A Survival Analysis of Islamic and Conventional Banks

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Abstract Are Islamic banks inherently more stable than conventional banks? We address this question by applying a survival analysis based on the Cox proportional hazard model to a comprehensive sample of 421 banks in 20 Middle and Far Eastern countries from 1995 to 2010. By comparing the failure risk for both bank types, we find that Islamic banks have a significantly lower risk of failure than that of their conventional peers. This lower risk is based both unconditionally and conditionally on bank-specific (microeconomic) variables as well as macroeconomic and market structure variables. Our findings indicate that the design and implementation of early warning systems for bank failure should recognize the distinct risk profiles of the two bank types.

Keywords Islamic banks • Failure risk • Survival analysis • Financial intermediation

JEL Classification C41 • G21 • G20

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1 Introduction

The management and operation of Western commercial banks has been the subject of much debate and research. A sound banking system that maintains credit flows to the private sector has become a primary objective for both policymakers and bank regulators around the globe (Levine and Zervos 1998; Reinhart and Rogoff 2009). However, mismanagement, poor performance, and bank failures were prominent during the recent financial crisis. One sector of the global financial system that has attracted attention because of its resilience during the recent crisis is Islamic banking. With total bank assets around $1.8 trillion and a strong annual growth rate, Islamic banking is quickly becoming an important part of the global financial system (Ernst and Young 2015; IMF 2015). Some of the factors that have contributed to the growth of the Islamic banking industry have been the increased demand for products that are compliant with the Islamic Law (Shariah), persistent oil revenues that fuel the core Islamic finance markets, safer and more stable returns on investments, and the operational transformation that has led to enhanced and differentiated products.

Islamic banking is built on a set of principles emanating from the Shariah. These principles differentiate it substantially from conventional banking in terms of financial products and objectives. In particular, Islamic banking is characterized by the prohibition of interest, complex derivatives, and short-selling. Shariah also bars investments that involve dealings in alcohol, gambling, and tobacco.

Although key observable features distinguish the Islamic banking sector from the rest of the financial system, skeptics still argue that these differences have no practical significance; see, e.g. Khan (2010). To shed light on this debate, recent studies have compared Islamic and conventional banks on the basis of business models, efficiency, asset quality, credit risk, and stability.[1] To mention a few, Boumedeine and Caby (2009) show that Islamic banks have low volatility in their returns and greater resilience to the impact of crises. Čihák and Hesse (2010) find that the smaller Islamic banks tend to be financially stronger than commercial banks overall. Yet the larger Islamic banks are not as financially stable, which may be due to the challenges in managing credit risk. Beck et al. (2013) conclude that Islamic banks were better capitalized and had higher asset quality that made them relatively less vulnerable to the recent financial crisis. Similar findings are reported in the studies of Moazzam and Zaheer (2013) and Van Wijnbergen and Zaheer (2013). However, Abedifar et al. (2013) compare the relation between risk and stability for both bank types, including "mixed" banks with both Islamic and

[1] Although most studies tend to look at efficiency and stability in isolation, there are a few that examine the link between these concepts (see, e.g., Koutsomanoli-Filippaki and Mamatzakis (2009) and Koetter and Porath (2007) for applications using conventional banks, and Saeed and Izzeldin (2014) for a comparative study between Islamic and conventional banks). However, the exact link between efficiency and stability is not clear cut. For the Islamic versus conventional bank exposition, Kuran (2004) suggests that higher efficiency leads to higher stability, while Beck et al. (2013) finds the inefficient Islamic banks are more stable. Saeed and Izzeldin (2014) offer a nice exposition of the theories linking efficiency and stability in conventional banking. We opt not to address the issue of efficiency and stability in this paper due to data limitations arising from the necessity to use listed banks; we leave it instead for future research.

conventional "windows." While they uncover no significant differences with respect to insolvency risk, their findings regarding credit risk indeed depend on the proxy that is used.

Islamic and conventional banks differ conceptually in many aspects regarding their operations business model which, in turn, may lead to different survival rates. As regards their operations, the *"no money for money"* principle of Islamic banking implies that risk-sharing practices are embedded on both sides of the bank's balance sheet. Islamic banks' depositors are treated as investment account holders or preferred stockholders with a residual claim to profits but without explicit capital protection; hence, they share the risks of the banks' investments. On the one hand, this is likely to exacerbate the bank's withdrawal risk (Ebrahim, 1999). On the other hand, religious beliefs may instil a certain loyalty in depositors which would allow banks to pass on realized losses in bad times, thereby achieving some pro-cyclical protection. Islamic banks use two types of funding sources: equity/participation type and fee-based services.[2] The equity type is mainly used by large banks due to the relatively high costs involved (e.g., execution and Shariah compliance screening). By contrast, fee-based services offer a more certain source of income without exposure to adverse information and moral hazard issues.

A common theoretical aspect of all Islamic banking financial products is that they are asset-backed which should enhance stability during market distress. Debt contracts are precluded (unless these are backed by tangible assets such as real estate or commodities, that is, Islamic bonds) and thus Islamic banks face important restrictions on how to obtain liquidity. Furthermore, the tradability of Islamic bonds is curtailed by underdeveloped secondary markets in the majority of the countries in question which imposes additional constraints. But Islamic banks are subject to the same market conditions as conventional banks including competitive pressure and having a similar need for protection against deposit withdrawal. Against these risks, Islamic banks withhold more liquidity, maintain profit-equalisation reserves (profits in good periods as buffer to reduce volatility of payout in bad periods) and protect depositors/investment accountholders by shifting losses to shareholders (displaced commercial risk).[3]

The objectives of Islamic banks do not neatly square with the conventional profit maximization (cost minimisation) dogma. Islamic banks are more likely to be proponents of ethical banking with emphasis on charitable actions and interpersonal trust. Such practices are deeply rooted within the

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[2] Mudarabah and Musharakah are commonly used equity/participation type of contracts. In Mudarabah an investor (usually an Islamic bank) and an entrepreneur (individual or institutional) enter a joint venture where the bank provides the necessary funds and the entrepreneur provides the know-how. Fee-based services include the widely used contracts of Murabahah and Ijarah. Murabahah is in essence a cost-plus-profit sale. The bank arranges to sell a good to a customer at a premium which incorporates risks, costs and a profit margin. Ijarah is a lease contract where the bank leases an asset to an investor (or consumer) and the latter pays fees for utilising the asset.

[3] Islamic banks operating alongside conventional banks are subject to displaced commercial risk which is the risk arising from managing assets on behalf of investment accountholders that is effectively transferred to the Islamic banks' own capital. This risk unfolds as the bank may forgo its profit share on such investment when it considers this essential due to the commercial pressure in order to increase the rate of return payable to investment accountholders.

Islamic banking culture with a dedicated Shariah board overlooking the conformity of products and practices to the Islamic law. The role of Islamic banks as business partners in financing operations, in principle, ought to mitigate adverse selection and moral hazard. As such, suppliers of funds may be induced to greater diligence while borrowers' opportunistic behaviour to avoid repayment would be discouraged in fear of social disapproval.[4]

Lastly, Islamic banks predominantly focus on large scale financing of infrastructure and real estate projects given that contracts are tailor-made and need to undergo screening for compliance which increases complexity and costs. However, country variations do exist in Islamic banks with regards to clientele profile, operations and availability of financial products.

Following the differences outlined above, we anticipate the risk of failure to differ substantially between the two bank types. Failure risk is multifaceted; it involves credit risk, deposit withdrawal risk, insolvency risk, liquidity risk, and operational risk. For each type of risk, reasonable priors and theoretical arguments imply that Islamic banks are either less or more likely to experience failure than conventional banks. Given the differences in the business model of Islamic and conventional banks, we expect that distinct levels of exposure to all of these risks types might eventually lead to different failure risk profiles. But whether Islamic banks survive longer than conventional banks is an important yet still open empirical question.

This paper aims to contribute to a rapidly growing empirical literature by singularly investigating whether differences in failure risk exist between the Islamic banks and the conventional banks. For this purpose, we use the survival analysis to compare the hazard rates across the two bank types and to assess their determinants. While recent papers address the issues that pertain to the credit and insolvency risks of Islamic banks, none estimates their hazard rates directly by using the survival analysis. The survival models circumvent the need for proxies of the failure risk of banks that might lead to a distorted comparison (Abedifar et al. 2013). Indeed, one of the main advantages of the survival analysis in the present context is that it uses the actual time-to-failure as the main observable variable. The survival functions that identify the probability of survival beyond a certain number of years can also help to identify the determinants of the differential failure risk profiles associated with the two bank groups.

