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**REPORT**

# **Determinants of banking fragility**

Comparing Islamic and conventional banks  
An application of survival analysis

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## Introduction

The mechanism that conventional banks use to channel funds from surplus to deficit units relies on the interest rate; the spread between the offered and the charged interest rates determines the bank's profits. Commercial banks rely mostly on low wealth clients whereas investment banks are used by a few high wealth individuals and companies. Investment banking has been considered more risky as it is primarily involved in capital markets<sup>[1]</sup>. A bank was not allowed to operate in commercial and investment at the same time until 1999 when the Gramm-Leach-Bliley act was repealed thus allowing the formation of bank holding companies that could engage in all types of financial services<sup>[2]</sup>.

Islamic banks do not use interest to channel funds; they rely mostly on fees for simple "trade contracts"<sup>[3]</sup> and on equity for "partnership contracts"<sup>[4]</sup>. Islamic banks are not yet fully standardised, hence working at the micro level would incur more costs as contracts should be created from scratch every time. Conse-

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1 This is a very simple classification based on the origin of the funds. For a more detailed description of commercial and investment banks see Hefernan (2002)

2 This act is for the US, but similar acts were voted in other countries in the later years.

3 Murabahah for example can be classified as a "trade contract". In Murabahah the Islamic bank buys an assets and sells it at a mark-up which accounts for its expenses.

4 Mudarabah for example can be classified as a "partnership contract". The Islamic bank and the entrepreneur enter a contract under which the bank finances a business venture and the entrepreneur runs the business. Repayment is done according to a pre-agreed share ratio if the venture is profitable.

quently Islamic banks operate mainly at the macro level financing big scale projects (e.g. infrastructure projects); thus having similarities with investment banks. However, they offer deposit schemes to low wealth individuals; thus sharing similarities with commercial banks as well. Even so, it is argued that Islamic banking does not share the same risks with the conventional banking system for two main reasons. Firstly, the nature of Islamic banking products requires an underlying real asset (i.e. not debt) such as machinery, vehicles or land. It is argued that, unlike debt contracts, such assets are not affected by speculative pressure; hence the economic system will be more stable. Secondly, the equity character of partnership contracts does not contractually force the bank to offer a positive return, as happens under debt securities in the conventional system. Consequently in the event of an economy slowdown the Islamic bank is not obliged to give positive returns to its investors.

Although the aforementioned arguments have been discussed in a theoretical context, an empirical application is still lacking from the literature. By selecting a sample of Islamic and conventional banks from the MENA<sup>[5]</sup> and Far East region we empirically address these questions. We investigate the stylised facts of the banking regimes' hazard functions. The hazard function of a bank shows the impact of various economic factors upon its survival time. By modelling the hazard function we want to provide empirical evidence on the differences and similarities of conventional and Islamic banks.

## Data and Methodology

The dataset used includes 36 Islamic and 161 conventional<sup>[6]</sup> banks operating in the same countries in the 2002 – 2007 period. Sources for all financial statements are the Bankscope and Islamic Development Bank databases. Explanatory variables include: loans, assets, equity, liabilities, return-on-assets (RoA), return-on-equity (RoE) cost to income. Income diversity is included<sup>[7]</sup> as a measure of how diversified a bank's operations are. Equity-to-liabilities and loans-to-assets are also used because of their significance in similar studies. Year-to-year growth on assets and growth on loans are added to capture the magnitude

there were 4 failures. Rate of failure for conventional banks is 6.2% and for Islamic banks is 11%.

The results from the Cox proportional hazards model<sup>[9]</sup> are presented in table 1 (conventional banks) and table 2 (Islamic banks). The probability value shows the significance of each explanatory variable. A positive (negative) coefficient shows that an increase in the covariate is associated with a higher (lower) hazard for the bank. The hazard ratio<sup>[10]</sup> (HR) shows the magnitude of the rise or fall on the bank's survival time.

	Hazard Ratio	Coefficient	Stand. Error	Z	Probability
<b>Equity/Liabilities</b>	0.353	-1.040	0.142	-2.58	0.010
<b>Growth of Assets</b>	0.001	-8.819	0.001	-1.78	0.076
<b>Income Diversity</b>	0.116	-2.154	0.099	-2.52	0.012
<b>Growth of Liabilities</b>	21.36	3.061	40.736	1.61	0.108
<b>RoE</b>	0.985	-0.014	0.009	-1.46	0.144
<b>Cost to Income</b>	1.001	0.000	0.014	0.02	0.981

**Note:** Data on explanatory variables of the first year of the sample are taken into account in this model. Signs on explanatory variables agree with the literature and our expectations. An increase in Equity/Liabilities by one unit will lead to a decrease in the risk of bank failure by approximately 65% (1-HR %).

of a bank's expansion. Macroeconomic variables (real GDP growth, inflation, concentration) are included<sup>[8]</sup>. We use survival analysis techniques and more specifically the Cox proportional hazards model.

