CREDIT RISK ANALYSIS IN ISLAMIC AND CONVENTIONAL BANKS IN REGULATED BANKING ENVIRONMENT

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Abstract:

This study examines the difference between the credit risk level of Islamic banks (IBs) and conventional banks (CBs) in Bahrain, Indonesia, Pakistan and UAE. We use market and accounting information-based models to analyze the results. Data was collected from the financial reports of 32 banks for the period from 2008 to 2015. Group mean comparison test and panel regression are applied for hypothesis testing. Based on Distance to Default (DD) and Probability of Default (PD) models, results show that credit risk is higher in CBs as compared to IBs. Conversely, CBs have significantly higher Z-scores, lower Altman Z-scores and NPLs than Islamic banks, which suggests that CBs have lower credit risk. However, the results show a mix impact of bank-specific variables on the credit risk for both IBs and CBs.

Key Words: *credit risk, Islamic vs conventional banks, financial risk management & regulated banking environment*

1. INTRODUCTION

The banks face different risks including liquidity, market, credit and operational risk (Allan & Powel, 2011). In order to eliminate/ reduce and manage these risks, Risk Management Departments (RMDs) play an important role. These departments possess expertise in different risks zone and they also enjoy resources for handling such risks. Specific requirements are followed for determining assets that can help in changing risk levels. Banks in business take a risk to make a satisfactory required return. The banks are trying to switch risks by detecting exposure of credit, controlling parties which perform below average and also by calculating the borrower's credit worthiness. The banks should manage limits and control risk of credit to distinct groups and counterparties. A standardized technique is adopted and used by banks for measuring credit risk controlling charge in accordance with Basel-II and Basel-III necessities. It depends upon the valuation of outdoor agencies of credit rating. Banks are in the process of continuous improvement and they are trying to improve the system in accordance with the necessities of the Basel framework.

Management of risk in banks is accomplished through a continuing process which includes four basic steps i.e. risk identification, its measurement, monitoring and then controlling risks.

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Credit risk management is an important factor which is ignored most of the time which results in default and bankruptcy. After the financial crises of 2008, its importance was observed in many sectors, including banking sectors. However, before 2007-2008, most of the policymakers, regulators, and supervisory bodies were attracted towards IBs all over the world. The basic aim was to grow and prosper. Unsurprisingly, different studies are carried out comparing the efficiency (Alam, & Hossain, 2014; Tai, 2014; Beck, Demirgüç-Kunt, & Merrouche, 2013; Johnes, Izzeldin, & Pappas, 2013; Abdul-Majid, Saal, & Battisti, 2010), profitability (Alkassim, 2005; Hassan & Bashir, 2003) and performance (Johnes et al., 2013; Ariss, 2010; Hasan & Dridi, 2010) of CBs and IBs. But after the financial crises of 2007-2008, the main focus was on comparative analysis of credit risk level of CBs as well as IBs. In this study, we also compared credit risk in both types of banks. In response, numerous studies have supposed comparative examination of CBs and IBs credit risk. Čihák and Hesse (2010) conducted a study on 19 international banking system for inspecting the fiscal stability of CBs and IBs from the period of 1993 to 2004. Following the study of Čihák and Hesse (2010), many researchers (Beck et al., 2013; Abedifar, Molyneux, & Tarazi, 2013) have also examined and compared the relative level of stability between both type of banking system in distinct periods and in different countries. Literature provides mix results about the stability of banking systems. Some studies report after comparing both banks that CBs are less stable, whereas some studies found no indication of variances in credit risk in different banking systems. It is also evident that whenever banking sample is taken, different results are observed for different countries over time.

Based on standard accounting information, different proxy measures have been used for credit risk. Some of these measures include capital-asset ratio, the standard deviation of return on assets, Z-score, loan loss reserve, loan loss provision, non-performing loans (NPL) ratio and distance to default (DD). They are using these standards for measuring risk at organization level can results in difficulties, particularly for IBs. Such as, accounting values and ratios based on past performance may not be useful in measuring future performances and outcomes. Similarly, the real value of assets can vary from past values. The reason behind is that the recording methods that are used are traditional and conservative (Altman & Saunders, 1997), and managing earnings is an easy task (Agarwal & Taffler, 2008; Bharath & Shumway, 2008). This is especially problematic in the developing world, where most dedicated IBs operate.

Previous studies show that credit risk is significantly low in IBs when DD is employed for calculating credit risk and high in the case when Z-score and NPL ratio calculate credit risk. Whereas, such opposing outcomes appear unclear. They highlight the need to identify the role of different measures of evaluating credit risk, especially when different systems of banks are compared to identify the safer one. This study addresses the continuing discussion between regulators. It discusses whether IBs should function under different regulation or should employ techniques of credit risk management that differs from the techniques used by CBs. The findings of this study may assist policy makers and financial regulators to consider the need for different regulation development for different banking systems. This study also provides credit risk investigation at an international level, and as anticipated, classifies significant cross-country difference. Thus, any regulations and policy about the management of credit risk are essential. These results also have suggestions for depositors and investors about the credit risk level in every banking system.

The purpose of this study is to evaluate mean differences among different banking systems of Bahrain, Indonesia, Pakistan and UAE by using different credit risk measures and to examine whether or not different proxy measures of credit risk have the same results for the different banking system. Furthermore, we inspect the impact of bank-specific variables on credit risk of both types of systems.