We find that, both unconditionally and conditionally on bank-specific (microeconomic) variables as well as macroeconomic and market structure variables, the Islamic banks exhibit on average lower hazard rates than the conventional banks. In addition, the two bank types differ in their failure-risk sensitivities to several of the covariates that, in turn, confirm that their failure risk profiles are distinct. The z-score measure, widely-used as bank stability proxy, cannot differentiate between the two bank types in our sample. Bank characteristics explain at least one third of the total variation in the hazard

[4] Relatedly, Ostergaard et al. (2015) find that banks in communities with high social capital, such as interpersonal trust, civic engagement and charitable work are more likely to survive compared to banks driven by profit-maximization motives.

rates, while the inclusion of macroeconomic and market structure variables adds another ten percentage points to the survival models' explanatory power. Moreover, the country affiliation has a significant impact on the failure risk for the conventional banks but not for the Islamic banks. This impact suggests that only the conventional banks are locally interconnected from the viewpoint of failure risk.

The findings also indicate that the conceptual differences in the business model of the two bank types are ultimately manifested in their distinct failure risk profiles. Among the bank-level covariates for which the sensitivities of the hazard rates differ across the two bank types, higher leverage and higher margins imply that Islamic banks are less likely to fail, while the opposite effect applies to conventional banks; this finding vividly demonstrates how their modi operandi differ. Among the key macroeconomic factors, high inflation harms the Islamic banks the most, possibly because of their greater reliance on cash reserves and their widespread use of commodities as collateral. The greater banking sector concentration adversely affects the survival propensity of Islamic banks, while it reduces the failure risk of conventional banks; this may relate to the fact that in many markets, the Islamic banks are the new entrants while the conventional banks are the incumbents. Lastly, we show that the survival models that in reduced-form incorporate distinctive features of the Islamic banking system yield more reliable predictions of the risk of Islamic bank failure than general (one-size-fits-all) survival models.

This paper aims to investigate whether differences in failure risk exist between the Islamic banks and the conventional banks. The paper contributes to the literature on Islamic banks in at least three ways.

First, we show that the hazard function of Islamic banks is different from those of conventional banks and provide the first formal tests of the hypothesis that Islamic banks are as equally likely to fail as conventional banks by using a survival analysis that exploits actual bank failures. We also justify why it is more appropriate to adopt models relying on actual bank failures than panel models relying on default risk proxies. The survival framework can deal with censoring effects; hence inferences are based on surviving as well as failed banks, all of which could have started operating at different points in time, thereby eliminating any unaccounted for survivorship bias that earlier studies might suffer from.

Second, the use of the semiparametric Cox proportional hazard model enable us to draw comparisons between both bank types regarding the sensitivity of their failure risk to a comprehensive array of bank characteristics, macroeconomic conditions and market structure variables that extend those previously featured in the literature (see, e.g., Čihák and Hesse 2010 and Beck et al. 2013). Moreover, it has the advantage of not invoking any distributional assumptions with respect to the baseline hazard function.

Third, we show that failure-risk predictions generated through general and bank type-specific models lead to different conclusions. The results highlight the importance of taking into account the distinctiveness of Islamic banks in the context of failure-risk prediction. For instance, an Islamic bank specific model can identify the troubled Islamic banks better than a general model that does not cater for these banks' distinct features. This finding is useful for regulators involved in the design of Early Warning Systems in a financial system where both bank types co-exist.

The rest of the paper unfolds as follows. Section 2 presents the methodology and Section 3 describes the data. The empirical findings and implications are gathered in Section 4. Section 5 concludes.

2 Methodology

We use the survival analysis that is better suited for our purposes than conventional classification techniques, such as the discriminant analysis or the binary logit model. The main reason for using the survival analysis is because it yields estimates of the expected time-to-failure. Second, the parameter estimation can be done with the partial maximum likelihood that requires no distributional assumptions on the time-to-failure. A third reason is that the analysis recognizes the continuous-time nature of the failure probability. Lastly, both censored and complete lifetime data are easily accommodated.

The latter aspect is very appealing because it implies that the survival analysis of the banks' failure risk naturally controls for the fact that the observation period might not represent a bank's entire lifetime. Because the models exploit information on duration or survival time, defined as the actual number of years a bank has been in business, left-censoring is naturally avoided. However, a bank could remain in business beyond the sample, a problem that is known as right-censoring; the likelihood function of the survival models is formulated explicitly to account for the right-censored data.[5]

Moreover, the survival analysis is a more flexible method to analyze the risk of bank failure than an OLS analysis because an OLS requires a proxy for default or insolvency risk such as the z-score or Merton's distance-to-default. The z-score gives the number of standard deviations that the bank's return on assets (ROA) must drop below its mean in order to deplete equity as a percentage of assets, which leads to insolvency. One of the reasons for the popularity of the z-score is that it can be simply calculated from the ROA and the capital-asset ratio. But it has several drawbacks. One is that it assumes that the probability distribution of the bank's ROA is Gaussian that effectively implies ignoring higher-order moments such as skewness and kurtosis. But it is widely recognized that the Gaussian distribution is a crude (at best, first-order) approximation for financial returns because it presumes symmetry and underestimates downside tail risk. Another drawback to the z-score is that it merely acts as a proxy for the risk of insolvency but it does not convey information on the actual failure event. Because of the distinctive business model of the Islamic banks, it is not necessarily the case that the z-score is

[5] For a deeper technical discussion on survival analysis, see Hosmer et al. (1999) and Kalbfleish and Prentice (2002).

applicable to them. Moreover, other measures such as Merton's distance-to-default require the use of listed banks that imposes an important constraint on the cross-sectional dimension of the sample.

Banking studies that specifically address the issue of failure risk through the survival analysis follow two strands. The first one makes use of the semiparametric Cox proportional hazard model (Cox 1972; henceforth, the Cox model) that has the advantage of not requiring any distributional assumption on the hazard function and hence is a distribution-free approach. An early paper by Lane et al. (1986) adopts this framework to investigate the prediction of failure in the US banking sector. Whalen (1991) and Wheelock and Wilson (2000) extend Lane et al.'s study in terms of the sample. In a different setting, Dabos and Escudero (2004) examine failure in the Argentinean banking sector using the banks' accounting information. More recently, Cole and Wu (2009), Gomez-Gonzalez and Kiefer (2009) and Molina (2002) also use the Cox model to assess conventional bank failure.

The second strand of studies relies on parametric survival models that invoke distributional assumptions (see, e.g., Sales and Tannuri-Pianto (2007) for Brazil; Evrensel (2008) for a set of developed and developing countries; Männasoo and Mayes (2009) for Eastern Europe). Each of these studies assumes a different distribution for the baseline hazard (i.e., exponential, Weibull, and complementary log-log, respectively) that illustrates the potential problem of misspecification.

We use the Cox model where $\mathrm{T} \in [0, \infty)$ denotes the time-to-failure that is a random variable with the probability density function $\mathrm{f(t)}$ and the cumulative density function $\mathrm{F(t)}$ defined as

$$\mathrm{f(t)} = -\mathrm{dF(t)/dt} \tag{1}$$

$$\mathrm{F(t)} = \Pr(\mathrm{T} \leq \mathrm{t}) \tag{2}$$

The survivor function $\mathrm{S(t)}$ gives the probability of surviving beyond year t, and the hazard function or hazard rate $\mathrm{h(t)}$ is defined as the instantaneous risk of the bank's disappearance in year t conditional on its existence up to time t. These two crucial functions can be formalized, respectively, as

$$\mathrm{S(t)} = 1 - \mathrm{F(t)} = \Pr(\mathrm{T} > \mathrm{t}) \tag{3}$$

$$\mathrm{h(t)} = \lim_{\mathrm{dt}\to 0} \frac{\Pr(\mathrm{t} \leq \mathrm{T} < \mathrm{t} + \mathrm{dt})}{\mathrm{dt} \times \mathrm{S(t)}} = \frac{\mathrm{f(t)}}{\mathrm{S(t)}} \tag{4}$$

The object of primary interest in the survival analysis is the hazard rate that must be non-negative but not otherwise constrained, $\mathrm{h(t)} \geq 0$, and that provides a time-varying risk of bank failure.

We use the unconditional Kaplan and Meier (1958) estimator of the survivor function $\mathrm{S(t)}$ by using actual data on whether a bank failed over the observation window and the time when the failure occurred. The null hypothesis, the equality of the unconditional survival rates for the two bank types, is examined using a log-rank test statistic that is $\chi^2_{(1)}$ distributed.

