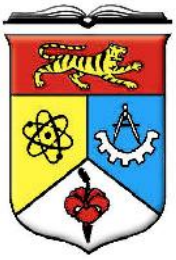

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**Working Paper in Islamic Economics and Finance No. 0822**

# Credit Risk, Risk Rating and Probability of Default in Islamic Banking

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**This Draft August 2008**

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**ABSTRACT**

Risk management has been widening to the top agenda of commercial banks and Islamic banks in the last few years. The credit exposure across the bank includes the extension of financing or credit facilities, the underwriting and acquisition of equities and Islamic private debt securities in primary and secondary market. This paper examines the impact of credit risk facing by the Islamic banks in Malaysia. Credit rating is very important in decision making on loan/credit since their role is to issue independent credit quality assessment A poor credit rating indicates a high risk of defaulting on a financing of Islamic banking industry .Several policy of implication are addressed to tells a lender a probability of defaults in a portfolio of Islamic banking such as Frameworks for Weighted Capital Adequacy (including their Islamic banking windows that is applicable to all banking institutions and the Capital Adequacy Framework for Islamic banks

Keyword: Credit Risk, Risk Rating, Panel Data

## INTRODUCTION

Regulators are now increasing the emphasis given to credit risk modeling. The new Basel proposal is much more risk sensitive, and requires significant detail in calculating the banks' credit risk exposure. Concerns that greater risk sensitivity will also make capital more procyclical have drawn academic attention to this area (Catarineu-Rabell, Jackson, and Tsomocos (2002), Jordan, Peek, and Rosengren (2003)). But while this proposal is intended to capture the best practices at major commercial banks, academic research has again been handicapped by the proprietary nature of the data and models. As a result, most studies of credit risk have examined similar market instruments, which are imperfect proxies for a bank's actual credit risk exposure (Carey (1998)). The capital requirements under Basel II are designed to be risk-sensitive, and therefore have the potential to be more volatile than under Basel I. Moreover, since downgrades, risky yields, and defaults (Cantor, Mahoney, and Mann 2003), as well as bank loan losses, are countercyclical, we might expect Basel II capital to be countercyclical (i.e., increase during recessions).

This sub-section considers three standard arguments favouring increased risk-sensitivity of capital requirements, discussing their relationship to the framework of benefits and costs. First, risk-sensitivity is needed to impose greater discipline on banks that seek to exploit the financial 'safety net' through greater risk-taking. Standard franchise value arguments suggest that only a small proportion of banks engage in moral hazard of this kind. Such divergence of behaviours emerges clearly in the dynamic models of Milne and Whalley (1999, 2001) as well as in the classic static franchise value model of Marcus (1984). The large majority of solvent banks with some expectation of net positive future returns will seek to hold a buffer of capital to protect shareholders from the costs of insolvency or breach of capital requirements and will not seek to exploit the safety net. For such banks, the analysis of benefits put forward in this section is complete.

In principal, this argument is relevant to a small minority of weak undercapitalized banks. In practice, such weak banks have every incentive to avoid regulatory requirements, e.g. through false reporting or "window dressing" (temporarily acquiring or disposing of assets to comply with regulatory capital requirements). So even in these cases bank discipline via risk-sensitive capital requirements is relatively ineffective. The moral hazard argument suggests no great benefit to greater risk-sensitivity of capital regulation, not captured in the benefit-cost. Control of moral hazard has to be sought through close and effective supervision of weak banks and rapid intervention in failing institutions.

Second, the crude risk weighting such as that of the 1988 Basel accord are ineffective and need to be replaced by requirements that are more sophisticated. Specifically it is often argued that banks can use asset-backed securitization as a way of avoiding the impact of capital requirements. This argument is irrelevant because it does not address costs and benefits of regulation. The concern with asset-backed securitization is dealt with quite simply in the Basel II by allowing a reduction in capital requirements only when their assets are taken off balance sheet with no possibility of recourse to the originating bank.