The remaining paper is distributed as follows: Section 2 provides a brief overview of past studies followed by the methodology presented in Section 3. Section 4 is about result which is followed by a conclusion and future research direction.

2. LITERATURE REVIEW

The possibility of the default to satisfying activities in time or at all, by the other party is known as credit risk. It is essential for banks to follow the standards of the Basel Committee whose aim is to supervise the banking system as it is very crucial to deal with different types of risks. Default risk shelters over 80% of the risk in middling banks' banking book assets portfolio; hence, it is 80% of bank failure. Credit risk is the foremost cause for bank failure. BCBS reports that weak controlling practices of credit risk and poor quality of credit are the main causes of bank failure and disasters. Defaults (by customers) can generate risks; thus, credit risk level undesirably influences the value of the firm and of its assets (Allan and Powel, 2011).

Operationally, a bank flops when its cash arrivals formal outlays of credits, sale of assets in place and mobilization of further funds fall short of its compulsory deposits' withdrawals, cash outflows, operating expenses, and meeting its debt. On the assets side; firstly, Islamic approaches of financing appears riskier because banks should not deal directly in merchandises and they must handle risky situations. IBs have satisfactory tools for risk management to avoid default. Moreover, profit loss sharing (PLS) modes financing Mudarabah and Musharaka are free from credit risk. The credit risk level does not depend upon the financing approaches used by banks; rather it depends upon the customer's choice and categories of choices they prepared. Even Mudarabah (which is widely used by IBs and is a "border-line tool) is not changed from the management of credit risk standpoint. Secondly, unlike CBs, the assets in IBs are diversified and they do not comprise loans. Assets are associated with changed parts of economics subdivisions; this provides to IBs a natural technique to diversify its risks. On the liability side, keeping in mind, investments accounts are accomplished through Mudarabah, CBs are extra leveraged than IBs. Fewer liabilities are due at maturity by the latter than by the former. IBs are vulnerable to the credit risk than CBs. Furthermore, investment protection reserves, pioneered by IBs of Jordan protect investment and capital deposits from any risk of loss containing default.

DD and PD are measuring tools for calculating credit risk in CBs and IBs (Allan and Powel, 2011). These methods have the benefit to be neutral to the specificity and size of every bank. PD directly depends on the quality of the assets on the maturity which frequently depends on credit risk level. Bad assets quality leads to bankruptcy and default; particularly in the segment of banking, because of higher leverage degree existing in it. This approach is advantageous for banks to identify risk level and the quality of their asset. Credit risk impacts directly as well as depositors and investment account holders. The reason behind is that banks do not honour the wish for the withdrawals at face assessment (Agarwal, 2008). It is beneficial for them to classify the credit risk they are subject to when they put their money in

the bank. In other words, it permits investment account holders to select their best couple (risk, return); permits account holders to the loss probability of their money.

Altman (1968) Z-score has led to the appeal of the contingent claims estimate method for forecasting business failure with the KMV model is being used in the financial sector. In literature, experimental tests of these methodologies are also missing, so the relative power is not clarified yet. Hillegeist et al. (2004) talked about this phenomenon but they failed to associate the market-based approaches with the models of Altman (1968) and Ohlson (1980) so this study suffers from misclassification issues (Begley et al., 1996). Additionally, they did not consider economic welfares of using these methodologies. Moreover, there is a need to compare them with commercial Zeta model (Altman et al., 1997) which is performing very well. Under Basel II, banks were not allowed to set their rating system for credit risks so there was a need to conduct a study in this regard as poor models for estimating risks can result in sub-optimal capital distribution.

Many theoretical models neither fulfil the required assumptions of stock returns normality nor can differentiate among changing the nature of the debt. These models also failed to identify the asset volatility and value (Saunders & Allen, 2006). Oderda et al. (2003) revealed that most of these models outperform credit ratings and by testing it through experiments, Hillegeist et al. (2004) also analyzed the same results. In comparison to these accounting information based models, market models are considered more structural. The Merton model is one of the examples that fulfil many of the required assumptions which accounting based models fail to fulfil. Campbell et al. (2006) found that if some variables are controlled, the predicting power of models based on the market becomes low.

Most of the studies used accounting-based techniques for analyzing the level of risk. To start with, Čihák and Hesse (2010) conducted a study using Z-score in CBs and IBs by categorizing the banks based on their size. Their findings revealed that small IBs are inclined to be further business-wise constant than small CBs, enormous CBs were better in handling risks than enormous IBs, and unexpectedly, small IBs were having strong financial position than large IBs. The results revealed that with the growth of IBs, managing risks become problematic. These researchers further state that monitoring systems of credit risk in IBs became more complex, especially when it functions on a large scale. Afterwards, Beck et al. (2013) examined the business coordination, efficiency, competence, and constancy of IBs and CBs and then compared both banking systems, the mean Z-score value shows that risks are significantly low in IBs. However, by controlling a number of factors, there is no significant difference between both systems. These researchers used NPLs ratio and reported that NPLs of IBs are consistently low, suggested that credit risk in IBs is low. Abedifar et al. (2013) examined the insolvency and credit risk of 53 banks of different countries from the period of 1999 and 2009 and employed three distinct ratios of accounting to measure credit and insolvency risk. Likewise, Čihák and Hesse (2010) examined the consistency and reported that small IBs are more constant.