## Results

Out of 161 conventional banks 10 failed in the examined period, while for Islamic banks

The signs of the covariates in the Cox model of conventional banks (table 1) match our expectations and agree with the literature. All variables (except for growth of liabilities and cost to income) have negative coefficients; consequently a rise, for instance, in equity-to-liabilities will decrease the hazard of bank failure by 65%.

6 We use only commercial banks in the analysis, as classified by Bankscope

7 Income Diversity is defined as: 1-(net operating income-other income/total income)

8 World Economic Outlook 2008

9 An iterative algorithm was used to select among all the candidate variables. The models presented are the ones with the best fit.

10 The Hazard Ratios are calculated as the exponential of the coefficients. Equally, coefficients are the logarithms of hazard ratios

The model that best fits the Islamic banks (table 2) is different to the one for conventional banks. The significant explanatory variables are equity-to-liabilities, growth of assets and RoE. A rise in growth of assets and RoE results in lower hazard and therefore longer survivor time for the Islamic

are allowed under certain circumstances to mingle investors' funds with their own equity. Consequently equity would reflect a proportion of the business risk that the Islamic bank undertakes.

**Table 2: Cox Proportional Hazards model in the Islamic banks.**

	Hazard Ratio	Coefficient	Stand. Error	Z	Probability
<b>Equity/Liabilities</b>	1.680	0.519	0.190	4.60	0.000
<b>Growth of Assets</b>	0.011	-4.490	0.026	-1.87	0.061
<b>RoE</b>	0.930	-0.072	0.021	-3.17	0.002

**Note:** Data on explanatory variables of the first year of the sample are taken into account in this model. Signs on explanatory variables agree with the literature and our expectations. The model for the Islamic banks is different than the conventional banks giving evidence that the banking systems' fragility is not captured by the same indicators. The hazard ratio on equity/liabilities is greater than 1 for Islamic banks indicating that an increase in the ratio will lead to an increase in the risk of bank failure (which is opposite to conventional banks).

**Table 3: Cox Proportional Hazards model in the Islamic banks with real GDP growth.**

	Hazard Ratio	Coefficient	Stand. Error	Z	Probability
<b>Equity/Liabilities</b>	2.805	1.031	0.608	4.75	0.000
<b>Growth of Assets</b>	1.591	0.464	3.975	0.19	0.853
<b>RoE</b>	0.919	-0.083	0.022	-3.39	0.001
<b>Real GDP growth</b>	0.357	-1.027	0.097	-3.79	0.000

**Note:** This is the alternative model which includes GDP growth. GDP Growth is highly significant and with the expected sign indicating that the Islamic banks have a closer link to the real economy. Growth of assets turns insignificant possibly because it acts as a good proxy for GDP growth. Data on explanatory variables (covariates) of the first year of the sample are taken into account in this model. Signs on explanatory variables agree with the literature and our expectations.

bank. Conversely an increase in equity-to-liabilities leads to higher hazard and 68% lower survival time. Consequently the effect of equity upon bank fragility is different in the two bank regimes. This is attributed to two factors; first the equity form of contracts that Islamic banks utilise can be susceptible to moral hazard issues. As Islamic banks expand, more projects are financed by participation contracts. These contracts need to be evaluated and monitored closely and since contracts and processes are not yet fully standardised, operational risk is high. Second, Islamic banks

### Macroeconomic Variables

Results of table 3 show that real GDP growth can be included as an explanatory variable in the model for Islamic banks while being highly significant and with the expected sign. However, when it is included, growth of assets becomes insignificant. This finding shows that growth of assets can work as a proxy for real GDP growth. Moreover the growth and expansion of Islamic banks is directly related to the real economy. In addition the fact that GDP growth is a significant explanatory variable in the model for Islamic banks, whereas it is not

for conventional banks, means that the survival of Islamic banks is affected more heavily by the macroeconomic environment.

