013; Faye et al., 2013). The cost to income ratio has a negative relation with both DD and the Z-score and a positive relation with both DP and the NPL ratio. The loan to asset ratio positively correlates with DD and the Z-score and negatively correlates with both DP and the NPL ratio, suggesting that an increase in the loan to asset ratio lowers credit risk. This result is statistically significant for DP, the Z-score, and NPL, but not DD.

ROA consistently demonstrates a positive significant relationship with both DD and Z-score and a negative significant relationship with both DP and NPL. This is in line with our expectation that profitable banks have better risk management skills. Income diversification also exhibits a significant negative relationship with all of our measures of credit risk. This suggests that banks relying more on fees or commission will have higher credit risk. This could be due to a lack of experience in the nontraditional activities of banks. Čihák and Hesse (2010) also find evidence of a significant negative relationship between income diversification and Z-score. The growth of assets displays a mixed relationship with the credit risk measures, with a significant positive impact on Z-score and NPL and a significant negative relationship on NPL. This is a contradictory result, which deserves further investigation.

In all of the regression equations, GDP growth significantly and negatively correlates with credit risk. Inflation has a significant negative influence on DD and Z-score and a significant positive impact on DP and NPL. None of the regression estimates indicates any

significant impact of the quality of governance on credit risk. Lastly, bank concentration significantly lowers DD and Z-score, but does not have any significant impact on either DP or the NPL ratio.

Robustness check

To check the robustness of the results, we reestimate equation (12) using the restricted sample with OLS. Table 14 presents the results. We use the full sample to check the robustness of the results using both the random effects model and OLS estimation techniques. Tables 15 and 16 provide the respective results. The results obtained in Tables 14–16 are quite consistent with our main findings. Overall, we find the distance to default is higher for Islamic banks indicating that Islamic banks have a lower probability of default. In contrast, both the Z-score and NPL ratio exhibit higher credit risk for Islamic banks than for conventional banks. The control variables also show results quite consistent with our main empirical results. We again find no strong evidence that the credit risk of Islamic banks differed significantly more than conventional banks during the crisis period. Yet again in some of the regressions, we find evidence that Islamic banks in MENA countries have significantly higher DDs and lower Z-scores than conventional banks in those countries.

<INSERT TABLE 14 HERE>

To further check the robustness of our main results, we incorporate the effect of very recent political instability in the Middle East. Several countries among the sample countries have faced political turmoil that has adversely affected the stability of their banking systems. To investigate the effect of this, we created country-specific crisis dummy variables that take values of one if the country faced severe political instability, otherwise zero. We interact the Islamic dummy variable with the local crisis dummy to compare the level of credit risk between Islamic and conventional banks during this local crisis. Our earlier results hold when we control for the effect of a local crisis on credit risk. As reported in Table 17, Islamic banks on average exhibit lower Z-scores and higher NPL ratios than conventional banks. Conversely, DD is higher and DP is lower when we control for local crises.

<INSERT TABLE 15 HERE>

<INSERT TABLE 16 HERE>

<INSERT TABLE 17 HERE>

6. Conclusion

The objective of this paper was to investigate whether Islamic banks face higher credit risk than their conventional counterparts. While previous studies investigated the level of credit risk using only accounting-based measures, to the best of our knowledge, this is the first analysis that employs both market- and accounting-based credit risk measures to compare the credit risk of these alternative banking systems. The market-based credit risk measure used is Merton's distance to default model, based on Black-Scholes's option pricing model, while the two accounting-based measures are the Z-score and the NPL ratio. Depending on the measure, we apply these techniques to a large number of banks over no less than 13 countries over the period 2000–12. Our results provide evidence that it is difficult to draw a simple conclusion about whether Islamic banks have higher or lower credit risk than conventional banks. In

general, based on the DD model, we find that Islamic banks have lower credit risk than their counterparts. Conversely, Islamic banks have significantly lower Z-scores and higher NPLs than conventional banks, suggesting Islamic banks have higher credit risk. One significant contribution is that we clearly demonstrate that the method used for measuring credit risk plays an important role in the level of measured credit risk. Although market-based credit risk models have superior predictive ability, we do suggest that policymakers and regulators should employ both sets of measures in any system of prudential credit risk management.

In addition, we do not find any significant difference in credit risk between the two banking systems during the most recent financial crisis. This indicates both banking systems suffered almost equally and refutes the oft-repeated claim that Islamic banks performed better than conventional banks. We find similar results when we control for recent local crises in Middle Eastern countries. The findings of this research therefore assist regulators and policymakers considering the necessity of developing special regulations for Islamic banks. We also provide an international comparative analysis of credit risk, and as expected, identify significant cross-country variation in credit risk. Therefore, any policy and regulations regarding credit risk management are necessarily country specific. These findings also have implications for investors and depositors as they should not have any predetermined position regarding the level of credit risk in each banking system.

One of the limitations of using DD to measure credit risk is that the stock price may not fully reflect the value of the company when the market is illiquid. Some of the stock markets in this study are not fully efficient; hence, DD may not truly reflect the credit risk of both banking systems as it would certainly do in strongly efficient markets. However, Anginer and Demirguc-Kunt (2014) measure DD for 1,942 banks from 65 countries including most of those in this study. This motivates us to measure DD in these countries, even though their markets are comparatively weak.

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Table 1
Variable definitions and data sources

Variable	Description	Source
Distance to default component		
Volatility of equity	Annualized volatility of daily share price	DataStream
Market capitalization	Share price × number of shares outstanding	DataStream
Total liabilities	Short-term + half of long-term liabilities	Osiris Database
Risk-free rate	3/6-month Treasury rate	DataStream/Central bank/IMF
Value of assets	Market value of assets	Authors' calculations
Volatility of assets	Volatility of asset	Authors' calculations
Expected return on assets	Expected market return on assets	Authors' calculations
Z-score component		
Return on equity	Net profit/total asset	BankScope
Leverage	Equity/asset	BankScope
Nonperforming loans	Net impaired loans/gross loans	BankScope
Bank-specific variables		
Total Asset	Natural logarithm of total assets	Bankscope
Asset growth	Change in total assets	Bankscope
Cost to income	Total operating cost/total operating income	Bankscope
Loan to asset	Gross loan/ total assets	Bankscope
Diversification	Noninterest income/total operating income	Bankscope
Islamic	1= Islamic, 0= conventional	
Macroeconomic variables		
GDP	Growth rate of nominal GDP	World Bank
Inflation	Change in CPI	World Bank
Governance	Mean of measures in Kaufmann et.al (2005)	Worldwide Governance Indicators
Concentration	% share of assets of three-largest banks	World Development Indicators
MENA	1= if country in MENA, otherwise 0	
GFC	1= 2007–09, otherwise 0	