It is true that banks have tended to increase holdings of some assets whose true risks were relatively high compared to their 1988 regulatory risk-weightings. However, this development was in response to the relative risk and return on different asset classes and would have taken place even in the absence of capital regulation. The use of more risk-sensitive regulatory capital requirements to discourage such portfolio shifts is justified only if it can be demonstrated that bank decisions over these asset holdings did not sufficiently internalize the social externalities of

bank failure and that greater sensitivity of regulatory capital requirements would be a cost effective way of internalising these social externalities.

Third, banks pursue fixed targets for return on equity. Hence, when they are subject to increased capital requirements, they will respond by shifting their portfolio into high risk/ high return assets to maintain earnings in relation to total equity capital. Such an operational objective is inconsistent with the proper exercise of market discipline since it implies that bank behaviours does not reflect the market price of risk and is destructive of shareholder value. Here, the slope of the market security line measures the price of risk. Under standard theories of security pricing such behaviours on the part of banks would trigger a decline in the market price of equity and hence a loss of shareholder value. It seems implausible that many banks would behave in such a manner but this is ultimately an empirical question.

Suppose it can be demonstrated that banks respond to increase capital requirements by increasing portfolio risk. Such a finding would also be inconsistent with the "incentive mechanism' interpretation of bank capital regulation (Milne and Whalley (1999, 2001), Milne(2001) where increased capital requirements reduces bank appetite for risk in the short run and has little impact in the long run. Then greater risk-sensitivity of capital, by imposing greater costs on such risk-acquisition, might usefully substitute for market discipline and be of net social benefit. The cost-benefit framework proposed in this section assumes rational (forward-looking) shareholder value enhancing behaviours on the part of banks and hence excludes this potential benefit of risk-sensitive capital regulation.

The remaining discussion of this paper is organized as follows. Second 2 overview the review of the theoretical and empirical literature dealing with the effects of capital requirements on banks behavior.. The third section will provide research design that consist of data sources and description and the models. The fourth of this paper will be focusing on the empirical analysis. The descriptive statistic for each of the variables selected in this analysis will also provided. By looking and analyzing each of the statistical components of the variables, the finest method of estimation will be decided. The next sub-section will explains the estimation results. The findings from these results will also be discussed and decision of which method fits the model best will be made by analyzing each of the estimation results. The last section will cover the conclusion for this research, with some suggestion of a new idea in improving the analysis.

## REVIEW OF THE THEORETICAL AND EMPIRICAL LITERATURE

The risk-taking of banks is limited by regulatory capital requirements to prevent bank insolvency. Recently, the Basel Committee on Banking Supervision (2003) issued a revised proposal for a capital adequacy framework ("Basel II") replacing the 1988 Basel Capital Accord. Due to this development a question which has been widely discussed since the eighties of the last century (e.g., Besanko & Kanatas, 1996; Blum, 1999; Flannery, 1989; Gjerde & Semmen, 1995; Lam & Chen, 1985; Kendall, 1991; Rochet, 1992; Santos, 1999; Zarruk, 1989, and the survey article of Santos, 2001) is again high on the agenda: what are the effects of changing and especially rising capital requirements? In respect to banking risk-taking, various empirical studies find that the organizational form of the financial institutions is directly related with their risk behaviour. (Verbrugge and Goldstein, 1981; Cordell *et al.*, 1993; Lamm-Tennant and Starks, 1993; Esty, 1997). García- Marco and Robles (2003) find significant differences in risk-taking behaviour related with ownership structure and size in a sample of Spanish financial entities.

The capital requirements under Basel II are designed to be risk-sensitive, and therefore have the potential to be more volatile than under Basel I. Moreover, since downgrades, risky yields, and

defaults (Cantor, Mahoney, and Mann 2003), as well as bank loan losses, are countercyclical, we might expect Basel II capital to be countercyclical (i.e., increase during recessions). Hancock and Wilcox (1998) and Chiuri, Ferri and Majnoni (2001) find evidence that the increase in capital requirements and the adoption of risk sensitive capital requirements rules reduced bank credit to high risk weight industries. However, Bernauer and Koubi (2004) find significant differences across countries. Goodhart, Hofmann and Segoviano (2004), after analyzing the US, Mexico and Norway cases, find that banks increased their capital levels by partially shifting to low risk-weighted assets, and, cautiously, conclude that this may have caused a reduction in the credit supply in the economy. They recognize the difficulty of proving that a shift to low risk-weighted assets by banks is the cause of a reduction in economic activity, "mainly due to the problem with identifying and separating credit-demand and credit-supply movements." Finally, Barajas, Chami and Cosimano (2005) find, in a sample of Latin American and Caribbean counties over the period 1987 to 2000, that "both bank capitalization and lending activities in Latin America increased after Basel. Consequently, Basel did not seem to lead to an overall credit decline."