### Stratification

Enhancements of the Cox PH model include stratification variables which allow countries to be modelled according to their macroeconomic characteristics. We use real GDP

two facts. First, when stratification is selected, the hazard ratios do not change as much in the conventional banks as in the Islamic banks. Second, when Islamic banks are stratified by real GDP growth, an explanatory variable (growth of assets- that was previously highly significant) drops out. Stratification results are also indicative of the Islamic banks'

**Table 4: Cox Proportional Hazards model in the conventional banks allowing for strata.**

	Hazard Ratio	Coefficient	Stand. Error	Z	Probability
<b>Equity/Liabilities</b>	0.342	-1.072	0.145	-2.52	0.012
<b>Growth of Assets</b>	0.002	-8.487	0.001	-1.93	0.054
<b>Income Diversity</b>	0.118	-2.133	0.106	-2.38	0.017
<b>Growth of Liabilities</b>	26.417	3.274	51.327	1.69	0.092
<b>RoE</b>	0.985	-0.014	0.009	-1.48	0.139
<b>Cost to Income</b>	1.004	0.004	0.015	0.27	0.785

**Note:** Data on explanatory variables (covariates) of the first year of the sample are taken into account in this model. Signs on explanatory variables agree with the literature and our expectations. An increase in Equity to liabilities by one unit will lead to a decrease in the risk of bank failure by approximately 66% (1-HR %). Strata are defined according to inflation. Two groups are made (inflation>8% and inflation≤ 8%). In comparison with the un-stratified model the model with strata is better based on the AIC

**Table 5: Cox Proportional Hazards model in the Islamic banks allowing for strata.**

	Hazard Ratio	Coefficient	Stand. Error	Z	Probability
<b>Equity/Liabilities</b>	1.964	0.675	0.256	5.17	0.000
<b>Growth of Assets</b>	0.652	-0.427	1.076	-0.26	0.796
<b>RoE</b>	0.926	-0.074	0.022	-3.05	0.002

**Note:** Data on explanatory variables (covariates) of the first year of the sample are taken into account in this model. Signs on explanatory variables agree with the literature and our expectations. An increase in Return on Equity (RoE) will lead to a decrease in the risk of bank failure by approximately 7% (1-HR %). Strata are defined according to real GDP growth. Two groups are made (real GDP growth > 4% and real GDP growth ≤ 4%). In comparison with the non-stratified model the model with strata is better based on the AIC. Signs remain the same and hazard ratios only change slightly. Because of the special nature of Islamic banks, the decrease in failure risk captured by growth of assets is now incorporated in the stratified baseline function.

growth, inflation, GDP per capita, region and market concentration as variables to identify the different strata. Models allowing for stratification fit better (lower AIC<sup>[11]</sup>) in both banking regimes. Tables 4 and 5 present the best-fit models for conventional and Islamic banks respectively. Results of stratification show that Islamic banks are affected to a greater extent by macroeconomic conditions than conventional banks. This is verified by

weakness in the sense that they do not share the same investment universe to conventional banks; thus not having the same hedging opportunities in the event of unfavourable economic climate. The best stratification for conventional banks is given by inflation while for Islamic banks by real GDP growth. Market concentration does not influence banking fragility.

