Economics Bulletin

Volume 35, Issue 4

Islamic Banks and Financial Stability: A Quantile Estimation

Wassim Rajhi
Kedge Business School

Abstract

This empirical analysis explores causes of insolvency risk between Middle East and North Africa and South East Asian countries. To measure the financial stability, we compute the z-score for a sample of banks in 16 countries where Islamic and conventional banks coexist over the period 2000-2008.

The authors would like to thank the anonymous reviewers for their valuable comments and suggestions to improve the quality of the paper.
Citation: Wassim Rajhi, (2015) "Islamic Banks and Financial Stability: A Quantile Estimation", *Economics Bulletin*, Volume 35, Issue 4, pages 2846-2852
Contact: Wassim Rajhi - wassim.rajhi@kedgebs.com.
Submitted: October 23, 2014. **Published:** December 18, 2015.

1. Introduction

Emerging financial markets often include Islamic financial services which are expected to enhance growth in these markets due to the positive relationship between market liquidity and economic growth (Rajan and Zingales 1998; Levine and Zervos 1998; Levine 2005).[1] Jokipii and Monnin (2013) find a positive link between banking sector stability and real output growth. The authors show that an unstable banking sector increases uncertainty about future output growth. Financial development, including emerging Islamic financial services, needs to be orderly and could be adversely affected by adverse macroeconomic or financial shocks. It is therefore interesting to analyse how an Islamic banking system that might be affected by these shocks acts differently from conventional banking systems.

We study the factors that cause failures for both conventional and Islamic banks in the MENA region and in Southeast Asian countries.[2] Finally, we introduce a methodological advance using quantile regression. Quantile regression can be considered superior to the previously used estimation techniques since it provides more precise estimates of the impact of the determinants of insolvency. For each of the regions in our sample, we estimate a quantile regression in 16 countries for the period 2000-2008. The structure of this paper is as follows. Section 2 discusses our methodology, and introduces the variables and data used in the paper (characterized in more detail in appendix 1). Section 3 presents the empirical results and section 4 summarizes the conclusions.

2. Methodology

2.1. Banking Stability Measure

We define the z-score, which measures the market value of a bank's assets in relation to the book value of its liabilities. The z-score indicates the distance from insolvency combining accounting measures of profitability, leverage and volatility. The z-score measures the number of standard deviations a return realization has to fall in order to deplete equity, under the assumption of normality of banks' returns.[3] The z-score is inversely related to the probability of a bank's insolvency, i.e., the probability that the value of its assets will become lower than the value of the debt. The z-score is calculated by using individual banks. The dependent variable, z-score of bank *i* at time *t*, is:

$$\text{z-score} = \frac{\mu + K}{\sigma_r} \qquad (1)$$

We estimate an individual bank's probability of insolvency – $P\{r \leq -K\}$ where $K = \frac{k}{A}$ and $r = \frac{\pi}{A}$ denote bank's equity capital to asset and return to asset ratios

[1] It is therefore an opportunity to promote economic growth for Muslims worldwide.

[2] Islamic jurisprudence is based on different schools that may vary from country to country (the *Shiah* branch and the *Sunni* branch). A typical example is the controversy regarding the *Bay al Dayn* (debt trading), which is rejected by some Middle East scholars on the grounds that it involves *riba (*interest). Islam prohibits the trading of debts, unless it is at par value.

[3] E(ROAA) was estimated using an average of some returns and the standard deviation term was estimated by the sample standard deviation of these returns.

respectively.[4] Assuming that returns follow a distribution with the first two moments μ and σ_r^2 , one can estimate the upper bound of probability of insolvency:

$$P\{r \leq -K\} \leq \frac{\sigma_r^2}{(\mu+K)^2} \quad (2)$$

Inequality (2) is reduced to:

$$P\{r \leq -K\} \leq \frac{1}{z^2} \quad (3)$$

Equation (3) is the bank's probability of insolvency. Z-score can be considered as a version of bank's distance- to-insolvency type measure. Specifically, z-score indicates the number of standard deviation that a bank's return on assets has to drop below its expected value before equity is depleted and the bank is insolvent:

$$P\{r \leq -K\} = P\left\{\frac{r-\mu}{\sigma_r} \leq \frac{-K-\mu}{\sigma_r}\right\} = P\left\{\frac{r-\mu}{\sigma_r} \leq -z\right\} = P\{r \leq \mu - z\sigma r\} \quad (4)$$