Table 2
Sample countries, banks, and observations

Country	No. of banks			No. of obs.		
	Islamic	Conv.	Total	Islamic	Conv.	Total
Bahrain*	15	15	30	139	136	275
Bangladesh*	7	29	36	87	366	453
Brunei	1	1	2	7	13	20
Egypt*	3	22	25	39	277	316
Indonesia*	9	57	66	47	596	643
Iran	13	–	13	167	–	167
Iraq	6	6	12	25	36	61
Jordan*	3	11	14	39	142	181
Kuwait*	8	6	14	72	67	139
Lebanon*	1	33	34	4	315	319
Malaysia*	17	22	39	123	275	398
Mauritania	1	8	9	13	71	84
Pakistan*	9	21	30	88	235	323
Palestine	2	2	4	14	18	32
Qatar*	3	7	10	32	73	105
Saudi Arabia*	5	8	13	52	104	156
Sudan	21	–	21	198	–	198
Syria	2	10	12	10	71	81
Turkey*	4	24	28	43	283	326
UAE*	9	16	25	83	198	281
Yemen	3	4	7	43	52	95
All	142	302	444	1325	3328	4653

Notes: * – included in DD and DP analysis

Table 3
Descriptive statistics

Variable	Islamic					Conventional						All				
	Obs.	Mean	Std. Dev.	Min.	Max.	Obs.	Mean	Std. Dev.	Min.	Max.	WRS	Obs.	Mean	Std. Dev.	Min.	Max.
Credit risk (restricted sample)																
Z-score	250	32.34	43.83	–59.49	288.30	1312	52.74	60.57	–3.00	390.55	0.00 ***	1562	49.48	58.68	–59.49	390.55
NPL	208	0.08	0.12	0.00	0.62	1211	0.07	0.08	0.00	0.62	0.04 **	1419	0.07	0.09	0.00	0.62
DD	269	2.72	5.27	–16.50	64.96	1381	1.91	3.81	–36.24	17.05	0.00 ***	1650	2.04	4.10	–36.24	64.96
DP	269	0.20	0.33	0.00	1.00	1381	0.25	0.36	0.00	1.00	0.02 **	1650	0.24	0.36	0.00	1.00
Credit risk (full sample)																
Z-score	1087	43.11	58.07	–59.49	380.84	3099	54.34	63.06	–20.60	392.00	0.00 ***	4186	51.43	61.99	–59.49	392.00
NPL	575	0.08	0.11	0.00	0.62	2559	0.09	0.10	0.00	0.62	0.07 *	3134	0.08	0.10	0.00	0.62
DD	269	2.72	5.27	–16.50	64.96	1381	1.91	3.81	–36.24	17.05	0.00 ***	1650	2.04	4.10	–36.24	64.96
DP	269	0.20	0.33	0.00	1.00	1381	0.25	0.36	0.00	1.00	0.02 ***	1650	0.24	0.36	0.00	1.00
Bank–specific																
Log total assets	1325	2.99	0.80	–0.70	4.90	3489	3.24	0.77	0.30	5.00	0.28	4814	3.17	0.79	–0.70	5.00
Asset growth	1170	0.34	0.58	–1.00	8.20	3236	0.21	0.37	–0.62	6.31	0.00 ***	4406	0.25	0.44	–1.00	8.20
Cost to income ratio	1249	0.64	0.67	0.02	9.50	3401	0.56	0.47	0.00	8.74	0.00 ***	4650	0.58	0.53	0.00	9.50
Loan to asset ratio	1240	0.50	0.23	0.01	1.00	3456	0.47	0.18	0.01	0.90	0.00 ***	4696	0.48	0.19	0.01	1.00
ROA	1116	0.02	0.06	–0.70	0.53	2960	0.02	0.03	–0.72	0.30	0.00 ***	4076	0.02	0.04	–0.72	0.53
Diversification	1263	0.41	0.54	–7.50	9.02	3421	0.35	0.38	–3.55	9.28	0.00 ***	4684	0.37	0.43	–7.50	9.28
Macroeconomic																
GDP	1325	0.05	0.04	–0.10	0.21	3489	0.05	0.03	–0.41	0.47		4814	0.05	0.03	–0.41	0.47
Inflation	1325	0.08	0.07	–0.10	0.54	3489	0.07	0.07	–0.10	0.55		4814	0.07	0.07	–0.10	0.55
Governance	1325	–0.52	0.71	–1.79	0.79	3489	–0.41	0.52	–1.93	0.79		4814	–0.44	0.58	–1.93	0.79
Concentration	1151	66.78	19.36	29.79	104.04	3468	58.34	17.58	29.79	103.00		4619	60.44	18.40	29.79	104.04

Notes: Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 4
DD by country

	Islamic					Conventional						
Country	Mean	SD	Min.	Max.	N	Mean	SD	Min.	Max.	N	t-stat.	
Bahrain	4.25	10.79	–2.11	64.96	36	4.56	3.09	0.03	14.11	42	0.17	
Bangladesh	1.23	3.15	–13.12	6.44	66	1.43	3.43	–27.06	8.48	236	0.43	
Egypt	–6.77	5.49	–16.50	1.19	10	1.01	3.16	–12.85	7.23	74	6.61	***
Indonesia	–	–	–	–	–	1.39	2.72	–12.96	9.31	235	–	
Jordan	3.70	2.56	0.04	10.03	14	3.27	2.75	–0.89	14.47	64	–0.53	
Kuwait	4.20	2.29	–0.84	8.44	25	3.98	1.95	–0.51	7.77	49	–0.42	
Lebanon	–	–	–	–	–	–0.73	6.11	–36.24	5.67	53	–	
Malaysia	–	–	–	–	–	4.70	3.18	–0.28	17.05	87	–	
Pakistan	1.71	2.07	–1.72	5.15	22	0.29	3.58	–16.27	6.11	160	–1.80	**
Qatar	5.02	2.57	0.43	7.76	23	3.74	2.33	–0.44	9.31	41	–2.02	**
Saudi Arabia	4.52	3.11	–1.29	11.58	29	4.57	2.54	–1.20	9.98	82	0.10	
Turkey	1.76	3.10	–3.76	5.11	13	–0.21	4.87	–28.33	6.54	141	–1.42	*
UAE	3.31	2.31	–2.50	6.76	31	3.33	2.97	–2.60	13.86	117	0.03	
MENA	4.16	5.59	–	–	158	3.29	3.61	–	–	448	–2.24	***
Non-MENA	0.66	3.97	–	–	111	1.24	3.79	–	–	933	1.54	*