Using the same data on bank failure together with the data on a vector of bank- and country-specific covariates, denoted $\mathbf{x}$, we can estimate the Cox model that is formalized as

$$h(t|\mathbf{x}(t)) = h_0(t)e^{\beta'\mathbf{x}(t)} \tag{5}$$

where $\boldsymbol{\beta}$ is a $k \times 1$ unknown parameter vector that represents the sensitivities of interest; $\mathbf{x}(t)$ is a $k \times T$ matrix of the variables for bank accounting statements alongside the market structure and macroeconomic indicators; $h_0(t)$ is the baseline hazard rate that is assumed to be the same for all of the banks at time t and, if the covariates have been demeaned, can be interpreted as the hazard rate of an "average" bank in the population; $h(t|\mathbf{x}(t))$ is the hazard rate and can be interpreted as the failure event rate that a bank fails any time within year t, conditional on its accounting characteristics and macroeconomic environment at the start of year t. A partial maximum likelihood estimation of the Cox model gives $\hat{\beta}_1, \ldots, \hat{\beta}_k$ without the need to specify a particular distribution for $h_0(t)$. A value $\hat{\beta}_k > 0$ indicates that a rise in the k^{th} covariate x_k increases the failure risk and decreases the survival time. The exponential coefficient $e^{\hat{\beta}_K}$ is called the hazard ratio, and $100 \times (e^{\hat{\beta}_K} - 1)$ gives the expected percentage increase in failure risk for a one unit increase in the k^{th} covariate.[6]

We also estimate a more general version of the conditional hazard function known as a shared-frailty Cox model that allows for other (unaccounted) latent country effects.

$$h_c(t|\mathbf{x}(t)) = h_0(t)a_c e^{\boldsymbol{\beta}'\mathbf{x}(t)} \tag{6}$$

$$h_c(t|\mathbf{x}(t)) = h_0(t)e^{\boldsymbol{\beta}'\mathbf{x}(t)+\nu_c}\,; \nu_c = \ln(\alpha_c) \tag{7}$$

Over and above the estimates of the sensitivity of failure risk to the observable bank-specific, market structure, and the macroeconomic covariates, $\boldsymbol{\beta}$, this model enables estimates of the contribution of latent macroeconomic factors to the bank's failure risk profile, ν_c. Logically, a value $\hat{\nu}_c > 1$ indicates that the banks operating in country c have higher hazard rates ceteris paribus. All of the country-level variables enter the model lagged by one year. A likelihood-ratio (LR) test is used to test the significance of the shared-frailty component ($\hat{\nu}_c$) (for details see Gutierrez et al. 2001).

We allow for four formulations of the Cox model with shared frailty, hereafter called Models I to IV, respectively. These models are progressively less restrictive in the sense that they allow for decreasingly fewer similarities between the two bank types. Model I is the conditional hazard function (equation 6) fitted to the pooled Islamic and conventional banks that implicitly imposes the restriction that the sensitivities gathered in $\boldsymbol{\beta}$ are identical for the two bank types. An Islamic bank dummy variable is included in the model to obtain a conditional estimate of the hazard rate differential between the two

[6] The log likelihood function that is maximized to estimate the sensitivities, β, is a partial log likelihood function as it is confined to the failure times and does not consider times when there is no failure. Thus, the only data that enter the log likelihood are the values of the covariates for both the failed and non-failed banks at the end of the sample years that immediately precede each of the observed failure times $\mathbf{x}(t_1), \ldots, \mathbf{x}(t_j), \ldots, \mathbf{x}(t_K)$, where K is the number of banks that failed during the sample period, and $N - K$ is the number of survivors.

bank types. Model II adds interaction terms between the control variables and the Islamic bank dummy, thereby allowing for the sensitivity of the hazard rate to each variable to differ between the two bank types. Models III and IV are fitted to the Islamic banks and the conventional banks separately. They can be viewed as unrestricted in the sense that they allow for more differences between the two bank types compared to Models I and II. Such differences are manifested in the marginal effect of each covariate to the hazard rate (the sensitivities) and in the baseline hazard function.

For each of the four models, we consider two variants. The first uses only bank-specific variables sourced from accounting statements. The second adds the market structure and the macroeconomic variables. The estimation is carried out by using the partial maximum likelihood and Efron's (1977) approximation for tied events that refers to banks failing within the same time interval,[7] while the inferences are based on the Huber-White standard errors that are robust to within-cluster correlations to the failure risk. A class or cluster can be defined by type, for example, Islamic banks versus conventional banks, or by geographic location. The variable selection is done through a general-to-specific procedure. Building on Lane et al. (1986), we use a forward-and-backward variable selection procedure. For each full set of K bank-specific variables and the market structure and macroeconomic variables, we start by comparing the K regressor and the $\mathrm{K}-1$ regressor models where one model is retained on the basis of two criteria: the significance of the covariates according to the p-values of the individual LR tests, and the degrees-of-freedom-adjusted explanatory power as given by the Akaike information criterion (AIC). Forward-and-backward means that variables can be added or dropped.

3 Data description and descriptive statistics

3.1 Cross-section of banks and countries

We use unconsolidated data from Bankscope over the period from 1995 to 2010 for 106 Islamic banks and 315 conventional banks located in 20 Middle and Far Eastern countries. These are all of the available countries that meet two conditions: both types of banks coexist, and the Islamic banks represent at least 1% of the total assets in the banking system.[8] This sample represents 77% of the worldwide Islamic banking industry by total assets. The use of unconsolidated data is dictated by their availability in Bankscope. The literature shows no clear preference for consolidated versus unconsolidated data. Čihák and Hesse (2010) use the former since they tend not to “beautify” a bank's financial status. Beck et al. (2013) use unconsolidated data to separately consider Islamic windows.

Table 1 shows the number of the Islamic and conventional banks for each country versus those available in Bankscope as of 2010. The table indicates that our sample has good coverage, with more than 90% of both banking systems represented, and it is somewhat more representative of the Islamic

[7] Interval-censoring arises from the imprecise measurement of time-to-failure. All we know is that a bank has failed within a certain month (this can be considered a limitation of Bankscope). The problem then is that in the event of more than one failure in any given month we do not observe the exact ordering of events. In the survival analysis, tied events are often handed via approximations. We use Efron's (1977) approximation to compromise between speed and accuracy (Cleves et al. 2010).

[8] The only exception is Iran where there are no conventional banks.

banking sector than those in previous studies because it contains 106 Islamic banks (25% of all banks sampled) whereas the studies by Čihák and Hesse (2010), Abedifar et al. (2012), and Beck et al. (2013) contain 77 (16%), 101 (22%) and 88 (17%), respectively.

[Table 1 around here]

Bankscope could contain outliers like most databases. The research has used different treatment methods for outliers (see e.g., Čihák and Hesse (2010); Beck et al. 2013). However dealing with outliers in a survival analysis context is distinct from the other regression-based methods. The survival analysis classifies the bank-year observations into two categories (surviving or failed). The bank-year observations immediately preceding the actual failure year are classified as failed. Any other bank-year observations are classified as surviving. The outliers among the surviving bank-year observations are conceptualized as "true outliers" because they lower the signal-to-noise ratio in the estimation. In contrast, the extreme observations for the failed bank-year observations are deemed informative because they could be signaling imminent distress. As such, the treatment of the outliers is ultimately a matter of judgment in a given context. In this study, we winsorize each variable at the 1st and 99th percentile but in the context of the surviving bank-year observations only.[9]

3.2. Dependent and independent variables

The dependent variable in the survival models is the time it takes a bank to fail after its inception. The main input is thus the observed failure event: the failure indicator is a binary dummy variable that takes the value of one in the year immediately prior to the actual failure and zero else. This variable equals zero for the surviving banks in all of the sample years.[10] In this study, a bank fails when any of the following criteria occurs: bankruptcy; dissolution; liquidation; negative net worth; state intervention, such as nationalization or capital injection; merger; or acquisition (Heffernan 2005). The main data source for bank failures is Bankscope but we cross-check the failed banks with the International Finance Information Service (IFIS), Islamic Development Bank (IDB), and the Zawya databases.[11]

The main independent variable of interest is a binary Islamic bank indicator that equals one for banks operating under Shariah law and zero otherwise. The Islamic banks are identified from Bankscope data and cross-checked with the IFIS, IDB, and Zawya databases. The sample covers primarily full-fledged Islamic banks. The Islamic windows are included where unconsolidated accounts exist; e.g., it is common for Islamic and conventional banks in Malaysia to coexist within a bank holding company. The column entries of the matrix $\mathbf{x}(t)$ in equations (5) and (6) include the Islamic bank indicator and a broad set of control variables. In choosing the latter we are guided by the literature and consider bank-specific variables, macroeconomic variables, and market structure variables.