Some of the studies inclined focused on a specific region to investigate this issue. Such as, Faye, Triki, and Kangoye (2013) paralleled the business coordination, output and constancy in Africa, from 11 IBs and 279 CBs from 45 African countries. The results showed that for IBs NPL ratio is low but the value of Z is greater. Rajhi and Hassairi (2014) find that high Z value for IBs means they are less robust for macroeconomic and bank-specific factors. Generally, it can be said that IBs are constant than CBs if large and less constant if small.

Gamaginta and Rokhim (2011) investigated the risk of 72 CBs and 12 IBs in Indonesia and observed that IBs are less constant. Furthermore, they reported that constancy of small IBs is similar as of small CBs, and like, Čihák and Hesse (2010) small IBs are more constant than large IBs.

We find only two studies that examined the reliability of CBs and IBs during the financial crisis period. Bourkhis and Nabi (2013) examined the constancy during the crisis by using Z-scores, but no significant differences were observed. Similar results were also observed in Beck et al. (2013). Finally, there was a single study using Merton's DD, concluding that IBs have comparatively low credit risk as well as low PD (Boumediene, 2010). The following hypotheses are developed based on the above literature:

H_1: There is a significant mean difference in the Islamic banks (IBs) and conventional banks (CBs).
H_2: There is a significant difference in different methodologies of measuring credit risk for IBs and CBs.
H_3: There is a significant impact of bank-specific variables (profitability, banks size, growth and loan to total assets) on credit risk of IBs and CBs.

3. METHODOLOGY

This study utilizes descriptive and causal research approach. Descriptive research is used to obtain information relating to the existing position of an issue or phenomenon to describe "what exists" within the variables or circumstances of the condition. Causal research is used for the investigation of cause-and-effect relationships. The data of four IBs and four CBs banks are collected from four different countries Bahrain, Indonesia, Pakistan and UAE and the secondary data was gathered of 8 years from 2008 to 2015. The banks are selected randomly and mostly out of financially performing ones. The data is taken from different stock exchanges as well as banks financial data. The macro-level data is obtained from DataStream and World Bank.

Accounting based method discussed in this study is commonly implemented by many organizations internally to manage the credit risk at the project level and firm level. From the last many years probably consisted of one and half decade has observed the expansion of a range of measurement techniques of credit risk which include accounting and market-based approaches. The accounting approaches include Altman's Z-score, the credit risk Z-score, Moody's RiskCalc and NPL analysis. Beaver (1966), Ohlson (1980) used 8 ratios, and Zmijewski (1984) used three ratios. Mostly, credit risk is measured by using approaches based on market and these approaches include Merton's PD (based on Black Scholes Model), Value at Risk (VaR), and Credit Metrics. In this study, following credit risk measures are used:

- **Z-Score:**

In most of the studies, the z-score is used as a major assessment of firm risk. Z-Score used the historic accounting data from accounting statements of banks. It takes into account the three most significant elements of the financial statement and in this way it is considered a better approach to evaluate the bank's stability. The formula for Z-Score is

$$Z = (k + \mu)/\sigma$$

Where;

- k is equity capital and reserves
- μ is average net income as a percent of total assets and
- σ is the standard deviation of ROA used as a proxy of volatility return.

A higher value of z-score means that default risk is low and if it is low, default risk is assumed to be high. Whereas, higher volatility of return specifies that income of the bank is lower than its mean and this instability of a bank's income from its mean which results in decrease value of z-score.

- **Altman's Z-Score:**

The Altman Z-Score is derived for computing the chances of bankruptcy in the near future. It consists of five ratios. Accounting data is used for calculating these ratios. The formula for Altman Z-score is as follows:

$$Z - Score = 1.2A + 1.4B + 3.3C + 0.6D + 1.0E$$

Where:

- $A =$ Ratio of working capital to total assets
- $B =$ Ratio of retained earnings capital to total assets
- $C =$ Ratio of earnings before interest and tax to total assets
- $D =$ Ratio of market value of equity to total liabilities
- $E =$ Ratio of sales to total assets

If the score is less than 1.8 chances of bankruptcy are more, score greater than 1.8 but less than 3.0 is inclusive and if the score is more than 3.0, there are no chances of bankruptcy. In short, there is an inverse relationship between the value of score and chances of bankruptcy.

- **Non-Performing Loans (NPL) Ratio:**

If costs (principal cost and interests) are not paid for 90 days or more or delayed payments for at least 90 days. In order to calculate the credit risk simple NPL ratio formula was used in different studies (Ahmad & Ariff, 2007; Berger & DeYoung, 1997; Das & Ghosh, 2007; Fiordelisi, Marques-Ibanez, & Molyneux, 2011). In this study, it is calculated as follows:

$$NPL\ Ratio = Total\ amount\ of\ doubtful\ loans\ /\ Net\ amount\ of\ loans$$

The lower ratio shows that there are very less chances of default/ bankruptcy. NPL ratio is mostly used ratio for credit risk as it is the simplest way to measure the bank's solvency and there are very chances for managers to manipulate this ratio.