Notes: Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 5
DD by year

	Islamic					Conventional						
Year	Mean	SD	Min.	Max.	N	Mean	SD	Min.	Max.	N	t -stat	
2000	–3.32	1.70	–4.52	–2.11	2	–1.56	5.14	–27.1	9.17	51	0.47	
2001	–0.16	3.92	–4.63	4.06	5	–1.34	5.51	–28.3	7.32	60	–0.46	
2002	–0.95	7.20	–13.12	5.29	5	–1.22	6.46	–36.2	8.25	65	–0.08	
2003	–0.93	7.23	–16.5	3.93	7	1.06	3.93	–11.5	9.1	67	1.16	
2004	4.42	3.88	–6.74	10.46	14	4.17	3.13	–3.26	14.11	95	–0.27	
2005	3.20	4.37	–11.58	9.52	20	2.54	3.18	–13	9.31	113	–0.80	
2006	4.06	12.54	–2.08	64.96	26	2.07	2.07	–3.79	8.03	121	–1.66	**
2007	4.30	3.09	–6.46	10.03	29	3.50	1.99	–3.48	11.25	131	–1.76	**
2008	0.16	2.40	–7.88	6.8	32	–0.02	2.63	–6.82	13.86	135	–0.35	
2009	2.79	2.30	–2.92	11.58	32	2.59	2.10	–4.23	9.26	134	–0.47	
2010	3.40	3.68	–8.99	9.99	33	3.54	3.11	–7.9	10.85	137	0.22	
2011	2.02	3.40	–10.74	7.14	32	1.24	3.37	–16.3	12.47	137	–1.17	
2012	3.86	2.82	–3.13	8.44	32	3.09	3.72	–10.1	17.05	135	–1.10	
GFC	2.35	3.09	–	–	93	2.00	2.70	–	–	400	–1.09	

Notes: Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 6
DP by country

	Islamic					Conventional						
Country	Mean	SD	Min.	Max.	N	Mean	SD	Min.	Max.	N	t -stat	
Bahrain	0.19	0.31	0.00	0.98	36	0.03	0.10	0.00	0.49	42	–3.12	***
Bangladesh	0.29	0.36	0.00	1.00	66	0.29	0.36	0.00	1.00	236	0.08	
Egypt	0.88	0.29	0.12	1.00	10	0.37	0.41	0.00	1.00	74	–3.80	***
Indonesia	–	–	–	–	–	0.28	0.35	0.00	1.00	235	–	
Jordan	0.06	0.15	0.00	0.48	14	0.08	0.18	0.00	0.81	64	0.33	
Kuwait	0.05	0.16	0.00	0.80	25	0.05	0.14	0.00	0.70	49	–0.13	
Lebanon	–	–	–	–	–	0.41	0.44	0.00	1.00	53	–	
Malaysia	–	–	–	–	–	0.05	0.14	0.00	0.61	87	–	
Pakistan	0.27	0.36	0.00	0.96	22	0.41	0.43	0.00	1.00	160	1.46	*
Qatar	0.04	0.09	0.00	0.33	23	0.05	0.13	0.00	0.67	41	0.52	
Saudi Arabia	0.09	0.22	0.00	0.90	29	0.07	0.19	0.00	0.89	82	–0.50	
Turkey	0.31	0.46	0.00	1.00	13	0.41	0.43	0.00	1.00	141	0.77	
UAE	0.12	0.26	0.00	0.99	31	0.12	0.26	0.00	1.00	117	0.14	
Total	0.20	0.33	0.00	1.00	269	0.25	0.36	0.00	1.00	1381	1.97	**
MENA	0.10	0.23	0.00	0.99	158	0.11	0.25	0.00	1.00	448	0.64	
Non-MENA	0.34	0.4	0.00	1	111	0.31	0.38	0.00	1.00	933	–0.79	

Notes: Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 7
DP by year

	Islamic					Conventional						
Year	Mean	SD	Min.	Max.	N	Mean	SD	Min.	Max.	N	t -stat	
2000	0.99	0.01	0.98	1.00	2	0.64	0.37	0.00	1.00	51	–1.32	*
2001	0.53	0.50	0.00	1.00	5	0.54	0.43	0.00	1.00	60	0.06	
2002	0.42	0.43	0.00	1.00	5	0.54	0.45	0.00	1.00	65	0.53	
2003	0.36	0.47	0.00	1.00	7	0.35	0.41	0.00	1.00	67	–0.10	
2004	0.08	0.27	0.00	1.00	14	0.09	0.22	0.00	1.00	95	0.15	
2005	0.15	0.30	0.00	1.00	20	0.15	0.30	0.00	1.00	113	0.04	
2006	0.20	0.27	0.00	0.98	26	0.17	0.25	0.00	1.00	121	–0.59	
2007	0.07	0.24	0.00	1.00	29	0.04	0.12	0.00	1.00	131	–0.89	
2008	0.45	0.36	0.00	1.00	32	0.51	0.39	0.00	1.00	135	0.84	
2009	0.09	0.22	0.00	1.00	32	0.12	0.25	0.00	1.00	134	0.79	
2010	0.17	0.35	0.00	1.00	33	0.10	0.24	0.00	1.00	137	–1.42	*
2011	0.22	0.32	0.00	1.00	32	0.31	0.36	0.00	1.00	137	1.15	
2012	0.11	0.26	0.00	1.00	32	0.19	0.32	0.00	1.00	135	1.42	*
GFC	0.20	0.33	–	–	93	0.22	0.34	–	–	400	–	

Notes: Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 8
Z-score by country

	Islamic					Conventional						
Country	Mean	SD	Min.	Max.	N	Mean	SD	Min.	Max.	N	t -stat	
Bahrain	36.65	58.25	–0.71	346.36	112	70.40	81.26	–0.96	389.99	110	3.56	***
Bangladesh	22.77	30.19	–59.49	149.86	82	39.05	54.90	–20.60	363.17	347	2.59	***
Brunei	79.66	22.31	57.49	104.60	5	15.97	11.51	3.62	39.95	13	–8.09	***
Egypt	46.21	68.61	–2.12	313.50	35	52.15	63.76	–6.59	392.00	259	0.51	
Indonesia	41.65	45.71	1.13	218.76	34	49.48	52.88	–3.00	372.39	537	0.84	
Iran	31.23	30.73	3.23	173.54	147	–	–	–	–	–	–	
Iraq	22.54	11.74	9.75	49.37	13	25.45	23.66	9.17	94.79	23	0.41	
Jordan	37.11	23.77	4.74	98.92	39	67.96	69.79	–14.63	390.55	137	2.71	***
Kuwait	31.34	43.20	0.04	260.09	61	56.31	64.54	–1.08	337.09	61	2.51	***
Lebanon	10.57	5.20	6.89	14.25	2	77.28	69.62	3.30	359.07	255	1.35	*
Malaysia	54.33	67.91	–2.29	362.39	89	60.41	59.77	0.38	336.02	262	0.80	
Mauritania	144.26	102.85	16.43	325.81	10	76.04	81.46	2.12	368.23	51	–2.31	***
Pakistan	51.53	69.49	0.92	336.71	65	39.86	55.08	–13.03	380.47	218	–1.40	*
Palestine	27.77	11.59	12.94	52.88	10	49.18	38.81	8.02	141.52	15	1.68	**
Qatar	50.19	62.36	6.24	253.57	29	71.17	75.04	0.87	349.91	66	1.31	*
Saudi Arabia	75.36	92.87	2.90	380.84	44	61.34	56.90	1.29	275.07	103	–1.12	
Sudan	38.10	47.16	–0.84	320.01	163	–	–	–	–	–	–	
Syria	35.56	47.47	7.23	119.66	5	38.95	45.81	3.81	246.69	48	0.15	
Turkey	56.85	63.03	2.48	278.86	35	41.90	55.65	–0.82	385.92	243	–1.46	*
UAE	61.85	83.25	1.38	356.23	69	69.42	76.65	4.95	382.41	176	0.67	
Yemen	49.34	64.27	8.28	336.94	38	50.63	63.84	6.71	293.87	44	0.09	
MENA	41.71	57.54	–0.71	380.83	569	65.00	69.81	–14.63	390.55	1169	6.89	***
Non-MENA	44.64	58.65	–59.49	362.39	518	47.88	57.64	–20.60	392.00	1930	1.12	