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[9] As a robustness check, we conduct the 1st-99th winsorization by using all of the (survived and failed) observations. Although the main findings are not challenged, we observe slightly worse goodness-of-fit statistics. The results are available on request.
[10] Suppose that a bank failed in March 2005. Because the last year-end accounting statement available for this bank corresponds to 2004, 2004 is in effect the year of failure for modelling purposes.
[11] See http://www.islamicfinanceservice.com (IFIS), http://www.isdb.org (IDB) and http://www.zawya.com.

3.2.1 Bank-specific variables

The bank-specific variables are categorized according to the CAMELS framework of standardized accounting measures of capital, asset quality, management, earnings, liquidity, and sensitivity to market risk. The analyses based on the survival models provide evidence that the accounting information is a relevant input in predicting the failure risk of the conventional banks. For instance, Lane et al. (1986) identify certain bank-specific characteristics as early signals of bank distress in the US during the period from 1979 to 1984 that include capital (leverage) ratios, earnings (operating expense/income), and liquidity (loans/assets) indicators. For European transition economies over the period from 1995 to 2004, Männasoo and Mayes (2009) show that high levels of leverage and operating costs are significantly linked with a higher risk of bank failure.[12] Besides considering the financial ratios in line with the CAMELS framework,[13] we draw information from the balance sheet and the income statement. Overall, our set of bank-specific variables is far wider than those used in previous studies that allows us to better capture not only the multifaceted aspects of failure risk but also the potential differences between the two bank types. We feature eight balance sheet variables and 12 financial ratios whereas Čihák and Hesse (2010) include only assets as a balance sheet covariate and three financial ratios while Abedifar et al. (2013) consider two financial ratios. The monetary variables are adjusted for inflationary pressure by the country's GDP deflator.[14]

3.2.2 Macroeconomic variables

There is evidence that economic downturns have an adverse effect on the banks' financial stability; see, for example, Demirgüç-Kunt and Detragiache (1998) and Männasoo and Mayes (2009). Our set of macroeconomic variables consists of real GDP growth, inflation, FX rate depreciation, and sovereign rating. The inflation is computed as the year-on-year logarithmic change in the GDP deflator. The FX rate depreciation is computed as the year-on-year logarithmic change in the spot exchange rate that is defined as the local currency per US$. The sovereign rating equals one for countries with a rating of BBB^{-} or better (investment grade), 0.5 for a rating of BB^{+} or below (noninvestment grade), and zero for nonrated countries at year-end.

3.2.3 Market structure variables

In terms of market structure we focus on the banking sector's concentration and the Islamic banks' share. Our concentration measure is the Herfindahl-Hirschmann Index (HHI). In line with the previous studies, the HHI is computed as the sum of the squared normalized market shares at year-end that are defined by the total assets (see e.g., Bikker and Haaf 2002; Čihák and Hesse 2010; Abedifar et al. 2012). The HHI ranges between zero and 100% and is calculated at the country level. On the debate between the banking sector's concentration and stability, one view invokes the "too-big-to-fail" concept

[12] Accounting ratios are also good indicators of corporate default risk (see, e.g., Duffie et al. 2007).
[13] Management and sensitivity-to-market-risk variables are not included due to data constraints.
[14] Ownership information from Bankscope or the other data sources we could access is scarce. Therefore, we do not have an ownership variable. Nevertheless, it is well known that Islamic banks are primarily domestically owned.

according to which a more concentrated banking environment increases moral hazard and risk taking (Mishkin 1999). Another view contends that larger profits in more concentrated banking sectors moderate the banks' risk-taking behavior (Allen and Gale 2004). The research also shows that intense banking competition increases the hazard of bank failure (see, e.g., Matutes and Vives 2000; Beck et al. 2006). The Islamic banks' share is calculated as the total assets of the Islamic banks over the total banking assets at year-end. A negative coefficient for this covariate in the all-countries pooled survival model suggests, indirectly, that the larger the presence of the Islamic banks in a country the greater the stability of its financial system.[15] The dependent variable and the full set of independent variables considered in our survival analysis are listed in Table 2. The descriptive statistics for the independent variables are provided in Table 3.

[Tables 2 and 3 around here]

3.3 Preliminary data analysis

As an initial comparison of the two bank types, we summarize their accounting profiles in Table 4, columns I to XII. The table also reports the t-tests on the mean difference[16] for the different classifications. The statistics shown in columns I and II confirm the previous findings that the Islamic banks can already be distinguished from their conventional peers on the basis of their accounting data only (see, e.g., Olson and Zoubi 2008). Specifically, we verify that the Islamic banks are smaller than the conventional banks in terms of assets ($3.7 billion against $4.9 billion), equity ($0.4b against $0.5b), and deposits ($2.8b against $4.0b). The net income is lower for the Islamic banks ($0.17b against $0.23b). Although the Islamic banks lag significantly behind their conventional peers in terms of interest-classified revenues, their income from fee-based services is similar.[17] This similarity might be a reflection of the fact that most Islamic banks primarily use fee-based rather than equity-based contracts because of lower administration costs, complexities, risks, and durations (Abedifar et al. 2013).

[Table 4 around here]

Despite their smaller size, the Islamic banks are better capitalized than the conventional banks as borne out, for example, by equity to assets and Tier 1 ratios of 21.7% (against 10.8%) and 25.0% (against 15.8%) respectively. The asset quality of their loan portfolios is also better for Islamic banks, as evidenced by a loan loss reserves to loans ratio of 6.8% (against 7.9%). This quality could be explained by the ability of Islamic banks to pass business related risks to depositors and investment

[15] Real GDP and FX rates are from the IMF database and Datastream, respectively. The sovereign ratings are from Standard & Poor's. The banking sector's concentration and the Islamic Bank Share are based on Bankscope data.
[16] Panel unit root tests indicate that the included variables behave as stationary processes during the sample period. Detailed results are available from the authors on request.
[17] Islamic banks do not offer or receive interest payments but share ratios of profits. However, effectively, the same "net interest" principle applies because depositors are offered a low share ratio of the bank's profits whereas banks charge a high share ratio when taking part in a venture through a business loan.

accountholders and the relatively low default rates of Islamic borrowers that arises possibly from their religious beliefs (Baele et al. 2014). The Islamic banks are more liquid than the conventional banks as suggested by higher liquid assets to deposits at 55.7% (against 40.3%) and lower net loans to assets at 49.8% (against 51.5%). The combined relatively low leverage and high liquidity of Islamic banks might relate to restrictions imposed by the business model instead of the inefficiencies emanating from mismanagement or poor performance.[18] In terms of operations, the Islamic banks are more profitable than the conventional banks, as evidenced by the higher ROA (2.1% against 0.9%). The higher ROE of the conventional banks might reflect their overleveraged balance sheets, in contrast with the practices in the Islamic banks. The higher net interest margins commanded by the Islamic banks (6.6% against 4.1%) might be attributed to similarities they share with private banks as they focus on macro-financing such as infrastructure and real estate. By contrast, retail banking and small-medium-enterprise financing are likely to be more competitive areas that are served mainly by the conventional banks that cannot afford to charge their clients high interest margins. Regarding costs, the Islamic banks show significantly higher cost-to-income ratios than the conventional banks, which confirms that they are typically less cost efficient.

In columns III and IV of Table 4, we compare the accounting profiles of surviving and failed banks. The failed banks are significantly smaller than the surviving banks in terms of size and turnover. The failed banks' equity and net income equal \$0.20b and \$0.08b, respectively, for the Islamic banks versus \$5.10b and \$0.24b for the surviving banks. The failed banks are in a significantly worse financial position by capital quality indicators (8.5% against 13.2% for equity/assets), liquidity indicators (55.5% against 50.8% for net loans/assets), and earnings indicators (0.7% against 1.3% for ROA). Hence, the critical conditions for the failed banks show up in their accounting information. Columns V to VIII of Table 4 suggest that differences between the surviving and the failed banks' accounting statements manifest themselves for both the Islamic and the conventional banks primarily with regards to the balance sheet and the income statement variables. Overall, this analysis confirms that the surviving banks, irrespective of the bank type, are characterized by a stronger financial profile than the failed banks. The last section of Table 4 (columns IX to XII) serves to verify the concept that the accounting profile of the Islamic banks is different from that of the conventional banks, irrespective of their status of surviving or failing.