- **Distance to Default (DD) and Probability of Default (PD)**

In recent years, practical understanding of Merton's model has acknowledged significant attention. One of them is KMV model which in reality is a tailored description of the Merton's concept. It can be changed from the original model by adding a few aspects. As per the previous argument, the terminal value of the asset is the same as a nominal value. KMV Corporation perceives that the probability of default is high if asset's value reaches the value of total debts or short-term debt value. So, using this measure alone is not useful, so the additional step was implemented to this threshold by KMV Corporation which is known as a default point. The KMV-Merton model estimates the market value of debt by applying the Merton (1974) bond pricing model. Two main assumptions of the Merton model are:

1. Total firm value is assumed to follow geometric Brownian motion, because of the demand and supply forces.

$$dV = \mu V\, dt + \sigma_V\, V\, dW \qquad (1)$$

Where,

- V is firm value,
- μ is the expected continuously compounded return on V,
- σ_V is the volatility of firm value and
- dW is a standard Weiner process.

2. The firm has issued just one 'discount bond' maturing in period T.

Under these two assumptions, a firm's equity is a call option on the underlying firm value with a strike price equal to the face value of the firm's debt and of maturity T. Moreover, the 'value of equity' as a function of the total value of the firm can be solved by the Black-Scholes-Merton Formula i.e.

$$E = V\, N\,(d1) - e^{-rT}\, FN\,(d2) \qquad (2)$$

Where,

- E is the market value of Equity
- F is the face value of the firm's debt,
- r is the instantaneous risk-free rate,
- $N(\cdot)$ is the cumulative standard normal distribution function.

$$d1 = \frac{ln(V/F) + (r + 0.5\sigma 2\, V)T}{\sigma V \sqrt{T}} \qquad (3)$$

And d2 is calculated as

$$d2 = d1 - \sigma V \sqrt{T} \qquad (3a)$$

The Merton model makes use of two important equations. The first is the Black-Scholes Merton equation (2), expressing the value of a firm's equity as a function of the firm value but in this study, the market value of equity is estimated by multiplying number of shares with the closing share price then the value is substituted in equation (2) to calculate the firm's assets value. The second relates the volatility of the firm's value to the volatility of its equity. Under Merton's assumptions the value of equity is a function of the value of the firm and time, so

$$\sigma_E = \left(\frac{V}{E}\right) \frac{\partial E}{\partial V} \sigma_V \qquad (4)$$

In the Black-Scholes-Merton model, it can be shown that $\frac{\partial E}{\partial V} = N(d1)$, so that under the Merton model's assumptions, the volatilities of the firm and its equity are related by

$$\sigma_E = \left(\frac{V}{E}\right) N(d1)\, \sigma_V . \qquad (5)$$

Where d1 is calculated using equation 3.

Now to calculate the distance to default equation (2) and (5) are used side by side to get the result.

Parameter's Estimation

The parameters of KMV model and equations are calculated by using MS Excel to solve the above equation simultaneously, to work out the market value of a firm's assets and volatility of assets as these two things are necessary to calculate the DD. We calculate the market value of the firm's assets and volatility of assets because both these two values can't be calculated or obtained from the market data with accuracy. As the volatility of assets needs a day to day interaction with the market to assess its true value. This study followed the accounting assumption of going concern; this study could not estimate the market worth of the firm's assets with approximation. So, we rely on two equations to iterate the worth of a firm's assets and price of the volatility of equity with reasonable approximation. After the calculation of all parameter used in the above equations, then we can find the exact distance to default figure.

The formula for calculating the return is as follows:

$$Ri = ln(prt - prt-1)$$

The formula for calculating the volatility of equity is mentioned below:

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

Where, n is the number of days of trading, which is approximately equal to 253.

The market value of the equity is found by multiplying the number of shares issued by the closing stock price of a particular date. The risk-free rate (r) is the yield on a Treasury bond. Generally, calculating exact maturity of the liabilities for each firm is not easy, so it is assumed that maturity will be one year i.e. *T=1*. Similarly,

liability is assumed to be equal to total liabilities. Data were calculated form annual reports. We use the above-mentioned equations to calculate the volatility of the asset by using MS Excel. After calculating all parameters, Distance to Default (DD) using the d2 formula mentioned above is calculated. After that, Implied Default Probability (IDP) or DP is calculated using the normal distribution.

Furthermore, we determine the impact of different variables on credit risk in the following equation:

$$(CR)_{i,t} = \alpha + \beta_1 (Size)_{i,t} + \beta_2 (LNT)_{i,t} + \beta_3 (GRW)_{i,t} + \beta_4 (ROA)_{i,t} \quad (6)$$

Where the dependent variable is the Credit Risk (CR) (Z-score, Altman Z-Score, NPL, DD and PD) for bank i in country j at time t and independent variable is bank-specific variables, (banks size is a natural log of the total assets, LNT is the loan to total assets ratio, GRW is a growth of total assets and ROA is the return on assets).

Literature shows that bank size impacts significantly on risk factors (Čihák & Hesse, 2010; Bourkhis & Nabi, 2013; Abedifar et al., 2013) The risks are more diversified in case of larger banks as they have more expertise, experience and networks to handle risks. Bourkhis and Nabi (2013) reported that loan to assets ratio also shows that banks are more stable. Asset growth also safe firms from moral hazards. Abedifar et al. (2013) find the asset growth and credit risk are inversely related. The model also comprises ROA as a profitability measure, if the profitability of banks' increases, then credit risk should be lower. We use panel regression for hypotheses testing. Furthermore, the differences across countries might affect the dependent variable credit risk which is also a reason to use the common/fixed/random effect model.