Notes: Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 9
Z-score by year

	Islamic					Conventional						
Year	Mean	SD	Min.	Max.	N	Mean	SD	Min.	Max.	N	t -stat	
2000	64.58	73.05	–2.23	260.09	40	46.12	57.66	–7.83	293.87	167	–1.72	**
2001	60.73	83.24	1.13	339.79	43	46.85	62.33	–3.23	353.32	181	–1.22	
2002	43.30	62.54	–4.54	342.75	52	51.62	58.73	–7.65	341.75	196	0.90	
2003	31.23	37.19	–4.03	221.06	59	55.47	67.96	–20.60	373.94	206	2.63	***
2004	47.97	77.05	–0.78	356.23	64	53.67	57.64	–3.44	373.26	208	0.64	
2005	42.04	66.60	0.46	380.84	73	48.22	60.41	–1.73	368.23	230	0.74	
2006	37.02	52.30	–59.49	313.50	76	52.63	70.60	–6.59	392.00	244	1.78	**
2007	43.58	56.80	–11.20	336.71	95	47.29	54.87	–3.26	367.25	245	0.55	
2008	46.21	65.83	–3.57	346.36	108	47.79	49.03	–2.51	340.35	270	0.26	
2009	32.62	46.44	–5.42	356.03	116	49.77	56.79	–5.66	385.92	281	2.88	***
2010	37.03	49.13	–13.29	362.39	124	57.76	59.25	–0.96	372.39	295	3.43	***
2011	46.64	47.06	–39.01	209.30	126	67.06	71.66	–0.52	389.99	293	2.94	***
2012	47.22	54.76	–40.13	278.86	111	72.16	77.55	–3.98	390.55	283	3.10	***
GFC	40.48	56.81	–	–	319	48.33	53.61	–	–	796	2.17	***

Notes: Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 10
NPL ratio by country

	Islamic					Conventional						
Country	Mean	SD	Min.	Max.	N	Mean	SD	Min.	Max.	N	t -stat	
Bahrain	0.07	0.09	0.00	0.36	28	0.06	0.06	0.00	0.40	97	–0.54	
Bangladesh	0.07	0.12	0.00	0.62	70	0.08	0.08	0.00	0.36	321	0.27	
Brunei	0.11	0.01	0.10	0.13	5	0.05	0.01	0.05	0.06	4	–8.54	***
Egypt	0.18	0.19	0.01	0.44	8	0.15	0.14	0.02	0.59	71	–0.66	
Indonesia	0.09	0.16	0.00	0.60	26	0.06	0.08	0.00	0.62	378	–2.09	**
Iran	0.06	0.04	0.00	0.14	24	–	–	–	–	–	–	
Jordan	0.24	0.24	0.01	0.62	22	0.11	0.10	0.00	0.55	136	–4.46	***
Kuwait	0.15	0.13	0.00	0.48	33	0.06	0.06	0.01	0.30	66	–4.70	***
Lebanon	–	–	–	–	–	0.14	0.12	0.00	0.60	263		
Malaysia	0.06	0.07	0.00	0.48	114	0.07	0.08	0.00	0.57	266	1.31	*
Mauritania	–	–	–	–	–	0.10	0.09	0.01	0.31	13		
Pakistan	0.11	0.10	0.00	0.40	49	0.13	0.11	0.00	0.59	223	1.36	*
Palestine	0.05	0.05	0.01	0.08	2	0.08	0.10	0.01	0.31	10	0.43	
Qatar	0.03	0.03	0.00	0.11	30	0.06	0.10	0.00	0.48	71	1.92	**
Saudi Arabia	0.04	0.06	0.00	0.27	41	0.03	0.03	0.00	0.21	104	–0.96	
Sudan	0.07	0.07	0.00	0.18	8	–	–	–	–	–	–	
Syria	0.07	0.01	0.06	0.08	3	0.05	0.07	0.00	0.30	32	–0.55	
Turkey	0.06	0.06	0.01	0.32	42	0.06	0.08	0.00	0.56	263	0.11	
UAE	0.06	0.08	0.00	0.33	49	0.07	0.06	0.01	0.28	182	0.26	
Yemen	0.07	0.07	0.00	0.27	21	0.32	0.15	0.06	0.61	35	7.07	***
MENA	0.07	0.10	–	–	322	0.07	0.09	–	–	1539	0.56	
Non-MENA	0.08	0.11	–	–	253	0.09	0.10	–	–	1020	1.73	**

Notes: Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 11
NPL ratio by year

	Islamic Bank					Conventional					
Year	Mean	SD	Min.	Max.	N	Mean	SD	Min.	Max.	N	t -stat
2000	0.16	0.20	0.00	0.61	18	0.13	0.12	0.00	0.53	152	–0.99
2001	0.15	0.17	0.01	0.6	21	0.13	0.13	0.00	0.62	158	–0.70
2002	0.11	0.11	0.00	0.4	19	0.13	0.11	0.00	0.57	161	0.61
2003	0.10	0.11	0.00	0.52	23	0.11	0.10	0.00	0.5	174	0.39
2004	0.09	0.13	0.00	0.62	26	0.08	0.09	0.00	0.6	181	–0.41
2005	0.06	0.10	0.00	0.51	30	0.07	0.09	0.00	0.59	193	0.45
2006	0.06	0.09	0.00	0.5	36	0.07	0.09	0.00	0.61	202	0.66
2007	0.05	0.08	0.00	0.48	45	0.06	0.07	0.00	0.44	211	0.51
2008	0.05	0.07	0.00	0.46	62	0.07	0.10	0.00	0.6	225	1.83 **
2009	0.06	0.07	0.00	0.39	74	0.09	0.10	0.00	0.59	203	1.74 **
2010	0.08	0.10	0.00	0.62	75	0.08	0.09	0.00	0.52	225	0.01
2011	0.09	0.12	0.00	0.57	77	0.07	0.09	0.00	0.57	239	–1.21
2012	0.08	0.12	0.00	0.61	69	0.07	0.09	0.00	0.54	235	–0.96
GFC	0.05	0.09	–	–	639	0.07	0.07	–	–	181	2.20 ***

Notes: Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 12
Correlation matrix