Boyd, De Nicoló and Al Jalal (2006) provide empirical evidence supporting the risk-shifting model using several measures of bank risk – namely a z-score measure based on bank returns on assets (ROA), its dispersion measured as σ(ROA), and the ratio of equity to total assets --and bank competition measured using a Herfindahl-Hirschmann index. [3]They found a negative and significant relationship between the bank concentration index and z-score; thus, more concentrated banking markets are associated with greater risk of bank failures. Moreover, De Nicoló and Loukoianova (2007) find that the former result is stronger when bank ownership is taken into account. Also in a cross-country setting, Schaeck, Cihák and Wolfe (2006) find that more competitive national banking systems are less prone to systemic crises based on their analysis of 38 countries over the period from 1980 to 2003 again using the H statistic.

**Model description**

To examine the various hypotheses regarding the traditional franchise value paradigm and the risk shifting hypothesis of Boyd and De Nicoló (2005), we use the general regression model:

$$risk_{it} = (Competition\ \ index_{it}, Bank\ \ control\ \ \text{var}iables_{it}, Bu\sin ess\ \ cycle_{it})$$

where the i subscript refers to a bank and the t subscript refers to the year. The model sets the relationship between the specified bank risk measure and the specified bank market competition measure, controlling for bank characteristics and the state of the business cycle. The actual model specification we examine is:

$$\ln\left(\frac{Npl_{it}}{100 - Npl_{it}}\right)_{it} = {}_0 + {}_1 \ln\left(\frac{Npl_{it-1}}{100 - Npl_{it-1}}\right) + {}_2 Compete_{it} + {}_3 compete^2{}_{it} + {}_4 CAR_{it} + {}_5 ROA_{it} + {}_6 size_{it} + {}_7 Loan_{it} + {}_8 gdp_{it} + {}_9 gdp_{it-1} + {}_{10} M3 + {}_{11} Uem + \text{¦}_i + £_{it}$$

sTo estimate equations above, we use an unbalanced bank-level panel data set for 15 Islamic banks (i.e., two full-pledged Islamic banks and thirteen Islamic windows). The data are annual

[3] They examine two data samples: a cross section of around 2,500 small, rural banks operating in only one market area within the U.S and a panel of about 2,700 banks from 134 countries, excluding Western countries.

and span the period from 1994 to 2006. In this manner a full cycle of the Malaysia economy is included.

**The Explanation of the Variables**

**A. Banking sector specific factors**

(i) The dependent bank risk variable is the log-odds transformation of a bank's NPL ratio. We use the logit transformation to change the variable's support from the unit interval to the real number line. More indirect measures of risk are credit growth and the total loans-to-assets ratio (Greenawalt and Sinkey, 1991; Keeton, 1999; Bikker and Hu, 2002). The total customer loans to total assets ratio is often used as an indicator of credit risk itself, for want of anything better

(ii) Our primary variables of interest here are those related to the degree of bank market competition, denoted $compete_{it}$ . For the loan market, we use the number of banks, C5, the HHI as well as the Lerner index for receivables, credit lines and all loans.

(iii) *Capital and reserves (as a share of balance sheet total).* This includes paid-up capital, reserved funds, retained profits and other capital funds. Capital and reserves constitute the "own funds" or core capital of a bank and—as an item in the balance sheet total— its solvency. The more risk investments carry, the more capital is needed, so that the coefficient may become negative. While high-risk investments bring in more returns, greater capital could go together with high profits, so that a positive coefficient may be expected as well, depending on the degree to which risk pays off. The capital and reserves variable is primarily a *control* variable

*(iv) Bank's Profitability (ROA)* is a measure of profitability before loan loss provisions are registered on banks' balance sheet. It can be thus used to test whether banks use provisions to smooth their income. If the income-smoothing hypothesis held, the coefficient of the ROA should have a positive sign.