Table 4 shows that all of the accounting variables and financial ratios support the hypothesis that the Islamic and the conventional banking models are distinct; thus clearly setting the scene for the differentiated treatment with respect to the modeling and prediction of failure risk.

[18] Some studies find that managerial competency is higher for the Islamic banks than for the conventional banks. Yet the Islamic banking system, due to constraints imposed by Shariah law, is less efficient than the conventional one (Johnes et al. 2014; Abdul-Majid et al. 2010)

4 Empirical results

4.1 Unconditional survivor function estimates

In this subsection, we test the hypothesis of equal survival rates for the two bank types. Panel A of Figure 1 graphs the unconditional survival function, $S(t), t = 1, \ldots, 30$ years, that is obtained for each bank type with the Kaplan-Meier estimator of the observed bank failures.

[Figure 1 around here]

Panel A shows that the probabilities of survival beyond 20 years are 91% (Islamic banks) and 84% (conventional banks). These probabilities fall to 86% and 77% respectively when the time-to-failure is extended to 30 years.[19] The difference is statistically significant; a log-rank test gives p-values of 0.043 and 0.041 for the 20- and 30-year periods, respectively. To examine whether bank size matters we categorize the sample banks into small and large by using the medians of their respective asset distributions. The survival rates are then estimated for each category and shown in Panel B of Figure 1. The log-rank test for the equality of the survival functions suggests that the small Islamic banks are more likely to survive than the small conventional banks as borne out by the p-values of 0.075 and 0.029 for the 20- and 30-year periods. This finding is similar to the conclusions of Čihák and Hesse (2010) who use a z-score framework. However, our findings are based on a framework that does not rely on the use of an insolvency proxy. The survival function of the large Islamic banks does not significantly differ from that of the large conventional banks as borne out by the p-values of 0.433 and 0.715 for the 20- and 30-year periods. Hence, the differences in the survival rates among the two bank types are mainly a small-bank phenomenon. A possible explanation is that the large banks are systemically important within each country and are more likely to receive support in cases of financial difficulties irrespective of their Islamic or conventional orientation (Hovakimian and Kane 2000).

4.2 Conditional survival function estimates

In this subsection, we discuss the failure-risk sensitivities to bank and macroeconomic conditions. Table 5 shows the results of the four distinct formulations of the shared-frailty Cox model (Models I to IV) based on balance sheet information.[20] Tables 6 and 7 show the estimation results for the counterpart models based on the accounting variables of the income statement and the financial ratios, respectively.

[Tables 5–7 around here]

In Table 5, Models I and II show that the estimated coefficients are significant with a negative sign after controlling for bank-specific, macroeconomic, and latent country variables and is suggestive of

[19] For the Islamic banks there are no recorded failures beyond this point as these banks are generally younger.

[20] The validity of the proportional hazards assumption that underpins the Cox model is assessed via the Schoenfeld (1982) residuals-based statistic. The null hypothesis is that, although bank failure risk is itself time-varying, the bank-level and macroeconomic covariates contribute to the hazard rate in the same proportion at any point in time. The test statistic, shown as PH test χ^2 in Tables 5 through 7, fails to reject the assumption.

the lower failure risk of Islamic banks. This result verifies the finding of Čihák and Hesse (2010) on the lower failure risk of small Islamic banks compared to small conventional banks. However, these coefficients are more informative because they also verify that the Islamic banks have lower failure risk after controlling for the banks' size. Moreover, the explanatory variables and their interactions with the Islamic binary variable provide evidence that the Islamic banks have a different failure profile compared to the conventional banks.

Table 5 shows the similarities and differences between the two bank types with respect to the balance sheet information. The positive coefficients of assets in Models I and II for both variants supports the view that the large banks might take on more risks by relying on the "too-big-to-fail" concept. This reliance might be indicative of the systemically important role of the large banks within each country. The result is in line with the literature that finds systemically important banks are insensitive to capital discipline measures; instead they try to maximize the added value from the financial safety net they enjoy (Hovakimian and Kane 2000). The growth of loans has a negative coefficient that implies that an expansion in loan portfolios is not necessarily (as is often thought) associated with a higher probability of failure. This is plausible given that our sample countries had no strong experience with a credit boom and bust (e.g., 2007 credit crunch) during the sample period. In addition, their banking systems were less leveraged than those of the West (IMF 2011). By contrast, for the Islamic banks the positive coefficient implies that the expansion in "loan portfolios" (these typically include equity-participation forms of financing) might increase the failure risk. The Islamic banks do not practice equity financing due to moral hazard and adverse selection attributes (Khan 2010). They prefer instead the certainty of collateralized fee-based contracts. The growth of equity lessens the failure risk for both bank types, possibly reflecting the fact that increased contributions by shareholders work as a safety net. However, the effect is less pronounced for the Islamic banks.

Table 6 reveals significant differences among the two bank types in the sensitivities of their failure risk to income statement variables. The growth of overheads significantly lessens the failure risk for the Islamic banks but has a less prominent effect for the conventional banks. This difference in sensitivity might reflect the importance that the Islamic banks place on human resource training and development where reputation and customer-relationship management rank high in their priorities. As the net interest revenue increases, the risk of bank failure decreases significantly for the conventional banks, although for the Islamic banks there is no significant effect. This lack of effect might be traced to the insubstantial contribution of the equity-participation forms of financing to a healthy financial state in the Islamic banks. The sensitivity of the failure risk to the net income is negative (positive) for the Islamic (conventional) banks, which could be linked to our broad definition of failure that includes mergers and acquisitions (as in Heffernan 2005).[21] In particular, M&A activity is not as common among the Islamic banks as with the conventional banks (ATKearney 2012).

The sensitivities of failure risk to financial ratios[22] are reported in Table 7. The statistically significant differences between the two bank types in most of the estimated sensitivities stresses further that their failure risk profiles are not alike. The cost inefficiencies, as measured by the cost/income ratio, increase the hazard only for the conventional banks. The previous studies find that the Islamic banks are less cost efficient than the conventional banks (see Ahmad et al. 1998). Newer empirical evidence suggests that the human capital investments on behalf of the Islamic banks have been paying off as they contribute toward closing the gap in managerial inadequacies (Johnes et al. 2014). The higher liquidity, as represented by liquid assets/deposits, has a favorable effect on both types of banks. This finding highlights the importance of liquidity management in Islamic banks; maintaining high buffers is key to overcoming their Shariah law related restrictions on generating funds through open market operations.

The higher capitalization level (equity/assets) decreases the failure risk for conventional banks but increases it for Islamic banks. A rationale for this finding draws upon the link between leverage, the inverse of capitalization, and profitability. A bank's exact leverage is influenced by both internal (managerial preferences) and external (regulation) factors, which may vary across bank types. Islamic banks operates on lower leverage levels than conventional banks due to their restrictions on the use of debt instruments, such as loans. Indeed, Islamic banks are precluded from attaching a fixed and predetermined interest rate on either side of their balance sheet items and instead, depend mainly on equity participation for the supply and demand of funds. There are Islamic financial instruments that could be used to increase the funds channelled to investments through asset/commodity repo agreements. However, these are fairly complicated and do not have a universal approval.

Consequently Islamic banks cannot match the leverage levels of conventional banks, which is verified by our own analysis and the literature (see e.g., Beck et al. 2013; Olson and Zoubi, 2008). This places more strain on the Islamic banks in competing with the profitability levels of conventional banks, thereby requiring Islamic banks either to invest in higher risk/reward projects or potentially be driven off the market. As such, the marginal gain from leveraging would be higher in Islamic than conventional banks by enabling the former to contribute more funds to their investments. Arguably, Islamic banks have the necessary mechanisms that provide discipline and prohibit leverage abuse in place. Depositors and investment accountholders are incentivized to monitor performance (given the uncertainty in payouts) that is achieved through the equity-type contractual agreements. The use of investment

[21] As a robustness check we repeat the analysis by narrowing our definition of failed banks to exclude mergers and acquisitions. The results do not challenge our main findings and are omitted for brevity.

[22] Due to insufficient data on asset quality (loan loss reserves, Tier 1 ratio) these variables are excluded. Nonperforming loans, ROA, and ROE have not been qualified based on our automatic variable selection process. As a robustness check we insert them into the model but they never reach statistical significance. These versions of Table 7 are available on request.

accountholders resembles the use of subordinated debt as a way to monitor bank activities through increased withdrawal risk, which has received some support in the conventional banking system (Wall, 1989). This supports the positive leverage-profitability link,[23] which has received additional support in a different context (DeAngelo and Stulz, 2015), and therefore a positive leverage-survival relationship. Moreover the finding is in line with Abedifar et al. (2013) where high leverage is associated with low credit risk for Islamic banks.