	DD	DP	Z-score	NPL	Ln(total assets)	Asset growth	Cost to income	Loan to asset	ROA	Divers-ification	GDP	Inflation	Governance	Concentration	MENA	Islamic	GFC
DD	1																
DP	–0.81*	1															
Z-score	0.12*	–0.12*	1														
NPL	–0.22*	0.21*	–0.13*	1													
Ln(total assets)	–0.02	0.03	0.01	–0.14*	1												
Asset growth	0.03	–0.04	–0.05*	–0.15*	–0.07*	1											
Cost to income	–0.24*	0.24*	–0.06*	0.26*	–0.03*	–0.03	1										
Loan to asset	0.24*	–0.23*	0.04	–0.38*	0.13	0.2*	–0.46*	1									
ROA	0.14*	–0.17*	–0.06	–0.22*	–0.07*	–0.04	–0.23*	0.11*	1								
Diversification	–0.04*	0.05*	–0.06	0.03*	–0.2*	0.12*	0.32*	0.04	0.08*	1							
GDP	0.14*	–0.15*	–0.02	–0.13*	–0.08	0.19*	–0.12*	0.25*	0.04*	0.13	1						
Inflation	–0.39*	0.37*	–0.11*	0.02	0.19*	0.02*	0.19*	–0.1*	–0.07*	–0.08	–0.04*	1					
Governance	0.3*	–0.28*	0.07	–0.13*	0.41*	–0.05*	–0.2*	0.26*	0.08*	–0.19*	0.11*	–0.25*	1				
Concentration	0.13*	–0.14*	–0.01	0.03*	0.14*	–0.14*	–0.08	0.1	–0.21*	–0.08*	0.15*	–0.1*	0.54*	1			
MENA	0.29*	–0.27*	0.14*	–0.09*	–0.01*	–0.09	–0.2*	0.26*	–0.1*	–0.08	0.1	–0.31*	0.62*	0.49*	1		
Islamic	0.07*	–0.07*	–0.05	0.08	–0.08*	0.1*	–0.01*	0.03*	0.13*	–0.05*	0.06	–0.04*	0.08*	0.07	0.16*	1	
GFC	0.00	–0.01*	–0.02	–0.08*	0.07	–0.01	–0.04	–0.02	0.11	–0.06	–0.16*	0.13*	0.08	–0.06*	0.08	0.07*	1

Notes: Asterisk denotes significance at the * – .05 level.

Table 13
Regression results GLS random effects (restricted sample)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent	DD	DD	DD	DP	DP	DP	Z-score	Z-score	Z-score	NPL	NPL	NPL
Islamic	1.805**	1.604*	0.986	–0.009	0.024	0.042	–0.188***	–0.183***	–0.266***	0.029**	0.027**	0.0286**
	(1.98)	(1.80)	(1.14)	(–0.30)	(0.90)	(1.34)	(–3.49)	(–3.38)	(–4.70)	(2.18)	(2.03)	(2.06)
Islamic × MENA	–	–	–0.235	–	–	–0.020	–	–	0.073	–	–	–0.003
	–	–	(–0.52)	–	–	(–0.43)	–	–	(1.22)	–	–	(–0.39)
Islamic × GFC	–	–	–0.235	–	–	–0.020	–	–	0.073	–	–	–0.003
	–	–	(–0.52)	–	–	(–0.43)	–	–	(1.22)	–	–	(–0.39)
Ln(total assets)	0.945***	0.564*	–0.132	–0.073***	–0.048***	–0.043**	0.126***	0.118***	0.016	–0.026***	–0.029***	–0.033***
	(3.18)	(1.81)	(–0.33)	(–4.36)	(–2.80)	(–2.41)	(4.68)	(3.92)	(0.51)	(–5.43)	(–5.36)	(–4.85)
Asset growth	0.443	0.238	0.347	–0.047	–0.042	–0.047	–0.238***	–0.278***	–0.247***	–0.049***	–0.046***	–0.043***
	(1.13)	(0.63)	(0.91)	(–1.22)	(–1.15)	(–1.27)	(–4.40)	(–5.16)	(–4.62)	(–6.95)	(–6.37)	(–5.96)
Cost to income	–1.149**	–0.370	–0.480	0.172***	0.080*	0.073*	–0.174**	–0.096	–0.123*	0.014	0.016*	0.011
	(–2.19)	(–0.73)	(–0.94)	(3.85)	(1.93)	(1.75)	(–2.35)	(–1.32)	(–1.69)	(1.57)	(1.75)	(1.22)
Loan to asset	1.520*	0.388	0.458	–0.321***	–0.270***	–0.283***	0.517***	0.369***	0.278**	–0.126***	–0.126***	–0.121***
	(1.70)	(0.43)	(0.50)	(–4.57)	(–3.85)	(–3.97)	(4.96)	(3.34)	(2.51)	(–7.31)	(–6.88)	(–6.57)
ROA	18.30***	20.040***	19.51***	–1.127*	–1.042*	–1.025*	2.172**	2.254**	2.508**	–1.018***	–0.969***	–1.007***
	(2.65)	(3.01)	(2.93)	(–1.92)	(–1.88)	(–1.86)	(2.17)	(2.25)	(2.55)	(–7.95)	(–7.53)	(–7.81)
Diversification	–0.197	–1.219**	–1.056*	0.010	0.105**	0.111**	–0.149**	–0.231***	–0.189***	0.027***	0.027***	0.033***
	(–0.35)	(–2.21)	(–1.89)	(0.21)	(2.22)	(2.33)	(–2.11)	(–3.28)	(–2.70)	(2.96)	(2.92)	(3.54)
GDP	–	5.754**	5.722*	–	–0.852***	–0.880***	–	1.008***	1.146***	–	–0.154***	–0.196***
	–	(2.01)	(1.96)	–	(–3.28)	(–3.37)	–	(2.78)	(3.16)	–	(–3.32)	(–4.14)
Inflation	–	–16.71***	–16.09***	–	1.691***	1.656***	–	–1.692***	–1.540***	–	–0.046*	–0.015
	–	(–10.92)	(–10.14)	–	(11.87)	(11.18)	–	(–7.51)	(–6.69)	–	(–1.83)	(–0.61)
Governance	–	0.353	0.035	–	–0.038	–0.015	–	–0.007	–0.013	–	0.006	0.017*
	–	(0.65)	(0.06)	–	(–1.43)	(–0.55)	–	(–0.16)	(–0.26)	–	(0.76)	(1.73)
Concentration	–	–0.018**	–0.024**	–	–0.000	–0.000	–	–0.003***	–0.003***	–	0.000	0.000
	–	(–2.02)	(–2.52)	–	(–1.08)	(–0.65)	–	(–3.03)	(–2.78)	–	(0.68)	(0.22)
MENA	–		2.170***	–	–	–0.055*	–	–	0.109**	–	–	–0.008
	–		(2.63)	–	–	(–1.88)	–	–	(1.98)	–	–	(–0.66)
GFC	–		–0.341	–	–	–0.009	–	–	–0.088***	–	–	–0.015***
	–		(–1.49)	–	–	(–0.40)	–	–	(–3.01)	–	–	(–4.07)
Constant	–1.752	2.614	4.239**	0.603***	0.451***	0.467***	0.940***	1.277***	1.520***	0.238***	0.252***	0.278***
	(–1.36)	(1.52)	(2.24)	(6.92)	(3.94)	(4.08)	(6.99)	(6.72)	(8.03)	(11.26)	(8.42)	(8.46)
N	1411	1411	1411	1411	1411	1411	1359	1359	1359	1236	1236	1236
R-squared	0.0707	0.1616	0.1644	0.0885	0.2030	0.2056	0.0865	0.1162	0.1596	0.2469	0.2587	0.2602
R-squared between	0.0368	0.1049	0.1287	0.1788	0.3955	0.4152	0.2092	0.2421	0.3069	0.2675	0.2690	0.2541