*(v) Natural Logarithm of Banks Total Assets (SIZE):* has been preliminarily included as a control variable and subsequently dropped to avoid perplexing results probably due to its interaction with the individual effects. we cannot forecast a clear effect of SIZE on bank risk-taking. On the one hand, under a ''too-big-to-fail'' policy, larger banks may have greater incentives to take risk than smaller banks, since they invariably enjoy a comprehensive safety net. On the other hand, larger banks have a greater potential to diversify and reduce their risk-taking.

*(vi) Loans (as a share of total assets)* this variable represent the (relative) size of lending. Loans have a positive influence on profitability, because as a bank's core business, they are a major generator of interest income. But lending also entails operational costs and credit losses. If costs and risks are not expressed adequately in the price of credit (*i.e.* the mark-up rate), for instance, as a result of cross subsidizations, then lending becomes a loss-making business. In any case, this variable serves to characterize a bank's balance sheet. Like the variables that follow below, total assets divide the loans variable in order to standardize it.

**B. Macroeconomic factors**

*(i) Gross Domestic Production (GDP).* The GDP figure is the most general and most direct measure of macroeconomic developments. In our context, it is first and foremost an indicator of the demand for banking services, including the extension of loans, and the supply of funds, such

as deposits, and as such is a direct determinant of profits. As a growth figure, it is the single most useful indicator of the business cycle, while the costs of banks are also expected to be linked to the GDP cycle.

*(ii) Unemployment (%)* Unemployment does not directly influence profitability, but it is a major cyclical indicator. If short-term unemployment is primarily a reflection of the business cycle, long-term unemployment especially indicates structural disequilibrium in the economy. In addition, unemployment is a measure of the current *phase* in the business cycle, whereas a figure like GDP merely indicates the *degree of change* in the business cycle.

*(iii) Money supply (M3)* the money supply is represented by the monetary aggregate M3, defined as the sum of cash and non-cash balances held by the public, short-term deposits, foreign-exchange holdings and short-term savings. The growth of money supply makes real growth possible, and is primarily an indicator of future growth potential (see Boeschoten *et al.*, 1994; Berk and Bikker, 1995). In the first place, it reflects the availability of money, which is strongly linked to the creation of money by banks through lending. Excessive money growth implies a risk of overheating the economy and its concomitant, rising inflation. The impact of money supply on profits is mostly indirect, which is why this variable, too, functions mostly as a *control* variable.

It could be possible that bank unobservable characteristics are correlated with the bank NPL ratios; for example, the risk aversion of bank managers and/or shareholders. In this case, a level estimation of model (2) would produce biased parameters due to the lagged dependent variable. Similarly, an OLS estimation of model (2) would also bias the results. To address these estimation problems, we use the Arellano and Bond (1991) procedure and estimate the model in first-difference form using the Generalized Method of Moments estimator (GMM). We thus treat bank characteristics as endogenous and use up to three lags of the dependent variable to instrument for them. The validity of these instruments is tested using the standard Sargan test. Since we take first differences, we should observe first-order autocorrelation and no second-order autocorrelation in the residuals.

## EMPIRICAL TESTING AND DATA

To examine whether the sample data is normally distributed, we can see from mean, median, standard deviation, skewness, kurtosis and the Jarque-Bera value. A sample that is normally distributed is the value of skewness that will be equal to zero, the value of kurtosis should be three, the value of mean should be the same as the value of its median, and the value of Jarque-Bera should not be significant or with high value of probability. Generally, a sample data that is normally distributed will produce a good, unbiased and consistent estimation.

Nevertheless, the figures reported in Table 1 shows that the skewness, kurtosis and Jaque-Bera values indicate that the sample data is not normally distributed. The reason is that none of its characteristics is identical to the one recently discussed. For all variables, the values of mean and median are not the same; the values of skewness are not equal to zero (data distributed are not symmetrical around mean that is skewed to the right). At the same time the values of kurtosis are not equal to three and this fortify the earlier findings. Similarly to the values of Jarque-Bera, apart being significant the values rejected the hypothesis that the data are normally distributed. The above initial findings indicate that the estimation of the determinants of fiscal decentralization that affect the economic growth will not produce a better result using OLS estimation technique.