4. Results

Table 1: Group Mean Comparison Test

Z-score							
	Islamic banks			**Conventional Banks**			**T-Test**
Countries	**Obs.**	**Mean**	**St. Dev.**	**Obs.**	**Mean**	**St. Dev.**	
Bahrain	32	18.47	7.61	32	66.55	51.31	-4.42096**
Indonesia	32	52.53	113.26	32	113.74	69.30	-2.43906**
Pakistan	32	22.62	20.98	32	35.86	17.76	-2.54878**
UAE	32	130.12	121.63	32	102.45	80.79	0.903524
Altman Z-score							
	Islamic banks			**Conventional Banks**			**T-Test**
Countries	**Obs.**	**Mean**	**St. Dev.**	**Obs.**	**Mean**	**St. Dev.**	
Bahrain	32	5.52	3.24	32	1.21	1.42	6.463052**
Indonesia	32	0.39	0.27	32	0.15	0.12	4.40102**
Pakistan	32	0.38	0.61	32	0.36	0.17	0.164877
UAE	32	2.05	2.01	32	0.53	0.29	3.442674**
Non-Performing Loans (NPL) Ratio							
	Islamic banks			**Conventional Banks**			**T-Test**
Countries	**Obs.**	**Mean**	**St. Dev.**	**Obs.**	**Mean**	**St. Dev.**	
Bahrain	32	3.16%	0.04	32	1.38%	0.03	1.946375
Indonesia	32	0.67%	0.01	32	-0.05%	0.00	5.928925**

Pakistan	32	-0.48%	0.02	32	1.17%	0.01	-3.18132**
UAE	32	1.37%	0.01	32	1.38%	0.01	-0.04558
Distance to Default (DD)							
	Islamic banks			**Conventional Banks**			**T-Test**
Countries	**Obs.**	**Mean**	**St. Dev.**	**Obs.**	**Mean**	**St. Dev.**	
Bahrain	32	2.91	0.76	32	2.11	0.76	3.962469**
Indonesia	32	2.49	0.17	32	1.69	0.17	17.55325**
Pakistan	32	1.80	0.18	32	1.49	0.19	6.343557**
UAE	32	1.24	0.01	32	1.00	0.18	2.028643**
Probability of Default (PD)							
	Islamic banks			**Conventional Banks**			**T-Test**
Countries	**Obs.**	**Mean**	**St. Dev.**	**Obs.**	**Mean**	**St. Dev.**	
Bahrain	32	0.35%	0.22%	32	2.75%	1.41%	-8.88286**
Indonesia	32	0.70%	0.31%	32	4.78%	1.58%	-13.4143**
Pakistan	32	3.81%	1.49%	32	7.13%	0.02%	-6.18052**
UAE	32	13.08%	14.88%	32	16.23%	4.39%	-0.93886

This study compares the group mean of credit risk measures, namely, Z-score, Altman Z-score, Non-Performing Loans (NPL) Ratio, Distance to Default (DD) and Probability of Default (PD) for the CBs and IBs of four countries. The above table results show that significant difference exists in the Z-Score mean values of IBs and CBs in Bahrain, Indonesia and Pakistan but in UAE there is the insignificant mean difference between the Z-Score of both banking systems. The Z-Score means of CBs are greater than IBs in Bahrain, Indonesia and Pakistan but in UAE the mean value of IBs is greater than CBs. The Altman Z-Score there is a significant mean difference in IBs in Bahrain, Indonesia and UAE but insignificant in Pakistan. The Altman Z-Score means of IBs are greater as compared to CBs in all four countries, Bahrain, Indonesia, Pakistan and UAE. The result of NPL ratio shows that there is a significant mean difference in both banking systems in Indonesia and Pakistan but insignificant in Bahrain and UAE. The NPL ratio means of IBs are greater as compare to CBs in Bahrain and Indonesia but in Pakistan and UAE the mean values of CBs are greater as compared to IBs. The result of DD shows that there is a significant mean difference in IBs and CBs in all four countries. The DD means of IBs are greater as compared to CBs in all four countries. The PD shows that there is a significant mean difference in IBs and CBs in Bahrain, Indonesia and Pakistan but insignificant in UAE and the means of CBs are greater as compared to IBs in our sample.

Table 2: Results of Panel Least Squares

Dependent Variable	Variables	Bahrain	Indonesia	Pakistan	UAE
Z-Score (Islamic Banks)	*LTA*	24.2459	-233.663	-19.1875	-991.1843
		(2.578)**	(-1.2797)	(-0.3624)	(-3.9642)***
	LNT	3.5244	-61.1066	-3.7656	-136.7093
		(2.384)**	(-1.6171)	(-0.4913)	(-8.1213)***
	GRW	-1.9909	3.8568	8.5013	-55.2527
		(-0.61)	(0.0369)	(0.4516)	(-0.6278)
	ROA	39.4568	8764.742	769.3189	220.9975
		(2.722)**	(1.5468)	(1.1907)	(0.1707)
	C	0.6438	1329.594	95.9012	3587.560
		(11.58)***	(1.8276)*	(0.6376)	(9.6403)***
	R^2	0.670	0.183	0.089	0.855
	F-stat	10.390**	1.296	0.565	23.690***
	P-value of Likelihood Test	0.2220	0.9464	0.1490	0.1105