Equations (3) and (4) ensure the negative relation between z-score and probability of bank's failure. A higher z-score corresponds to a lower risk of insolvency. So far, we have not presumed returns r to follow any specific probability distribution. However, specifying the distribution enables one to determine the exact insolvency probability:

$$P\{r \leq -K\} = P\left\{\frac{r-\mu}{\sigma_r} \leq -z\right\} = \Phi_r(-z) \quad (5)$$

Where $\Phi_r$denotes distribution function of bank's standardized returns.

2.2. Regression Analysis

We attempt to establish a relation between z-score and a number of relevant macro and bank-specific indicators. Our approach aims mainly at testing whether Islamic banks are more or less stable than conventional banks, using regressions of z-scores as a function of a number of variables. We aim to define an insolvency model of the form:

$$(z_{i,j,t}) = \alpha + \varphi B_{i,j,t-1} + \gamma I_{j,t-1} + \sum \delta_S T_S + \sum \emptyset_S T_S I_{j,t-1} + \sum \varphi_S B_{i,j,t-1} T_S + \omega M_{j,t-1} + \varepsilon_{i,j,t}, \quad (6)$$

Where the dependent variable is the z-score ($Z_{i,j,t}$) for bank *i* in country *j* at time *t*; $B_{I,J,t-1}$ is a vector of bank-specific variables; $I_{J,t-1}$ contains time-varying industry-specific variables T_S and $T_S I_{J,t-1}$ are the type of banks and the interaction between the type and some industry-specific variables; $M_{J,t-1}$ denotes macroeconomic variables. Finally, $\varepsilon_{i,j,t}$ is the residual.

[4] The equity acts as a buffer against future losses, reducing excessive risk taking (Gersbach 2002).

2.3. Control Variables

The list of explanatory variables used in regressions incorporates a number of possible risks and bank characteristics discussed in the literature. These are divided into three groups: (i) bank specific variables from bank balance sheets and profit and loss accounts, (ii) national banking sector data and (iii) macroeconomic variables. To distinguish the impact of bank type on the z-score, we include a dummy variable that takes the value of 1 if the bank in question is an Islamic bank and 0 otherwise (i.e., if it is a conventional bank).[5] In order to control bank specific characteristics, the regression includes a number of other control variables to separate the impact on financial stability of the Islamic nature of a bank from the impact of other bank-level characteristics, from macroeconomic and other system-level influences. We include the bank's asset size logged, capital-asset-ratio loans over assets, credit risk, cost-income ratio and liquidity risk. The logarithm of total assets is used as a proxy for bank size, whereas share of loans to assets describes bank asset structure. As a robustness check, we add the ratio of loan loss provisions to net interest income (credit risk). We expected that a higher ratio would increase the bank insolvency risk. However, this sign might be ambiguous too, as higher loan loss provisions could reflect banks' precautionary reserve building as well as high non-performing loans. Both proxies represent the risk profile of the bank. We interacted a credit risk variable with the Islamic bank dummy because there are differences between Islamic and conventional banks.

For cost efficiency, the cost to income ratio has been used as an indicator of bank cost efficiency. This is a simple measure indicating how well banks manage their total costs (such as overhead expenses) relative to their income; higher values indicate more inefficiency. Liquidity risk is measured as a ratio of liquid assets to deposits and short-term funding. Lack of liquidity can lead to large losses in asset/liability portfolios and it can generate financial distress and insolvency. In general, liquidity reserves promote financial soundness; on the other hand, excess liquidity undermines efficiency and profitability. Originally developed by Laeven and Levine (2007), income diversity captures the degree to which banks diversify from traditional lending activities (those generating net interest incomes) to other activities. In Islamic banks, the net interest income is generally defined as the sum of the positive and negative income flows associated with the Profit and Loss Sharing (PLS) arrangements. We interacted the income diversity variable with the Islamic bank dummy because there are differences between Islamic and conventional banks.