Notes: Figures in parentheses are t-statistics. Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 14
Regression results OLS (restricted sample)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent	DD	DD	DD	DP	DP	DP	Z-score	Z-score	Z-score	NPL	NPL	NPL
Islamic	–	–	0.558**	–	–	–0.039	–	–	0.064*	–	–	0.031***
	–	–	(1.96)	–	–	(–1.58)	–	–	(1.86)	–	–	(4.78)
Islamic × MENA	–	–	–0.199	–	–	–0.025	–	–	0.049	–	–	–0.006
	–	–	(–0.37)	–	–	(–0.53)	–	–	(0.73)	–	–	(–1.20)
Islamic × GFC	0.899***	0.505***	0.401**	–0.070***	–0.047***	–0.043***	0.038**	0.0238	–0.019	–0.016***	–0.021***	–0.013
	(5.81)	(2.94)	(2.25)	(–5.18)	(–3.16)	(–2.78)	(2.02)	(1.09)	(–0.87)	(–5.72)	(–6.02)	(–1.26)
Ln(total assets)	–0.022	0.049	0.162	–0.031	–0.041	–0.047	–0.239***	–0.257***	–0.224***	–0.059***	–0.055***	–0.020***
	(–0.05)	(0.12)	(0.38)	(–0.80)	(–1.12)	(–1.26)	(–4.16)	(–4.47)	(–3.96)	(–6.41)	(–5.83)	(–5.71)
Asset growth	–1.795***	–0.686	–0.672	0.182***	0.077**	0.071*	–0.335***	–0.241***	–0.263***	0.048***	0.049***	–0.055***
	(–3.85)	(–1.53)	(–1.49)	(4.47)	(1.98)	(1.82)	(–5.12)	(–3.67)	(–4.05)	(5.14)	(5.10)	(–5.85)
Cost to income	1.041	0.370	0.359	–0.286***	–0.275***	–0.281***	0.205**	0.128	0.030	–0.111***	–0.113***	0.047***
	(1.47)	(0.50)	(0.48)	(–4.61)	(–4.29)	(–4.27)	(2.35)	(1.35)	(0.33)	(–7.80)	(–7.14)	(4.85)
Loan to asset	23.33***	22.01***	21.90***	–1.260**	–1.134**	–1.116**	1.080	1.082	1.371	–0.979***	–0.980***	–0.112***
	(3.70)	(3.64)	(3.61)	(–2.28)	(–2.15)	(–2.11)	(1.20)	(1.20)	(1.54)	(–6.92)	(–6.76)	(–6.87)
ROA	0.444	–0.452	–0.410	0.010	0.102**	0.106**	–0.289***	–0.365***	–0.318***	0.014	0.017	–0.977***
	(0.82)	(–0.87)	(–0.78)	(0.23)	(2.26)	(2.32)	(–4.30)	(–5.45)	(–4.78)	(1.43)	(1.64)	(–6.71)
Diversification	–	6.188**	6.207**	–	–0.822***	–0.856***	–	0.928***	1.058***	–	–0.148***	0.019*
	–	(2.15)	(2.14)	–	(–3.28)	(–3.39)	–	(2.58)	(2.97)	–	(–2.69)	(1.86)
GDP	–	–18.75***	–17.54***	–	1.711***	1.667***	–	–1.615***	–1.413***	–	–0.047	–0.175***
	–	(–11.88)	(–10.56)	–	(12.44)	(11.50)	–	(–7.04)	(–5.99)	–	(–1.55)	(–3.14)
Inflation	–	0.837***	0.677**	–	–0.035	–0.020	–	0.032	0.016	–	0.008	–0.044
	–	(3.18)	(2.41)	–	(–1.55)	(–0.82)	–	(0.99)	(0.49)	–	(1.57)	(–1.38)
Governance	–	–0.000	–0.003	–	–0.001*	–0.000	–	–0.001**	–0.001**	–	0.000	0.011**
	–	(–0.04)	(–0.52)	–	(–1.68)	(–1.25)	–	(–2.05)	(–1.99)	–	(0.77)	(2.15)
Concentration	–	–	0.558**	–	–	–0.039	–	–	0.064*	–	–	0.000
	–	–	(1.96)	–	–	(–1.58)	–	–	(1.86)	–	–	(0.90)
MENA	–	–	–0.217	–	–	–0.008	–	–	–0.008	–	–	–0.006
	–	–	(–0.82)	–	–	(–0.36)	–	–	(–0.36)	–	–	(–1.20)
GFC	–1.277	1.590	1.619	0.569***	0.469***	0.481***	1.564***	1.812***	1.852***	0.183***	0.206***	–0.080***
	(–1.47)	(1.34)	(1.36)	(7.51)	(4.55)	(4.65)	(14.29)	(11.77)	(12.21)	(10.86)	(8.35)	(–3.38)
Constant	–1.277	1.590	1.619	0.569***	0.469***	0.481***	1.564***	1.812***	1.852***	0.183***	0.206***	0.211***
	(–1.47)	(1.34)	(1.36)	(7.51)	(4.55)	(4.65)	(14.29)	(11.77)	(12.21)	(10.86)	(8.35)	(8.56)
N	1411	1411	1411	1411	1411	1411	1343	1343	1343	1236	1236	1236
R-squared	0.086	0.196	0.200	0.089	0.203	0.206	0.094	0.136	0.173	0.265	0.275	0.282
Adj. R-squared	0.082	0.190		0.084	0.197		0.089	0.129		0.261	0.268	0.197