	P-value of Hausman Test	---	---	----	---
Z-Score (Conventional Banks)	*LTA*	72.745	240.996	-89.1006	-456.8142
		(0.84)	(-1.6978)*	(-2.5934)**	(-3.0907)***
	LNT	-0.0265	30.7509	-24.7271	76.4778
		(-0.01)	(2.0074)**	(-3.5946)***	(5.3285)***
	GRW	25.354	12.3001	-27.3129	-365.4903
		(0.25)	(0.1634)	(-0.9012)	(-1.7580)*
	ROA	505.84	-17205.91	1337.961	10306.88
		(03441)	(-2.837)***	(5.0425)***	(3.7416)***
	C	23.023	-204.1065	555.8153	-1441.641
		(0.2297)	(-0.6726)	(3.7802)***	(-4.9087)***
	R^2	0085	0.494	0.551	0.739
	F-stat	0.536	5.627***	7.060***	4.834***
	P-value of Likelihood Test	0.6120	0.9681	0.1543	0.0206
	P-value of Hausman Test	----	---	----	0.004
Altman Z-Score (Islamic Banks)	*LTA*	-1.3208	-4.1316	-1.1966	-4.2342
		(-0.3541)	(-0.4511)	(-0.9970)	(-0.6635)
	LNT	-2.3918	0.2898	-0.1336	-2.6564
		(-3.929)***	(4.809)***	(-0.7691)	(-7.9915)***
	GRW	0.9972	-0.3464	-0.3493	0.5787
		(0.7399)	(-2.0761)**	(-0.8183)	(0.2601)
	ROA	-28.1716	-10.8713	-22.2294	-64.2695
		(-1.2532)	(-1.2030)	(-1.5177)	(-1.9542)*
	C	52.3872	-5.0744	3.3652	60.7179
		(4.3318)***	(4.374)**	(0.9870)	(11.3225)***
	R^2	0.410	0.625	0.439	0.946
	F-stat	4.008**	9.614***	4.510***	17.604***
	P-value of Likelihood Test	0.0570	0.2950	0.7921	0.0027
	P-value of Hausman Test	---	---	----	0.000
Altman Z-Score (Conventional Banks)	*LTA*	-1.2547	0.0752	-0.1650	0.5685
		(-0.7964)	(0.4120)	(-2.9559)***	(1.3785)
	LNT	-0.2343	0.0552	-0.7746	-0.1624
		(-3.811)***	(2.8058)**	(-2.7782)**	(-4.0549)***
	GRW	0.1317	0.0310	13.6438	-0.7339
		(0.0720)	(0.3202)	(6.3362)***	(-1.2651)
	ROA	-52.8583	25.0727	-0.3084	5.0668
		(-1.9767)	(3.217)***	(-1.2539)	(0.6592)
	C	7.4218	-1.3711	3.8457	3.8469
		(4.0701)***	(-3.515)***	(3.2229)***	(4.6946)***
	R^2	0.602	0.721	0.662	0.847
	F-stat	8.703***	14.88***	11.281***	9.479***
	P-value of Likelihood Test	0.3195	0.0504	0.4728	0.000
	P-value of Hausman Test	---	---	----	0.000
Non-Performing Loans (NPL) Ratio (Islamic Banks)	*LTA*	-0.1578	-0.0038	-0.0400	0.0813
		(-4.933)***	(-0.4102)	(-1.0810)	(2.8773)**
	LNT	-0.0175	-0.0006	-0.0116	0.0030
		(-3.488)***	(-0.2957)	(-2.1625)**	(1.6019)
	GRW	0.0076	0.0069	0.0183	0.0226
		(0.6859)	(1.2949)	(1.3935)	(2.2718)**
	ROA	-0.7972	-0.3757	2.4089	-0.2957
		(-4.292)***	(-1.3070)	(5.3341)***	(-2.0209)*
	C	0.4345	0.0208	0.2146	-0.0991
		(4.3522)***	(0.5627)	(2.0414)*	(-2.3569)**
	R^2	0.657	0.217	0.672	0.532
	F-stat	11.02***	1.594	11.784***	4.565**
	P-value of Likelihood Test	0.8501	0.8297	0.2862	0.4262
	P-value of Hausman Test	---	---	----	----