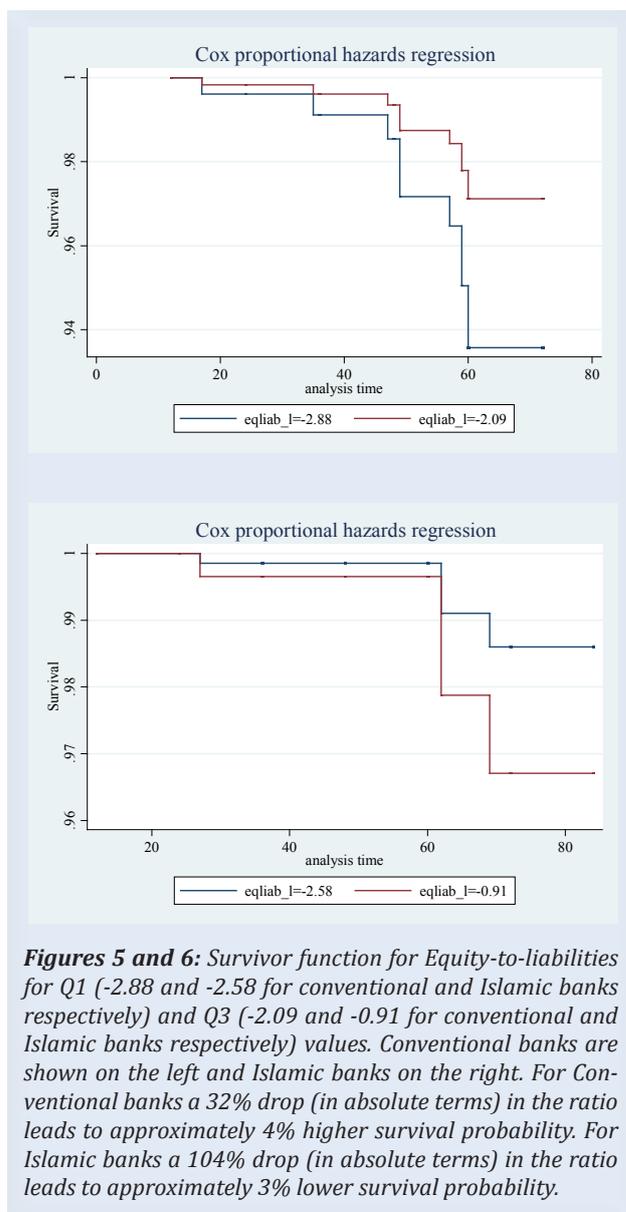
## Frailty

Frailty is defined by the same variables used for the stratification but now the question is whether the failure of a bank is caused by the macroeconomic variables that were used to distinguish among the groups. In other words, frailty investigates whether a bank operating in a country with, for instance high inflation, faces an increased hazard that could lower its survival time. The most important finding of this analysis is that when inflation is used in the Islamic banks' model, then the frailty term ( $\theta$ ) is significant at the 10% significance level and the hazard ratio of  $\theta$  is positive ( $\theta=4.87$ ). This means that Islamic banks that operate in a high inflation background have an additional, common source of risk that could increase their probability of failure. This could be attributed to inflation causing capital to lose its purchasing power. Conventional banks have financial products that protect investor's capital against inflation. By contrast, any capital protection contractually offered by Islamic banks is prohibited under the Shariah Law. However, as Islamic banks operate alongside conventional banks, they will be subject to competition forcing them to accept investment with higher yields in order to offer some basic protection against inflation to their clients. Naturally, higher returns come with higher risk for the bank.

## Graphs

The survival function of the banks can be drawn for any value of the covariate that we specify. For comparison we

choose to plot the survivor functions for the 1<sup>st</sup> and 3<sup>rd</sup> quartile<sup>[12]</sup> of equity-to-liabilities for conventional and Islamic banks.



**Figures 5 and 6:** Survivor function for Equity-to-liabilities for Q1 (-2.88 and -2.58 for conventional and Islamic banks respectively) and Q3 (-2.09 and -0.91 for conventional and Islamic banks respectively) values. Conventional banks are shown on the left and Islamic banks on the right. For Conventional banks a 32% drop (in absolute terms) in the ratio leads to approximately 4% higher survival probability. For Islamic banks a 104% drop (in absolute terms) in the ratio leads to approximately 3% lower survival probability.

For conventional banks a 32% drop (in absolute terms) in the ratio leads to approximately 4% higher hazard. For Islamic banks a 104% drop (in absolute terms) in the ratio leads to approximately 3% lower hazard.

## Conclusion

Motivated by the recent debates on whether Islamic banks are more resistant to financial crises, whether the same factors that could put a conventional bank in danger have the

12 Q1: -2.88 and -2.584; Q3: -2.09 and -0.91 for conventional and Islamic banks respectively.

same impact on Islamic banks and by the rate of default on this area we use survival analysis methods to give some insight to these questions. Using a sample ranging from 2002 to 2007 and including 161 conventional and 36 Islamic banks we have reached some significant conclusions that would be useful to policy makers and regulatory bodies so that Islamic banks could be regulated effectively. We find that Islamic banks are more fragile than conventional banks, as the rate of default for Islamic banks (11%) over the examined period was almost two times the failure rate for conventional banks (6.2%).

Secondly, we find that the hazard functions of conventional and Islamic banks are influenced by different factors and in different proportions. The most notable difference is equity-to-liabilities which has opposite effects in the two bank regimes. In conventional banks, a rise in this ratio will lead to a decrease in the hazard. By contrast, in an Islamic bank the increase of the same ratio will lead to higher

hazard. This difference is attributed to the different type of financial products and the fund-mingling techniques used by Islamic banks. Consequently we believe that any regulatory attempt needs to consider the special role that equity plays in an Islamic bank.

Thirdly, the inclusion of macroeconomic variables leads to models with higher statistical significance. When real GDP growth is included in the model, the Islamic banks' growth-of-assets variable loses its statistical significance meaning that there is a close relationship between them. Islamic banks operating in high inflationary environments face an additional competition from the competition of conventional banks that offer inflation-linked financial products. This forces Islamic banks to undertake more profitable, thus riskier, projects to compete with the higher returns offered by conventional banks.

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The main purpose of the Centre is to conduct empirical research focused on key economic and financial developments in the Middle East and North Africa (MENA) region, with special emphasis on the Gulf region. This region includes Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates, countries that form the Gulf Cooperation Council.

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