In addition to bank-by-bank data, we incorporate country-specific control variables, using a number of variables that take the same value for all banks in a given year and country. We follow Schaeck and Čihák (2012) by using the inflation rate, the official exchange rate and real gross domestic product growth, since macroeconomic developments are likely to affect the quality of banks‘ assets, as well as the level of bank capitalization. First, we use real GDP growth rate where we expect higher growth to reflect better conditions for financial stability. An important variable influencing z-score is the economic activity in the country. Next, we use inflation and official exchange rates, assuming that price and exchange rate stability contribute to the profitability and stability of the banking sector.

[5] If Islamic banks were relatively weaker than conventional banks, the dummy variable would have a negative sign in the regression explaining z-score.

We adjust for the impact of the macroeconomic cycle by including LIBOR to which Islamic banks often benchmark the pricing of their instruments. The value of assets such as a deferred sale and lease transaction will vary with the distance between the price at which they were issued and market changes in the benchmark. LIBOR changes affect an Islamic bank income statement in the same way they do with a conventional bank depending on the share of the balance sheet linked to the benchmark (Chapra and Ahmed 2002). We interacted this with the Islamic bank dummy. At the systemic level, we examine the conventional banks' impact on Islamic banks and the hypothesis that the presence of conventional banks lowers systemic stability. For this reason, we have calculated the market share of conventional banks for each year and country and interacted it with the Islamic bank dummy. A negative sign for the interaction of the conventional market share and the Islamic bank dummy would indicate that a higher share of conventional banks reduces their soundness (reduces their z-scores). We try to capture the possible impact of banking sector concentration on risk-taking behavior by including the Herfindahl-Hirschman index in the model. Regarding country-specific factors, we include the concentration level, measured by this index for each country and year, to account for cross-country variation in financial stability caused by differences in market concentration.

Included in the institutions are the process by which governments are selected, monitored and replaced, the capacity of the government to effectively formulate and implement sound policies, the respect of citizens; and the state of the institutions that govern economic and social interactions. Furthermore, we controlled for the effect of the institutional environment by using the governance indicators compiled by Kaufmann, Kraay and Mastruzzi (2010). This indicator captures cross-country differences in institutional developments that might have an effect on banking risks.

All explanatory variables are lagged one year (-1) to capture the possible past effects of these variables on the banks' individual risk. To do that, we estimate the same regressions between the MENA region and Southeast Asian countries. We had no a priori assumptions on the sign of coefficients on these variables as they can all affect bank solvency positively or negatively.

2.4. The Data

Our balance sheets and profit and loss accounts data stem from Bureau van Dijk's BankScope database. Our sample covers 467 conventional banks and 90 Islamic banks for the period 2000-2008 in the following 16 countries: 6 Southeast Asian countries and 10 MENA countries (alphabetically ordered): Bahrain, Bangladesh, Brunei, Egypt, Indonesia, Jordan, Kuwait, Malaysia, Pakistan, Qatar, Saudi Arabia, Singapore, Tunisia, Turkey, United Arab Emirates and Yemen.

3. Empirical Results

Quantile regression provides information about the slope at different points of the measure of stability given the set of explanatory variables. Quantile regression is an evolving body of statistical methods for estimating and drawing inferences about conditional quantile functions. Quantile regression is a good choice for descriptive regressions because they will be robust to outliers. Finally, the quantile regressions are estimating the conditional distribution of z given characteristics.