**Table 1: Summary Statistics**

| | Mean | Median | Std. Dev. | Skewness | Kurtosis | Jarque-Bera |
|---|---|---|---|---|---|---|
| $risk_{it}$ | 0.1009 | 0.0498 | 0.2215 | 5.8059 | 42.3917 | 9346.2440 |
| $compete_{it}$ | 1.0558 | 0.5167 | 4.6155 | 9.8813 | 100.9511 | 44932.3800 |
| $compete_{it-1}$ | 22.2208 | 0.2670 | 221.6303 | 10.2454 | 105.9826 | 49613.7900 |
| $CAR_{it}$ | 0.0981 | 0.0891 | 0.0918 | 9.0776 | 100.1737 | 63113.0800 |
| $ROA_{it}$ | 1.9809 | 1.7125 | 1.2714 | 1.2792 | 5.0913 | 49.5907 |
| $loan_{it}$ | 13.2600 | 13.6882 | 2.1131 | -0.8217 | 3.3368 | 13.7197 |
| $size_{it}$ | 0.3863 | 0.3060 | 0.4693 | 4.6114 | 36.8410 | 6048.8370 |
| $gdp_{it}$ | 10.8245 | 10.8437 | 0.1416 | -0.2166 | 2.5723 | 2.5481 |
| $M3_{it}$ | 4.0957 | 8.2347 | 22.5434 | -2.4042 | 7.7322 | 312.9118 |
| $uem_{it}$ | 3.1436 | 3.2000 | 0.3982 | -0.4330 | 1.7598 | 15.7310 |

Table 2 presents the correlation matrix of the regression variables. The correlations indicate a statistically significant correlation between bank variable and each of the explanatory variables. The correlations between bank variable and variables of macroeconomic factors have a positive sign. We find a negative relationship between all our measures and proxies of bank market power in both, the loan and deposit markets and bank's commercial NPL ratios, our measure of bank risk. Therefore, simple correlation analysis points towards a negative relationship between market power and bank risk, supporting the franchise value paradigm. As expected, commercial NPL ratios are correlated negatively with the business cycle. It seems that specialization in lending to firms has a positive effect on screening and monitoring of borrowers by bank while current problem loans have a negative impact on current profitability. The correlation between size of the bank and risk in business loans seems weak. Profitability of banks seems to be inversely related to the number of banks operating in each local market and positively related to the standard concentration measures as well as market power indicators.

**Table 2: Correlation Matrix**

| | $risk_{it}$ | $compete_{it}$ | $compete_{it-1}$ | $CAR_{it}$ | $ROA_{it}$ | $size_{it}$ | $loan_{it}$ | $gdp_{it}$ | $M3_{it}$ | $uem_{it}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $risk_{it}$ | 1.0000 | | | | | | | | | |
| $compete_{it}$ | -0.0571 | 1.0000 | | | | | | | | |
| $compete_{it-1}$ | -0.0537 | 0.9941 | 1.0000 | | | | | | | |
| $CAR_{it}$ | 0.8283 | -0.0235 | -0.0155 | 1.0000 | | | | | | |
| $ROA_{it}$ | 0.0003 | 0.0481 | 0.0441 | -0.0683 | 1.0000 | | | | | |
| $size_{it}$ | 0.0207 | -0.1667 | -0.2016 | -0.0986 | -0.2556 | 1.0000 | | | | |
| $loan_{it}$ | 0.2792 | -0.1362 | -0.1370 | 0.2722 | 0.2196 | 0.0578 | 1.0000 | | | |
| $gdp_{it}$ | 0.1420 | -0.0233 | -0.0384 | 0.0748 | -0.1458 | 0.4197 | 0.0038 | 1.0000 | | |
| $M3_{it}$ | -0.1192 | 0.2411 | 0.2482 | 0.0023 | -0.0614 | -0.1095 | -0.0251 | -0.1180 | 1.0000 | |
| $uem_{it}$ | 0.1685 | -0.2673 | -0.2875 | 0.0536 | 0.0300 | 0.3574 | 0.0852 | 0.5376 | -0.6999 | 1.0000 |