The higher values of the net interest margin (NIM), aggravate (lessen) the failure risk of conventional (Islamic) banks. Over the years there is a tendency for the NIM of conventional banks to decrease which has been attributed to the increasingly diversified sources of income of these banks (Liebeg and Schwaiger, 2006). Therefore, and as competition further reduces the NIM, a positive relation between NIM and failure risk can be expected. By contrast, Islamic banks do not have such diversified income streams, which is mainly attributed to their small size and the restrictions pertaining to their business model. Additionally, for cost related reasons Islamic banks do not have a strong presence in the retail sector; they specialise instead in real estate, oil drilling and infrastructure projects, where large NIMs can typically be sustained. Consequently, for Islamic banks a negative relation between NIMs and failure risk is plausible.

Next we analyze the sensitivity of failure risk to macroeconomic and market structure variables. The generalized Cox model in Tables 5 through 7 shows a link between the growth of real GDP and the failure risk and offers a noteworthy contrast between the two bank types. An increase in economic growth of 1% delivers about a 6.7% reduction in the failure risk for the conventional banks, with a more muted effect for the Islamic banks. Inflation is a major source of concern for Islamic banks as they are more prone to inflation pressure, as displayed by the results. Specifically, a 1% rise in inflation leads to a 13.9% increase in the failure risk for the Islamic banks and to a 3.7% increase for the conventional banks. This greater sensitivity of the Islamic banks to inflation may be attributed to the fact that most of the Islamic contracts (e.g., profit-and-loss sharing contracts) have a fixed maturity and cannot be inflation-linked by construction. Hence any costs due to adverse inflationary pressure have to be borne by the bank (it is also not permitted by Shariah restrictions to access specialized derivative hedging instruments available to conventional banks, e.g., swaps). In terms of market structure, an increase of 1% in the banking sector's concentration (HHI index) lessens the failure risk by about 9.7% for the conventional banks. This is in line with the concept that a lower degree of sector concentration (and

[23] Leverage impacts Islamic and conventional banks in different ways, which might explain the finding that higher leverage increases (reduces) survival rates of Islamic (conventional) banks. Fully understanding the link between leverage and stability in the two bank types requires an appreciation of the relation between leverage and profitability, which can be illustrated by the two main theories on capital structure: the pecking order (Myers and Majluf, 1984) and the trade-off theory (Bradley et al. 1984). The pecking order theory assumes a negative leverage-profitability relation and applies more to companies. The trade-off theory is particularly relevant for banks (Toumi et al. 2011). It assumes a positive leverage-profitability relation and posits that higher leverage allows a bank to raise its profitability by committing more funds to investments (i.e., leverage multiplier effect). Under this theory higher leverage can lead to higher profitability and hence higher survival.

potentially more intense competition) undermines prudent bank behavior by encouraging excessive risk taking. For the Islamic banks, the effect of concentration is suggestive of the increased failure risk that emanates from the increased concentration. Specifically, a 1% rise in the concentration leads to a 3.4% increase in the failure risk.

In terms of goodness-of-fit measures, we observe that the McFadden pseudo-R^2 statistics reported in Tables 5 through 7 are very close for the models based on the bank- and country-specific variables and the models based on the bank-specific variables. This similarity suggests that the accounting statement variables carry most of the predictive power. It is also noticeable that the additional explanatory power attained by adding country (macroeconomic and market structure) factors into the survival model is roughly two times larger for the Islamic banks than the conventional banks. This finding clearly shows that the Islamic banks are more sensitive to the economic environment and market structure effects than the conventional banks. The finding is also reaffirmed by the percentage increase in the AIC, BIC, and the log-likelihood. For both bank types, a classification of the accounting statement components in terms of their explanatory power shows that the financial ratios outperform the income statement and the balance sheet variables by 4.3% and 6.5%, respectively.

Figure 2 shows the shared-frailty component obtained from the Cox model, equation (6). The model is estimated separately with balance sheet, income statement, and financial ratios (along with the market structure and macroeconomic variables) and we plot the average shared-frailty. The shared frailty captures the influence on the failure risk of other (observed or unobserved) country variables not explicitly accounted for by the model. Such unobserved country-level heterogeneity can reflect, for instance, domestic contagion risk, political stability, opacity of the banking sector's governance, and the role of the regulatory framework. The shared-frailty values above (below) unity imply that the latent country factors increase (decrease) the effect of the failure risk. For example, the average estimate for Jordan of 0.50 means that the latent domestic factors reduce the failure risk of Jordanian banks by 50%. The hypothesis that the shared-frailty α_c in equation (6) is negligible is assessed through a LR test for the restriction $H_0: \theta = 0$, where θ is the variance of the probability distribution of α_c. The results reported in the diagnostics section of Tables 5 through 7 indicate that the hypothesis is only rejected for the conventional banks. Thus, the latent country variables induce domestic correlation in the failure risk but only for conventional banks. The Islamic banking products and practices might be deemed as not contributing to the susceptibility of the financial system to systemic crises which is plausible given their resilience in the recent financial crisis. By contrast, the conventional banking business model together with regulatory measures (e.g., Basel II) act pro-cyclically in the sense that they aggravate the impact of banking crises on the financial system in terms of duration and intensity (Daníelsson et al. 2001).

[Figure 2 around here]

In sum, we find that Islamic banks exhibit lower failure risk than conventional banks after controlling for the accounting statement information, market structure, and the macroeconomic environment; the latter has greater relevance for the Islamic bank failure. For both bank types, the risk of failure is sensitive mostly to accounting indicators from the income statement and financial ratios but there are differences between the two bank types regarding the magnitude and even the sign of the sensitivities.

4.3 Differential predictability

In this subsection, we demonstrate that a risk model tailored to the conventional banks cannot accurately predict the Islamic banks' failure and vice versa. The coefficient estimates of the models based on bank- and country-specific variables that use all of the banks (Models I and II), Islamic banks (Model III) and conventional banks (Model IV) are used to generate hazard rate predictions that can be grouped into three categories: all banks, Islamic banks, and conventional banks. The predicted hazard rates are summarized by operation status (surviving/failed) within each category. Further, we formally compare the distribution of hazard rates for the failed and the surviving banks within each category by using two statistics: the t-test for the null hypothesis of equal means and the Mann-Whitney test for the null hypothesis of equal medians. Table 8 reports the results for Models I to IV with the bank-specific variables drawn from the financial ratios.[24]

[Table 8 around here]

Panel A of Table 8 summarizes the hazard rate predictions of Model I separately for: i) all banks, ii) Islamic banks, and iii) conventional banks. We them test the null hypothesis that the surviving and the failed banks have identical hazard rates. Panels B, C, and D report the counterpart results when Models II, III, and IV, respectively, are used instead. Both the t-test and Mann-Whitney test indicate that all of the models are significant in predicting failure. However, as suggested by the relative size of the t-statistic and Mann-Whitney statistic, and the associated p-values, the predicted hazard rates from Model III can most accurately separate the surviving and the failed Islamic banks; by contrast, it cannot discriminate well between the surviving and the failed conventional banks. Likewise, Model IV cannot accurately discriminate between the surviving and the failed Islamic banks, as suggested by both tests.

This analysis shows the practical importance of designing specific failure risk models for each type of bank. In particular, the most accurate failure risk predictions for the Islamic banks are obtained from the Cox proportional hazard models purposely and exclusively estimated with the Islamic banks' accounting information along with the market structure and the macroeconomic variables.

4.4 Failure and insolvency risk

[24] Analogous conclusions are reached when the explanatory variables are drawn from the balance sheet and the income statement and are therefore omitted for brevity.

This subsection illustrates the value added by the survival analysis versus a standard OLS analysis based on the z-score proxy. The initial summary statistics and tests reported in Table 4 suggested that the z-score is significantly higher for the Islamic banks than the conventional banks; this implies, in principle, that the former financial intermediaries are subject to lower insolvency risk. However, the fact that neither the failed Islamic banks nor the failed conventional banks have significantly lower z-scores than their surviving counterparts suggests that insolvency risk is not tantamount to failure risk; namely, the z-score is not able to capture the complex nature of failure risk. To shed further light on this issue, we estimate one of the OLS models[25] considered in the Čihák and Hesse (2010) study but with our data. The dependent variable is the z-score and the regressors are the accounting statement and the macroeconomic variables. Table 9 reports the estimation results obtained with two distinct samples. The first sample includes surviving banks only (Model A), as in Čihák and Hesse (2010). The second sample considers all of the surviving and the failed banks (Model B).