Table 1 reports the coefficients for the 25th, the 50th and the 75th of the distribution of the z-score.[6] In MENA countries, Islamic banks are weaker than conventional banks. In Southeast Asian countries, Islamic banks are more robust than conventional banks. The results are significant at the 1 and 5 % levels. Estimations provided any substantial evidence for a positive role of a higher presence of conventional banks on the average Islamic bank's stability. In MENA countries, Islamic banks do not suffer from a stronger conventional sector. The results are significant at the 5 and 10 % levels. The results are not significant in Southeast Asian countries. Greater income diversity tends to increase z-scores on the Islamic banks in MENA countries. In Southeast Asian countries, greater income diversity tends to decrease z-scores of Islamic banks at the 5 and 10 % levels. In Southeast Asian countries, the coefficients of the credit risk and its interaction with the Islamic bank dummy show that credit risk decrease z-scores of Islamic banks; the results are significant at the 10 and 5 % levels. Greater credit risk increase z-scores of the Islamic banks in MENA countries at the 10 % level.

Table 1. Quantile Regressions

Dependent Variable: Z-score	**Middle East and North Africa**			**Southeast Asia and Pakistan**		
Quantile	**0.25**	**0.5**	**0.75**	**0.25**	**0.5**	**0.75**
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Islamic Dummy	**-10.4064**	**-20.7393**	**-16.2846**	**35.2994**	**98.0696**	**53.4661**
	(0.1565)	**(0.0041)*** **	**(0.1238)**	**(0.2626)**	**(0.0278)** **	**(0.3492)**
Log Asset (-1)	1.1764	0.8188	0.5062	-0.0174	0.3637	0.5118
	(0.0001)***	(0.0040)***	(0.3413)	(0.9578)	(0.3085)	(0.3945)
Loans/ Assets (-1)	0.0505	0.0510	0.0668	-0.0124	0.0262	-0.0418
	(0.0771)*	(0.0547)*	(0.2500)	(0.6675)	(0.5155)	(0.5826)
Credit Risk (- 1)	-0.0118	-0.0156	-0.0092	-0.0006	-0.0002	0.0005
	(0.1922)	(0.0227)**	(0.3989)	(0.6473)	(0.8932)	(0.8056)
Credit Risk * Islamic Bank Dummy (-1)	**0.0123**	**0.0160**	**0.0086**	**0.0592**	**-0.4140**	**-0.7688**
	(0.2777)	**(0.0714)***	**(0.4858)**	**(0.7681)**	**(0.0434)** **	**(0.0583)***
Income Diversity (-1)	-0.6050	-0.5814	-0.2837	-0.5348	-2.8815	-0.1636
	(0.1534)	(0.2471)	(0.7336)	(0.8092)	(0.3568)	(0.9665)
Income Diversity * Islamic Bank Dummy (-1)	**6.3322**	**7.2567**	**1.7993**	**-39.5504**	**-38.1093**	**-55.9362**
	(0.1477)	**(0.0986)***	**(0.7581)**	**(<.0001)*** **	**(0.0036)*** **	**(0.0209)** **
Cost / Income Ratio (-1)	-0.0852	-0.1023	-0.0942	-0.0702	-0.0798	-0.0609
	(<.0001)***	(<.0001)***	(0.0303)**	(0.0022)***	(<.0001)***	(0.0127)**
Liquid Assets Customer / Short Term Fund (-1)	0.0688	0.0701	0.0677	0.0276	0.0951	0.1630
	(<.0001)***	(<.0001)***	(0.0340)**	(0.1702)	(0.0066)***	(0.0100)***
Herfindahl Index (-1)	-10.4869	4.1975	-10.8134	2.9666	-8.3453	8.2904
	(0.0327)**	(0.5516)	(0.3339)	(0.6573)	(0.4177)	(0.6499)
Market share Conventional banks (- 1)	-0.1296	-0.1054	0.0405	0.1341	0.2562	0.1074
	(0.0022)***	(0.0311)**	(0.6074)	(0.0711)*	(0.1080)	(0.6505)
Market share Conventional banks*Islamic Dummy (- 1)	**0.0663**	**0.1989**	**0.2217**	**-0.0318**	**-0.6533**	**-0.1163**
	(0.4112)	**(0.0129)** **	**(0.0686)***	**(0.9202)**	**(0.1609)**	**(0.8621)**
LIBOR (- 1)	-0.2170	0.1143	0.5293	0.5628	0.4860	0.2398
	(0.3507)	(0.6471)	(0.4015)	(0.0355)**	(0.1714)	(0.6852)
LIBOR* Islamic Dummy (-1)	**0.8659**	**1.1454**	**0.2405**	**-2.1980**	**-1.1668**	**0.7539**
	(0.1613)	**(0.1348)**	**(0.8272)**	**(0.2473)**	**(0.6489)**	**(0.8386)**
Real GDP Growth (-1)	-0.0741	0.2091	0.3933	0.4420	0.9605	0.6786
	(0.5363)	(0.1805)	(0.1708)	(0.2314)	(0.1057)	(0.3323)
Inflation (-1)	-0.0416	-0.0633	-0.0599	-0.1768	-0.8546	-1.1847
	(0.2790)	(0.1320)	(0.5342)	(0.2231)	(<.0001)***	(<.0001)***
Official Exchange Rate (-1)	-0.0137	-0.0838	-0.1105	-0.2354	-0.4010	-0.4356
	(0.6247)	(0.0102)**	(0.1753)	(0.0002)***	(<.0001)***	(0.0010)***
Constant	7.2041	12.8319	12.7389	-2.4917	-11.0729	14.3226
	(0.2043)	(0.0730)*	(0.1384)	(0.8044)	(0.5604)	(0.6094)
Observations	878	878	878	1019	1019	1019