Notes: Figures in parentheses are t-statistics. Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 15
Regression results GLS random effects (full sample)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent	DD	DD	DD	DP	DP	DP	Z-score	Z-score	Z-score	NPL	NPL	NPL
Islamic	1.805**	1.604*	0.986	–0.009	0.024	0.042	–0.067**	–0.014	–0.023	0.013	0.008	0.014
	(1.98)	(1.80)	(1.14)	(–0.30)	(0.90)	(1.34)	(–2.14)	(–0.43)	(–0.64)	(1.57)	(0.93)	(1.60)
Islamic × MENA	–	–	3.530**	–	–	–0.007	–	–	–0.07	–	–	–0.22***
	–	–	(2.07)	–	–	(–0.35)	–	–	(–1.39)	–	–	(–3.27)
Islamic × Crisis	–	–	–0.235	–	–	–0.020	–	–	–0.020	–	–	–0.077*
	–	–	(–0.52)	–	–	(–0.43)	–	–	(–0.43)	–	–	(–1.96)
Ln(total assets)	0.945***	0.564*	0.132	–0.073***	–0.048***	–0.043**	–0.073***	–0.048***	–0.043**	0.078***	0.072***	0.000
	(3.18)	(1.81)	(0.33)	(–4.36)	(–2.80)	(–2.41)	(–4.36)	(–2.80)	(–2.41)	(4.77)	(3.97)	(0.04)
Asset growth	0.443	0.238	0.347	–0.047	–0.042	–0.047	–0.047	–0.042	–0.047	–0.155***	–0.170***	–0.152***
	(1.13)	(0.63)	(0.91)	(–1.22)	(–1.15)	(–1.27)	(–1.22)	(–1.15)	(–1.27)	(–6.94)	(–7.01)	(–6.35)
Cost to income	–1.149**	–0.370	–0.480	0.172***	0.080*	0.073*	0.172***	0.080*	0.073*	–0.196***	–0.184***	–0.197***
	(–2.19)	(–0.73)	(–0.94)	(3.85)	(1.93)	(1.75)	(3.85)	(1.93)	(1.75)	(–7.31)	(–6.83)	(–7.38)
Loan to asset	1.520*	0.388	0.458	–0.321***	–0.270***	–0.283***	–0.321***	–0.270***	–0.283***	0.214***	0.106*	0.104*
	(1.70)	(0.43)	(0.50)	(–4.57)	(–3.85)	(–3.97)	(–4.57)	(–3.85)	(–3.97)	(3.71)	(1.72)	(1.69)
ROA	18.30***	20.04***	19.51***	–1.127*	–1.042*	–1.025*	–1.127*	–1.042*	–1.025*	1.621***	1.871***	1.736***
	(2.65)	(3.01)	(2.93)	(–1.92)	(–1.88)	(–1.86)	(–1.92)	(–1.88)	(–1.86)	(3.79)	(4.34)	(4.07)
Diversification	–0.197	–1.219**	–1.056*	0.010	0.105**	0.111**	0.010	0.105**	0.111**	–0.112***	–0.135***	–0.123***
	(–0.35)	(–2.21)	(–1.89)	(0.21)	(2.22)	(2.33)	(0.21)	(2.22)	(2.33)	(–3.19)	(–3.65)	(–3.37)
GDP	–	5.754**	5.722*	–	–0.852***	–0.880***	–	–0.852***	–0.880***	–	–0.019	0.154
	–	(2.01)	(1.96)	–	(–3.28)	(–3.37)	–	(–3.28)	(–3.37)	–	(–0.08)	(0.65)
Inflation	–	–16.71***	–16.09***	–	1.691***	1.656***	–	1.691***	1.656***	–	–1.292***	–1.080***
	–	(–10.92)	(–10.14)	–	(11.87)	(11.18)	–	(11.87)	(11.18)	–	(–8.53)	(–7.02)
Governance	–	0.353	0.0357	–	–0.038	–0.015	–	–0.038	–0.015	–	–0.006	0.016
	–	(0.65)	(0.06)	–	(–1.43)	(–0.55)	–	(–1.43)	(–0.55)	–	(–0.25)	(0.57)
Concentration	–	–0.018**	–0.024**	–	–0.000	–0.000	–	–0.000	–0.000	–	–0.003***	–0.004***
	–	(–2.02)	(–2.52)	–	(–1.08)	(–0.65)	–	(–1.08)	(–0.65)	–	(–5.57)	(–6.10)
MENA	–	–	2.170***	–	–	–0.055*	–	–	–0.055*	–	–	0.136***
	–	–	(2.63)	–	–	(–1.88)	–	–	(–1.88)	–	–	(4.09)
GFC	–	–	–0.341	–	–	–0.009	–	–	–0.009	–	–	–0.089***
	–	–	(–1.49)	–	–	(–0.40)	–	–	(–0.40)	–	–	(–4.18)
Constant	–1.752	2.614	4.239**	0.603***	0.451***	0.467***	1.277***	1.645***	1.783***	0.286***	0.290***	0.265***
	(–1.36)	(1.52)	(2.24)	(6.92)	(3.94)	(4.08)	(19.82)	(17.67)	(19.10)	(22.06)	(15.86)	(13.75)
N	1411	1411	1411	1411	1411	1411	3294	3168	3168	2551	2525	2525
R-squared	0.071	0.162	0.163	0.083	0.203	0.202	0.082	0.118	0.152	0.223	0.233	0.251
R-squared between	0.033	0.106	0.144	0.178	0.392	0.423	0.139	0.125	0.171	0.247	0.242	0.262