***Table 3: Estimation Analysis***

| Specification | Parameter Estimates | |
|---|---|---|
| | Model I (GMM-Difference) | Model II (GMM-System) |
| $risk_{it-1}$ | -0.1398 (-3.5778)* | 0.0466 (1.1024)** |
| $compete_{it}$ | 0.0010 (0.1663)* | 0.0031 (0.3770)* |
| $compete_{it-1}$ | -5.24E-05 (-0.4121)** | -9.85E-05 (-0.5744) |
| $CAR_{it}$ | 1.5706 (19.6316)* | 1.8731 (19.5694)* |
| $ROA_{it}$ | 0.0160 (2.8334)* | 0.0265 (3.8637) |
| $size_{it}$ | 0.0464 (3.2677)* | 0.0232 (2.2245)** |
| $loan_{it}$ | -0.0921 (-2.9588)* | -0.1780 (-6.5768) |
| $gdp_{it}$ | -0.2375 (-1.3323)** | -0.0144 (-0.0762) |
| $gdp_{it-1}$ | 0.1295 (1.1354)** | 0.4515 (3.3963)** |
| $M3_{it}$ | 0.0002 (0.1319) | -0.0041 (-2.2149)** |
| $uem_{it}$ | -0.0246 (-1.5464) | -0.0745 (-3.6380)* |
| $R^2$ | 0.5715 | 0.5277 |
| $Adj\ R^2$ | 0.5226 | 0.4959 |
| *MSE* | 0.141759 | 0.133425 |
| Sargan test | 35.49472 | 34.11282 |

*Significant at 1% **Significant at 5% ***Significant at 10%
( ) t-value
Sargan test refers to the test of over-identifying restrictions.

The GMM results are presented in Table 3. First of all, it is worth noting that variables in the empirical equation are defined in levels, while some (such as $risk_{it-1}$) are likely to be correlated with $\eta_i$. As usual in panel data analysis, we proceed to transform into first differences, to enable unbiased estimates to be obtained. Further, as the lagged endogenous variable is included among the regressors and other explanatory variables are likely to be endogenous, an estimation procedure based on the generalized method of moments (GMM) seems the most appropriate. In particular, the instruments chosen for the lagged endogenous variable $compete_{it-1}$ and $gdp_{it-1}$. These lags have been chosen to avoid correlation with the error term $\varepsilon_{it}$ (which now appears in first differences) while minimizing, at the same time, the number of observations lost. The variables of size and business cycle are considered to be exogenous and therefore used as their own instruments.

Columns 3–4 of Table 3 present the baseline results of estimating equation for the lagged risk and business cycle indicators. The findings with respect to the other variables are also worth mentioning. The estimated coefficients of the lagged risk confirm our dynamic specification at the one percent significance level in Model II and Model I.

We find highly significant and negative coefficient of capital ($CAR_{it}$), The coefficient of the proxy for the cost of capital adjustment is reflecting a rather slow adjustment of capital to the target level. This implies that the costs of adjustment are substantial: on average, it takes years before the level of capital is adjusted. It may also reflect that bank capital is driven by bank income and default losses rather than by continuous policy adjustments. Apparently, capital reserves adjust more slowly towards their optimal (or model) value than is observed by a similar model for the level of loans.

With respect to cyclicality, we find a highly significant and positive sign coefficient for $gdp_{it}$ and $uem_{it}$ in model I but in model II, $gdp_{it}$ not significant. Based on model I and II, we also find that coefficients of $loan_{it}$ are negatively related with risk and significant at one percent in model GMM-differencebut not significant in model GMM-system. We find a clear positive size ($size_{it}$) effect, which, as explained earlier, may be due to several reasons. A higher level of monitoring and screening in large banks. In terms of the diagnostics, the Sargan test fails to reject the null hypothesis of the validity of the instruments at 5 per cent level.

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