Non-Performing Loans (NPL) Ratio (Conventional Banks)	*LTA*	-0.1450 (-4.684)***	0.0056 (0.8379)	0.0518 (1.8609)*	0.0662 (5.4504)***
	LNT	-0.0063 (-5.185)***	0.0001 (0.1799)	0.0024 (0.4269)	-0.0046 (-4.1715)***
	GRW	0.0311 (0.8671)	-0.0026 (-0.7496)	0.0249 (1.0142)	0.0208 (2.1485)**
	ROA	-0.9483 (-1.8044)*	0.4392 (1.5460)	-0.6446 (-3.0001)***	-0.9924 (-5.0283)***
	C	0.2266 (6.3225)***	-0.0113 (-0.7924)	-0.0514 (-0.4317)	0.0912 (3.8177)***
	R^2	0.723	0.312	0.430	0.613
	F-stat	15.080***	2.615*	4.351***	9.117***
	P-value of Likelihood Test	0.4749	0.7994	0.8554	0.2101
	P-value of Hausman Test	---	---	----	----
Distance to Default (DD) (Islamic Banks)	*LTA*	-0.5287 (-1.3446)	-0.1710 (-3.3697)***	-0.4000 (-1.9093)*	-0.0936 (-0.6090)
	LNT	1.36267 (1.3572)	-0.1498 (-0.6109)	0.1611 (5.3112)***	2.2823 (1.0001)
	GRW	1.5195 (4.6943)***	-0.1044 (-0.7429)	-0.1320 (-1.7711)*	-0.1964 (-0.2445)
	ROA	3.1478 (0.5422)	19.8858 (2.6127)***	-0.3703 (-0.1448)	-28.0671 (-2.3746)**
	C	12.3699 (1.5987)	5.8284 (5.9645)***	-0.8859 (-1.4883)	2.3797 (0.7006)
	R^2	0.593	0.237	0.804	0.342
	F-stat	4.175***	3.104**	23.592***	2.084
	P-value of Likelihood Test	0.2115	0.3342	0.7216	0.5678
	P-value of Hausman Test	---	-----	----	----
Distance to Default (DD) (Conventional Banks)	*LTA*	0.0521 (1.0481)	-0.0739 (-1.9060)*	0.3277 (0.7037)	0.1009 (3.3738)***
	LNT	1.1523 (0.8866)	-0.9143 (-2.5464)**	0.1832 (1.9648)*	-1.4879 (-4.8320)***
	GRW	0.1036 (0.0687)	-0.1182 (-0.6208)	-0.2003 (-0.4876)	-0.3756 (-0.8672)
	ROA	-10.3204 (-04678)	62.6446 (4.0834)***	1.9047 (0.5296)	11.9157 (2.0762)*
	C	0.4942 (0.3285)	3.1218 (4.0669)***	-2.3659 (-1.1872)	-0.5396 (-0.8819)
	R^2	0.049	0.466	0.257	0.768
	F-stat	0.299	5.018***	1.992	5.646***
	P-value of Likelihood Test	0.875	0.1104	0.8809	0.0035
	P-value of Hausman Test	---	---	----	0.000
Probability of Default (PD) (Islamic Banks)	*LTA*	0.0008 (1.6371)	0.0028 (2.9193)***	0.0306 (1.6892)	0.0323 (0.6858)
	LNT	-0.0040 (-1.2923)	0.0031 (0.6657)	-0.0143 (-5.4578)***	-0.4103 (-0.5868)
	GRW	-0.0013 (-1.1977)	0.0013 (0.5036)	0.0104 (1.6128)	-0.0378 (-0.1536)
	ROA	0.0057 (0.3151)	-0.3039 (-2.1235)**	0.1612 (0.7280)	6.4447 (1.7798)*
	C	-0.0102 (-1.0514)	-0.0478 (-2.6010)**	0.2796 (5.4250)***	-0.4120 (-0.3960)
	R^2	0.202	0.285	0.789	0.245
	F-stat	1.457	2.294*	1.554***	1.301
	P-value of Likelihood Test	0.3799	0.6159	0.8360	0.5678
	P-value of Hausman Test	---	---	---	---

Probability of Default (PD) (Conventional Banks)	*LTA*	-0.001 (-0.1557)	0.0081 (2.1851)**	-0.0408 (-0.6918)	-0.0239 (-3.1160)***
	LNT	-0.0202 (-0.8707)	0.0723 (2.1135)**	-0.0245 (-2.0696)**	0.3663 (4.6320)***
	GRW	-0.0128 (-0.4738)	0.0065 (0.3585)	0.0302 (0.5802)	0.1178 (1.0590)
	ROA	-0.3535 (-0.8967)	-5.7565 (-3.9379)***	-0.2689 (-0.5897)	-3.1479 (-2.1360)**
	C	0.0457 (1.6997)	-0.1035 (-1.4156)	0.5849 (2.3145)**	0.5211 (3.3168)***
	R^2	0.133	0.433	0.284	0.747
	F-stat	0.889	4.408***	2.286*	5.042***
	P-value of Likelihood Test	0.5775	0.1243	0.8934	0.0044
	P-value of Hausman Test	---	---	---	0.000

***Notes**: LTA is Natural log of total assets, LNT is Loan to total asset ratio, GRW is growth of total assets and ROA is return on assets, t-value in parenthesis, *, ** & *** 10%, 5% & 1% significance level respectively.*

We describe the results of Bahrain and common effect model is more suitable for analysis based on p-values of the redundant test. The above table results exhibit that bank size and Loan to Total Assets have a significant impact on Z-Score in IBs while growth and ROA have an insignificant impact on Z-Score in IBs. We find the insignificant impact of selected variables on the Z-Score of CBs. We further find that bank size, growth and ROA have an insignificant impact on Altman Z-Score in both banking systems. We find a mixed trend; most of the bank-specific variables are significant with a different measure of credit risk. Bank size, Loan to Total Assets and ROA have a significant impact on NPL Ratio in both banking sectors but growth has not found significant. Firm Size, Loan to Total Assets and ROA have an insignificant impact on DD in both types of banking. We find that firm size, Loan to Total Assets, Growth and ROA have an insignificant impact on PD in both systems.