[Table 9 around here]

The estimation results for Model A broadly confirm those in Čihák and Hesse (2010). The coefficient of the Islamic bank dummy is positive and significant at the 5% level suggesting that the failure risk (the inverse of the z-score) of Islamic banks is lower than that of conventional banks, in line with our survival analysis. However, the Islamic bank binary variable is insignificant in Model B; prima facie, this suggests that the z-score regression, because it does not account for the survivorship bias, cannot accurately pick up the difference in the failure risk profiles of the two bank types.

Model B shows that the Islamic banks do not have significantly higher z-scores than the conventional banks, which seemingly contradicts our main finding that the Islamic banks are less prone to fail than the conventional banks. One explanation for the seemingly contradictory findings is that the presumption that the z-score is an equally 'valid' proxy for the failure risk in the Islamic and the conventional banks might be erroneous. A complementary explanation is that the type of risk captured by the OLS models for the z-score (insolvency risk) is not strictly equivalent to the risk captured by the survival models that rely directly on bank failures. In this light, the findings suggest that Islamic banks have lower failure risk than conventional banks, but the two bank types are more aligned in terms of insolvency risk. Relatedly, Abedifar et al. (2013) find no differences in insolvency risk between Islamic and conventional banks after controlling for bank-level and macroeconomic conditions.

As a final check on the suitability of the z-score to discriminate between Islamic and conventional banks in terms of the failure risk, we estimate (by maximum likelihood) two logit models, Models C and D in Table 9, where the dependent variable is the failure dummy. In Model C the explanatory variables are the Islamic bank binary variable and the z-score. Model D uses only the z-score as the

[25] This is the model reported in page 109, column (4) of Table 5, in Čihák and Hesse (2010). Consistent with their analysis, we adopt an OLS as the estimation approach with Newey-West h.a.c. standard errors for inference.

explanatory variable. The coefficient of the Islamic bank variable is negative and statistically significant, a result which is consistent with the survival analysis findings. By contrast, although the failed banks ought to have reached lower z-scores (and hence, the coefficient on the latter ought to be significantly negative), this is not what the results suggest for our sample of 421 banks. As robustness checks, we re-estimate Model D for the 315 conventional banks only, but the results do not challenge our main findings. While the number of bank-year observations drops now from 4,583 to 3,660, the (untabulated) coefficients are very similar to those reported for the pooled sample (Model D), namely, the coefficient on the z-score is 0.007 (p-value is 0.052). Considering a more complete version of Model D with control variables did not alter our main conclusions either. For instance, including as controls the same covariates as those retained in our survival model specification with financial ratios (Table 7), the coefficient of the Islamic bank binary variable is -1.435 (p-value is 0.009) and that of the z-score is 0.012 (p-value is 0). Hence, the inclusion of the controls is immaterial to our main conclusions on the lack of a meaningful relation between the z-score and failure risk. These findings further indicate that the z-score serves as a proxy for a risk that is not strictly equivalent to the failure risk.

These findings can be rationalized as follows. The conventional proxies for bank failure risk were designed with the conventional business model in mind and consequently can lead to fallacious conclusions when applied to Islamic banks given the specificities of their business model. For example, the PLS arrangements on the asset and the liability sides of an Islamic bank's balance sheet enable the bank to pass through any risk associated with its investments to the depositors and investment accountholders. This pass through provides the bank with a layer of protection over and above the usual capital cushion, which undermines the z-score. Moreover, the results in this subsection, which to the best of our knowledge represent novel evidence on this issue, indicate that the insolvency risk that the z-score is designed to capture is not necessarily tantamount to the risk of actual failure.

5 Conclusions

Islamic banking and finance has experienced an extraordinary expansion during the last three decades. This paper contributes to a growing empirical literature that compares Islamic banks with conventional banks. Our yardstick for comparison is the risk of failure and its sensitivity to bank-level, market structure, and macroeconomic factors. We use the survival analysis, a novel methodological approach in the present context, that has two advantages over the approaches used in the previous Islamic banking studies. Survival models sidestep reliance on the z-score or similar distance-to-default proxies that are suspect in the context of the Islamic banking business model. In addition, the survival analysis is built on models where time-to-failure is the stochastic variable of interest. Hence, the failure risk is effectively treated as a time-varying latent variable that thereby imposes no specific distributional assumption on the estimates.

Our empirical investigation provides, firstly, unconditional and conditional measures of failure risk for the Islamic and the conventional banks. Second, we identify relevant contrasts between the two bank types in the sensitivity of the failure risk to accounting statement variables, macroeconomic indicators, and latent country factors. Third, we examine the predictive power of distinct survival type models estimated from pooled information both from banking systems and from information specific to each. To the best of our knowledge, this is the first paper in the literature to conduct such exercises. Fourth, we show that survival models lead to substantially different conclusions to those of the z-score. This is important as many papers rely on the z-score to draw inferences on banks' stability and more recently to compare the stability of Islamic banks and conventional banks.

The unconditional survival functions obtained using the nonparametric Kaplan-Meier estimator, which relies exclusively on failure data, indicate that the failure risk of small Islamic banks is significantly lower than that of small conventional banks. The conditional survival functions obtained via the Cox models that control for observed bank heterogeneity (including total assets as a proxy for size), observed country-level heterogeneity, and latent country effects confirm that the Islamic banks are generally less hazardous than the conventional banks.

We document important differences in the sensitivity of failure risk. The higher leverage aggravates the failure risk for the conventional banks but moderates it for the Islamic banks. The higher liquidity is associated with lower failure risk in general, but it is significantly stronger for the Islamic banks, which might relate to the constraints imposed by the Shariah law on their funding. A rise in the net interest revenue increases (decreases) the hazard of bank failure for the conventional banks (Islamic banks) possibly as a reflection of their different clienteles. The cost-to-income has an adverse effect on the failure risk of both bank types but the Islamic banks are more sensitive. This is unsurprising given their larger operational risk. A banking sector's lower concentration decreases the likelihood of failure for the Islamic banks but exacerbates it for the conventional banks. The failure risk for Islamic banks is more strongly affected by inflation. The latent country factors play a negligible role as the drivers of failure risk for the Islamic banks but are strongly significant for the conventional banks. This role might reflect a larger probability of domestic co-failure for the conventional banks. The failure risk and insolvency risk are shown to be not strictly equivalent. The Islamic banks are significantly less risky than the conventional banks in terms of their failure hazard but the two types of banks are difficult to separate in terms of the distance-to-insolvency z-score proxy.

Our findings suggest that bank heterogeneity across accounting information should be closely monitored to identify financial distress. There are also macroeconomic policy implications because the failure risk of the Islamic banks shows a stronger sensitivity to a country's inflation than the failure risk of the conventional banks. Our findings therefore provide evidence in favor of differentiated failure risk models for the two bank types. As such, an early warning system purposely designed that uses historical data for the conventional banks is likely to provide distorted signals if it is applied to the Islamic banks.

References

Abdul-Majid M, Saal DS, Battisti G (2010) Efficiency in Islamic and conventional banking: An international comparison. J Prod Anal 34:25–43

Abedifar P, Molyneux P, Tarazi A (2013) Risks in Islamic banking. Rev Finance 17, 1–62

ACCA and KPMG (2010) Accountancy futures: Harmonizing financial reporting of Islamic finance

Ahmad A, Khan T, Iqbal M (1998) Challenges facing Islamic banking (Vol Occassional 01) Jeddah: Islamic Research and Training Institute, IDB

Allen F, Gale D (2004) Competition and financial stability. J Money Credit Bank 36:453–80

ATKearney (2012) The Future of Islamic Banking. http://wwwatkearneycom/documents/ 10192/654853/Future+of+Islamic+Bankingpdf/27167edf-a96d-4465-b88a-83beb25ed4bd Accessed 15 November 2014

Baele L, Moazzam F, Ongena S (2014) Of religion and redemption: Evidence from default on Islamic loans. J Bank Finance 44 (7):141–159

Beck T, Demirgüç-Kunt A, Levine R (2006) Bank concentration, competition, and crises: First results. J Bank Finance 30:1581–1603

Beck T, Demirgüç-Kunt A, Merrouche O (2013) Islamic vs conventional banking: Business model, efficiency and stability. J Bank Finance 37:433–447