Notes: Figures in parentheses are t-statistics. Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 16
Regression results OLS (full sample)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent	DD	DD	DD	DP	DP	DP	Z-score	Z-score	Z-score	NPL	NPL	NPL
Islamic	0.621**	0.214	0.145	–0.070***	–0.047***	–0.043***	–0.066***	–0.041**	–0.029	0.017***	0.014***	0.022***
	(2.23)	(0.81)	(0.44)	(–5.18)	(–3.16)	(–2.78)	(–3.42)	(–1.97)	(–1.23)	(4.03)	(3.14)	(4.22)
Islamic × MENA	–	–	1.51***	–	–	–0.012	–	–	–0.072	–	–	0.007
	–	–	(2.80)	–	–	(–0.59)	–	–	(–1.53)	–	–	(0.82)
Islamic × Crisis	–	–	–0.199	–	–	–0.025	–	–	–0.025	–	–	–0.021**
	–	–	(–0.37)	–	–	(–0.53)	–	–	(–0.53)	–	–	(–2.28)
Ln(total assets)	0.899***	0.505***	0.401**	–0.070***	–0.047***	–0.043***	–0.031	–0.041	–0.047	0.031***	0.014	–0.018***
	(5.81)	(2.94)	(2.25)	(–5.18)	(–3.16)	(–2.78)	(–0.80)	(–1.12)	(–1.26)	(2.77)	(1.18)	(–7.34)
Asset growth	–0.022	0.049	0.162	–0.031	–0.0419	–0.047	0.182***	0.077**	0.071*	–0.203***	–0.196***	–0.045***
	(–0.05)	(0.12)	(0.38)	(–0.80)	(–1.12)	(–1.26)	(4.47)	(1.98)	(1.82)	(–8.74)	(–7.68)	(–7.62)
Cost to income	–1.795***	–0.686	–0.672	0.182***	0.077**	0.071*	–0.286***	–0.275***	–0.281***	–0.274***	–0.250***	–0.000
	(–3.85)	(–1.53)	(–1.49)	(4.47)	(1.98)	(1.82)	(–4.61)	(–4.29)	(–4.27)	(–10.79)	(–9.81)	(–0.11)
Loan to asset	1.041	0.370	0.359	–0.286***	–0.275***	–0.281***	–1.260**	–1.134**	–1.116**	–0.032	–0.091*	–0.123***
	(1.47)	(0.50)	(0.48)	(–4.61)	(–4.29)	(–4.27)	(–2.28)	(–2.15)	(–2.11)	(–0.75)	(–1.95)	(–12.39)
Roa	23.33***	22.01***	21.90***	–1.260**	–1.134**	–1.116**	0.010	0.102**	0.106**	1.160***	1.391***	–1.122***
	(3.70)	(3.64)	(3.61)	(–2.28)	(–2.15)	(–2.11)	(0.23)	(2.26)	(2.32)	(2.85)	(3.38)	(–11.49)
Diversification	0.444	–0.452	–0.410	0.010	0.102**	0.106**	–0.015	0.022	0.040	–0.141***	–0.181***	0.020***
	(0.82)	(–0.87)	(–0.78)	(0.23)	(2.26)	(2.32)	(–0.65)	(0.99)	(1.42)	(–4.31)	(–5.24)	(2.80)
GDP	–	6.188**	6.207**	–	–0.822***	–0.856***	–	–0.822***	–0.856***	–	–0.047	–0.246***
	–	(2.15)	(2.14)	–	(–3.28)	(–3.39)	–	(–3.28)	(–3.39)	–	(–0.19)	(–5.10)
Inflation	–	–18.75***	–17.54***	–	1.711***	1.667***	–	1.711***	1.667***	–	–1.409***	0.056**
	–	(–11.88)	(–10.56)	–	(12.44)	(11.50)	–	(12.44)	(11.50)	–	(–9.37)	(2.15)
Governance	–	0.837***	0.677**	–	–0.035	–0.020	–	–0.035	–0.020	–	0.026	–0.007*
	–	(3.18)	(2.41)	–	(–1.55)	(–0.82)	–	(–1.55)	(–0.82)	–	(1.51)	(–1.91)
Concentration	–	–0.000	–0.003	–	–0.001*	–0.000	–	–0.001*	–0.000	–	–0.001**	0.000**
	–	(–0.04)	(–0.52)	–	(–1.68)	(–1.25)	–	(–1.68)	(–1.25)	–	(–2.20)	(2.29)
MENA	–	–	0.558**	–	–	–0.039	–	–	–0.039	–	–	0.018***
	–	–	(1.96)	–	–	(–1.58)	–	–	(–1.58)	–	–	(4.51)
GFC	–	–	–0.217	–	–	–0.008	–	–	–0.008	–	–	–0.007
	–	–	(–0.82)	–	–	(–0.36)	–	–	(–0.36)	–	–	(–1.56)
Constant	–1.277	1.590	1.619	0.569***	0.469***	0.481***	1.633***	1.876***	1.901***	0.241***	0.208***	0.214***
	(–1.47)	(1.34)	(1.36)	(7.51)	(4.55)	(4.65)	(33.48)	(27.23)	(27.85)	(24.42)	(15.27)	(15.76)
N	1411	1411	1411	1411	1411	1411	3294	3168	3168	2551	2525	2525
R-squared	0.086	0.196	0.200	0.089	0.203	0.206	0.106	0.140	0.161	0.236	0.250	0.265
Adj. R-squared	0.082	0.190	0.192	0.084	0.197	0.197	0.104	0.137	0.157	0.234	0.247	0.261

Notes: Figures in parentheses are t-statistics. Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 17
Regression results GLS random effects incorporating local crises (full sample)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent	DD	DD	DP	DP	Z-score	Z -score	NPL	NPL
Islamic	1.467	1.431	0.031	0.036	–0.095	–0.069	0.008	–0.040
	(1.05)	(1.03)	(0.87)	(1.02)	(–1.14)	(–0.80)	(0.01)	(–0.03)
Local Crisis	–0.870*	–1.069*	0.032	0.081	0.233*	0.422***	0.781	0.575
	(–1.69)	(–1.70)	(0.48)	(0.93)	(1.88)	(3.03)	(0.78)	(0.54)
Islamic × Local crisis	–	0.692	–	–0.165	–	–0.613**	–	0.974
		(0.69)		(–1.47)		(–2.43)		(0.35)
Ln(total assets)	0.051	0.0481	0.004	0.004	0.011	0.011	–1.025***	–1.027***
	(0.46)	(0.43)	(1.13)	(1.14)	(0.78)	(0.81)	(–4.35)	(–4.35)
Asset growth	0.001	0.001	–0.000	–0.000	–0.003***	–0.003***	–0.037***	–0.037***
	(0.51)	(0.51)	(–0.83)	(–0.83)	(–4.85)	(–4.86)	(–3.18)	(–3.18)
Cost to income	–0.000	–0.000	0.000	0.000	–0.004***	–0.004***	–0.001	–0.001
	(–0.01)	(–0.02)	(0.72)	(0.74)	(–5.44)	(–5.46)	(–0.10)	(–0.10)
Loan to asset	–0.007	–0.007	–0.002**	–0.002**	0.002	0.001	–0.214***	–0.214***
	(–0.49)	(–0.48)	(–2.21)	(–2.24)	(0.99)	(0.86)	(–5.38)	(–5.38)
ROA	0.287***	0.289***	–0.018**	–0.018**	0.034*	0.034*	–0.886***	–0.885***
	(2.82)	(2.82)	(–2.34)	(–2.37)	(1.91)	(1.95)	(–2.92)	(–2.92)
Diversification	–0.017***	–0.016***	0.001***	0.001***	–0.000	–0.000	0.032	0.032
	(–3.47)	(–3.45)	(3.34)	(3.28)	(–0.58)	(–0.57)	(1.14)	(1.14)
GDP	8.701***	8.659***	–0.934***	–0.927***	1.091*	1.120*	–23.07***	–23.16***
	(3.47)	(3.45)	(–3.97)	(–3.94)	(1.88)	(1.92)	(–3.65)	(–3.66)
Inflation	–16.42***	–16.41***	1.623***	1.623***	–2.627***	–2.625***	–0.162	–0.148
	(–6.04)	(–6.04)	(8.75)	(8.74)	(–5.09)	(–5.07)	(–0.04)	(–0.03)
Governance	0.703	0.716	–0.103***	–0.103***	0.069	0.074	1.088	1.085
	(1.16)	(1.19)	(–3.88)	(–3.87)	(0.98)	(1.05)	(1.03)	(1.03)
Concentration	–0.022*	–0.022*	0.000	0.000	–0.009***	–0.009***	–0.004	–0.004
	(–1.73)	(–1.73)	(0.59)	(0.54)	(–5.24)	(–5.27)	(–0.18)	(–0.19)
Constant	4.225*	4.252*	0.149	0.154	4.268***	4.272***	30.67***	30.70***
	(1.94)	(1.95)	(1.24)	(1.27)	(18.85)	(18.96)	(8.35)	(8.35)
R squared	0.16	0.16	0.2	0.2	0.08	0.08	0.16	0.16
R-squared between	0.13	0.13	0.37	0.36	0.09	0.09	0.15	0.15
N	1411	1411	1411	1411	3168	3168	2525	2525

Notes: Figures in parentheses are t-statistics. Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.