We apply the common effect model on Indonesia data based on the redundant test in all models. The results in Table-2 exhibit that bank size, Loan to Total Assets, Growth and ROA have an insignificant impact on Z-Score in both type of banks of Indonesia. The above table results further state that Firm Size and ROA have an insignificant impact on Altman Z-Score in IBs while Loan to Total Assets and Growth have a significant impact on Altman Z-Score in IBs. While discussing the CBs, Firm Size and Growth have an insignificant impact on Altman Z-Score while Loan to Total Assets and ROA have a significant impact on Altman Z-Score in CBs of Indonesia. Further, the results show that bank-specific variables have an insignificant impact on NPL Ratio in both types of banks. The above table results further exhibit that Firm Size and ROA have a significant impact on DD in IBs while Loan to Total Assets and Growth have an insignificant impact on DD in IBs of Indonesia. While discussing the CBs, Firm Size and Growth have an insignificant impact on DD in CBs while Loan to Total Assets and ROA have a significant impact on DD in CBs. Firm Size and ROA have a significant impact on PD in IBs while Loan to Total Assets and Growth have an insignificant impact on PD. While discussing the CBs, Firm Size, Loan to Total Assets and ROA have a significant impact on PD and Growth have an insignificant impact on PD.

The results in table-2 further suggest that redundant test should be run for the all credit risk models of Pakistan. The above table results exhibit that Firm Size, Loan to Total Assets, Growth and ROA have an insignificant impact on Z-Score in IBs of Pakistan. While discussing the CBs, Firm Size, Loan to Total Assets and Return on Assets have a significant impact on Z-Score but Growth has an insignificant impact on Z-Score. Firm Size, Loan to Total Assets, Growth and ROA have an insignificant impact on Altman Z-Score in IBs of Pakistan whereas the CBs' Size, Loan to Total Assets and Growth have a significant impact

on Altman Z- while ROA has an insignificant impact on Altman Z-Score. We find that bank-specific variables have a significant impact on NPL Ratio in both types of banks of Pakistan. The above table results further exhibit that Firm Size, Growth and ROA have an insignificant impact on DD in IBs but Loan to Total Assets have a significant impact on DD in IBs of Pakistan. CBs' Firm Size, Loan to Total Assets, Growth and ROA have an insignificant impact on DD. The results show that bank-specific variables have a significant impact on PD in IBs because the p-value is less than 0.05 while bank-specific variables have an insignificant impact on PD in IBs of Pakistan because the p-value is greater than 0.05.

Table-2 suggests that redundant test should be run on UAE data in IBs for Z-Score, NPL Ratio, DD and PD, and for CBs, it is applied for NPL Ratio. Further results suggest that the Hausman test is appropriate for IBs only for Altman Z-Score while discussing the CBs, Hausman test is suitable for Z-Score, Altman Z-Score, DD and PD. Firm Size and Loan to Total Assets have a significant impact on Z-Score in IBs whereas Growth and ROA have an insignificant impact on Z-Score in IBs of UAE. While discussing the CBs, Firm Size, Loan to Total Assets and Return on Assets have a significant impact on Z-Score. The above table results further exhibit that Firm Size, Growth and ROA have an insignificant impact on Altman Z-Score in IBs while Loan to Total Assets has a significant impact on Altman Z-Score CBs' Size, Growth and ROA have an insignificant impact on Altman Z-Score. The results show that significant impact of bank-specific variables exist on NPL Ratio in both types of banks. We find that bank-specific variables have an insignificant impact on DD in IBs and have a significant impact on DD in CBs. Furthermore, the results show that bank-specific variables have a significant impact on PD in IBs and CBs.

The results of the current study are aligned with the earlier studies carried out by Kabir, Worthington & Gupta (2015) suggesting that as compare to CBs, credit risk level in IBs is lower if DD is used. However, using other measures presents the opposite results. This study reconfirms the conclusion of Arris (2010) and Gamaginta (2011). Models of credit risk based on the market have the greater predictive ability (Altman, 1997). Concerning Firm Size, the results of this study are aligned with Bouyd (1993) stating that firm size has a significant reverse relation with PD. This shows that as Firm size increase, PD decrease and vice versa. Similarly, growth shows insignificant and reverse relationship with PD as measured by Bouyd (1993). It shows that growth in assets shows no effect on PD.

5. CONCLUSION

This study aims to examine the group mean differences among the Islamic and conventional banks of different countries, including Bahrain, Indonesia, Pakistan, and UAE. Furthermore, it investigates the impact of bank-specific variables on credit risk of both types of banks. We find that by using market models like Distance to Default (DD) and Probability of Default (PD) models, conventional banks will have higher credit risk as compared to Islamic banks. On the other hand, opposing the case of Islamic banks, Z-scores are significantly higher and NPL are lower for conventional banks. These results suggest that credit risk is low for conventional banks. As far as our concern with the second objective, that whether the results of different methods to measure credit risks are the same or not, we conclude that results are different for different methods to measure credit risk. Although market-based measures are more predictive than accounting based, however, we suggest that policymakers should apply a blend of these methods. Like other studies, this study also suffers from certain limitations. The sample data is only for eight years with data containing more periods and a greater sample would have more generalizability. There are other macroeconomic and bank-specific variables which may have a significant effect on credit

risk; there might be a good future study to incorporate more variables which may provide better results.

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