Table reports the coefficients for the 25th, the 50th and the 75th of the distribution of the Z-score. P values in parentheses * Significant at 10%; ** significant at 5%; *** significant at 1%.

[6] The quantile regressions are descriptive and not estimating causal effects.

4. Conclusion

In this paper, the relative financial strength of Islamic and conventional banks is assessed empirically in 16 banking systems which have a substantial presence of Islamic banking. Examining the 2000-2008 time period, we employed the quantile estimation introduced by Koenker and Bassett (1978). We find that in MENA countries, Islamic banks are weaker than conventional banks. In Southeast Asian countries, Islamic banks are more robust than conventional banks. Estimations provided any substantial evidence for a positive effect of a higher presence of conventional banks on the average Islamic bank's stability. In MENA countries, an increased presence of conventional banks has a positive effect on the Islamic banks; Islamic banks do not suffer from a stronger conventional sector. Greater income diversity tends to increase z-scores on the Islamic banks in MENA countries. In Southeast Asian countries, greater income diversity tends to decrease z-scores on the Islamic banks. The coefficients of the credit risk and its interaction with the Islamic bank dummy in Southeast Asian countries show that credit risk has a negative effect on the Islamic banks. Finally, Greater credit risk has a positive effect on the Islamic banks in MENA countries.

References

Berger, A. (1995) "The Relationship between Capital and Earnings in Banking" *Journal of Money, Credit and Banking,* 27(2), 432-456.

Beck, T., Demirguc-Kunt, A. and Merrouche, O. (2013) "Islamic vs. conventional banking : business model, efficiency and stability" *Journal of Banking & Finance*, 37 (2), 433-447.

Chapra, U. and Ahmed, H. (2002) "Corporate Governance in Islamic Financial Institutions" Occasional Paper 6*, Islamic Research and Training Institute, Islamic Development Bank, Jeddah*.

Chen, C. (2005) "An Introduction to Quantile Regression and the QUANTREG Procedure" *Statistics and Data Analysis SUGI 27, SAS Institute Inc*.

Čihák, M. and Hesse, H. (2010) "Islamic Banks and Financial Stability : An Empirical Analysis" *Journal of Financial Services Research*, 38(2), 95-113.

Gersbach, H. (2002) "The Optimal Capital Structure of an Economy" *Alfred-Weber-Institut, University of Heidelberg, Grabengasse, Germany.*

Jokipii, T. and Monnin, P. (2013) "The Impact of Banking Sector Stability on the Real Economy" *Journal of International Money and Finance*, 32, 1-16.

Kaufmann, D., Kraay, A. and Mastruzzi, M. (2010) "Governance Indicators for 2000-2008, *The Worldwide Governance Indicators (WGI) project", World Bank Policy Research, Washington, D.C.*

Koenker, R. and Bassett, G. (1978) "Regression Quantiles" *Econometrica*, 46(1), 33-50.

Laeven, L. and Levine, R. (2007) "Is There a Diversification Discount in Financial Conglomerates" *Journal of Financial Economics,* 85(2), 331-367.

Levine, R. and Zervos, S. (1998) "Stock Markets, Banks and Economic Growth" *American Economic Review*, 88(3), 537-558.

Levine, R. (2005) "Finance and Growth: Theory and Evidence" *Handbook of Economic Growth*, Volume 1, Part A, 865-934.

Rajan, R. and Zingales, L. (1998) "Financial Dependence and Growth" *American Economic Review,* 88(3), 559-586.

Schaeck, K., Čihák, M. and Wolfe, S. (2009) "Are More Competitive Banking Systems More Stable" *Journal of Money, Credit and Banking*, 41(4), 711-734.
Schaeck, K. and Čihák, M. (2012) "Banking Competition and Capital Ratios" *European Financial Management*, 18(5), 836-866.
Schaeck, K. and Čihák, M. (2014) "Competition, Efficiency, and Stability in Banking" *Financial Management*, 43(1), 215-241.
Strobel, F. (2010) "Bank Insolvency Risk and Aggregate Z-score Measures: a Caveat" *Economics Bulletin*, 30(4), 2576-2578.
Yudistira, D. (2004) "Efficiency in Islamic Banking: An Empirical Analysis of Eighteen Banks" *Islamic Economic Studies*, 12(1), 1-19.

Appendix. Definition of Variables

Variable		Description
Dependent Variable: Insolvency Risk Exposure		
		Z-score$=\frac{\mu+K}{\sigma_r}$, where μ stands for expected return on average assets, $K=\frac{k}{A}$ and $r=\frac{\pi}{A}$ denote bank's equity capital to asset and return to asset ratios respectively. (*r*) as a proxy for return volatility, *σ(r)* denotes standard deviation of return on assets.
Explanatory Variables :		
Bank Specific	Log Assets	Logarithm of the total assets of a bank (In U.S. thousand dollars).
	Assets Structure	Share of total credits in bank assets.
	Cost to Income Ratio	Ratio of cost to income.
	Credit Risk	Loan loss provisions to net interest income.
	Credit risk*Islamic Bank Dummy	Interaction of credit risk and Islamic bank dummy.
	Income Diversity	1 - | (Net interest income - Other operating income) / Total operating income |.
	Income Diversity*Islamic Bank Dummy	Interaction of income diversity and Islamic bank dummy.
	Liquidity Risk	Liquid assets as percentage of customer and short term funding.
Banking Sector	Concentration	Herfindal-Hirschman Index.
	Market Share of Conventional banks	Market share of conventional banks in a country per year.
	Market Share of Conventional Banks*Islamic Bank Dummy	Interaction of market share of conventional banks and Islamic bank dummy.
Macroeconomic Variables	GDP Growth	Growth rate of nominal GDP, adjusted for inflation (Percent).
	Inflation	Year-on-year change of the CPI index (Percent).
	Official Exchange Rate	The official exchange rate refers to the exchange rate determined by national authorities or the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar), transformed in percent.
	London interbank offered rate	6-months LIBOR.
	London interbank offered rate*Islamic Bank dummy	Interaction of LIBOR and Islamic bank dummy.
Governance	Governance	Voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, control of corruption (2000-2008).
Dummy Variable	Islamic Bank Dummy	Equals 1 for Islamic banks, 0 otherwise.

Sources: *All microeconomic variables are taken from BankScope database. The Z-score, the Herfindal-Hirschman Index and the market share of conventional banks are the author's calculations based on the BankScope database. The macroeconomic variables are taken from the IFS (International Financial Statistics published by the International Monetary Fund (IMF)). The LIBOR variable is taken from the Mortgage-X LIBOR Index. The dummy variable and the interactions are the author's calculations. The governance variable is taken from Kaufmann, Kraay and Mastruzzi (2010). Data frequency: annual.*