Bikker JA, Haaf K (2002) Competition, concentration and their relationship: An empirical analysis of the banking industry. J Bank Finance 26:2191–2214

Boumediene A, Caby J (2009) The stability of Islamic banks during the subprime crisis. Available at SSRN: http://ssrncom/abstract=1524775

Bradley M, Jarrell GA, Kim EH (1984) On the existence of an optimal capital structure: Theory and evidence, J Finance 39: 857-877

Čihák M Hesse H (2010) Islamic banks and financial stability: An empirical analysis. J Financ Serv Res 38:95–113

Cleves M, Gutierrez RG, Gould W, Marchenko YV (2010) An introduction to survival analysis using stata. 3rd edn, Stata Press: United States

Cole AR, Wu Q, (2009) Predicting bank failures using a dynamic hazard model. Federal Deposit Insurance Corporation, Working Paper

Cox D R, (1972) Regression models and life-tables. J Royal Stat Soci Series B 34:187–220

Dabos M, Escudero SW (2004) Explaining and predicting bank failure using duration models: The case of Argentina after the Mexican crisis. R Anal Econ 19:31–49

Daníelsson J, Embrechts P, Goodhart C, Keating C, Muennich F, Renault O, Shin H-S (2001) An academic response to Basel II. Special Paper No 130

DeAngelo H, Stulz MR (2015) Liquid-claim protection, risk management, and bank capital structure: Why high leverage is optimal for banks. J Finance Econ 116: 219-236

Demirgüç-Kunt A, Detragiache E, (1998) The determinants of banking crises in developing and developed countries. IMF Staff Papers 45:81–109

Duffie D, Saita L, Wang K, (2007) Multi-period corporate default prediction with stochastic covariates. Journal of Financial Economics 83(3):635-665

Ebrahim MS (1999) Integrating Islamic and conventional project finance. Thunderbird Inter Bus Rev 41, 583–609

Efron B (1977) The efficiency of Cox's likelihood function for censored data. J Amer Stat Assoc 72:557–565

Ernst and Young (2015) World Islamic banking competitiveness report 2014–15: Participation banking 2.0

Evrensel AY (2008) Banking crisis and financial structure: A survival-time analysis. Inter Rev Econ Finance 17:589–602

Gomez-Gonzalez J E, Kiefer N M (2009) Bank failure: Evidence from the Colombian financial crisis. Inter J Bus Finance Res 3:15–31

Gutierrez R G, Carter S, Drukker DM (2001) On boundary-value likelihood-ratio tests Stata Technical Bulletin 60: 15–18 Reprinted in Stata Technical Bulletin Reprints, vol 10, pp 269–273. Stata Press: College Station, TX

Heffernan SA (2005) Modern banking. John Wiley & Sons: Chichester, West Sussex, England

Hosmer DW, Lemeshow S, May S (1999) Applied survival analysis: Regression modelling of time-to-event data. John Wiley & Sons, Inc: Canada

Hovakimian A, Kane JE (2000) Effectiveness of capital regulation at US commercial banks, 1985 to 1994. J Finance 55(1):451-468

IMF (2015) Islamic finance and the role of the IMF http://www.imf.org/external/themes/islamicfinance/#Factsheet Accessed 15 September 2015

Johnes J, Izzeldin M, Pappas V (2014) A comparison of performance of Islamic and conventional banks 2004 to 2009. J Econ Behav Organ S93–S107

Kalbfleisch JD, Prentice RL (2002) Statistical analysis of failure time data. Wiley Series in Probability and Statistics, 2nd edn, John Wiley & Sons: Hoboken, New Jersey

Kaplan EL, Meier P, (1958) Nonparametric estimation from incomplete observations. J Amer Stat Assoc 53:457–481

Khan F (2010) How Islamic is Islamic banking? J Econ Behav Organ 76:805–820

Koetter M, Porath D, (2007) Efficient, profitable and safe banking: an oxymoron? Evidence from a panel VAR approach In: Discussion paper Series 2: Banking and Financial Studies 02/2007

Koutsomanoli-Filippaki A, Mamatzakis E, (2009) Performance and Merton-type default risk on listed banks in the EU: A panel VAR approach. J Bank Finance 33:2050–2061

Kuran T, (2004) Why the Middle East is economically underdeveloped: Historical mechanisms of institutional stagnation. J Econ Persp 18:71–90

Lane WR, Looney SW, Wansley JW (1986) An application of the Cox proportional hazards model to bank failure. J Bank Finance 10:511–31

Levine R, Zervos S, (1998) Stock markets, banks and economic growth. Amer Econ Rev 88:537–58

Liebeg T, Schwaiger M (2006) Determinants of the interest rate margins of Austrian banks. Oesterreichische Nationalbank Financial Stability Report 12: 104–116.

Männasoo KA, Mayes DG (2009) Explaining bank distress in Eastern European Transition Economies. J Bank Finance, 33, 244–253

Matutes C, Vives X (2000) Imperfect competition, risk, and regulation in banking. Eur Econ Rev 44:1–34

Myers SC, Majluf NS (1984) Corporate financing and investment decisions when firms have information that investors do not have. J Finance Econ 2 (13):187-221

Mishkin SF (1999) Financial consolidation: Dangers and opportunities. J Bank Finance 23:675–691

Moazzam F, Zaheer S (2013) On the Co-Existence of Conventional and Islamic Banks: Do They Differ in Business Structure. In: Zaheer S (ed) Financial Intermediation and Monetary Transmission through Conventional and Islamic Channels. Rozenberg Publishing Services, Amsterdam, pp 41–61

Molina CA (2002) Predicting bank failures using a hazard model: The Venezuelan banking crisis. Emerging Markets Rev 3:31–50

Olson D, Zoubi TA (2008) Using accounting ratios to distinguish between Islamic and conventional banks in the GCC region. Inter J Acc 43:45–65

Ostergaard C, Schindele I, Vale B (2015) Social capital and the viability of stakeholder-oriented firms: Evidence from Norwegian savings banks. Rev Finance, Forthcoming.

Reinhart CM, Rogoff KS (2009) The aftermath of financial crises. Amer Econ Rev 99:466–472

Saeed M, Izzeldin M (2014) Examining the relationship between default risk and efficiency in Islamic and conventional banks. J Econ Behav Organ. http://dxdoiorg/101016/jjebo201402014

Sales AS, Tannuri-Pianto ME (2007) Explaining bank failures in Brazil: Micro, macro and contagion effects (1994–1998). Central Bank of Brazil Working Paper 147

Schoenfeld D (1982) Residuals for the proportional hazards regresssion model. Biometrika 69(1):239–241

Toumi K, Viviani JL, Belkacem L (2011) A comparison of leverage and profitability of Islamic and conventional banks. International Conference of the French Finance Association (AFFI), May 11-13, 2011. Available at SSRN: http://ssrn.com/abstract=1836871

Van Wijnbergen SJG, Zaheer S (2013) Capital structure, risk shifting and stability: conventional and Islamic banking. In: Zaheer S (ed) Financial Intermediation and Monetary Transmission through Conventional and Islamic Channels. Rozenberg Publishing Services, Amsterdam, pp 63–88

Wall LD (1989) A plan for reducing future deposit insurance losses: Puttable subordinated debt. Economic Review, Federal Reserve Bank of Atlanta, July/August, pp 2–17

Whalen G (1991) A proportional hazards model of bank failure: An examination of its usefulness as an early warning tool. Federal Reserve Bank of Cleveland Working Paper, pp 21–31

Wheelock CD, Wilson WP (2000) Why do banks disappear: The determinants of US bank failures and acquisitions. Rev Econ Stat 81:127–138

Table 1 Sample banks and bank population by country and type. The table shows the number of the Islamic banks and the conventional banks for each country versus those available in Bankscope as of 2010 and our sample coverage. The banks listed in Bankscope in 2010 are taken as the population that in some cases is smaller than our sample due, for instance, to banks failing or ceasing to maintain accounts with Bankscope. Coverage (%) is the number of banks included in the sample as a percentage of the number of banks listed in Bankscope as of 2010

Country	**Sample banks**			**Bankscope banks**			**Coverage (%)**		
	Islamic	Conventional	Total	Islamic	Conventional	Total	Islamic	Conventional	Total
Albania	1	4	5	1	13	14	100	31	36
Bahrain	17	9	26	19	12	31	89	75	84
Bangladesh	2	28	30	2	33	35	100	85	86
Brunei	3	2	5	1	1	2	300	200	250
Egypt	2	31	33	2	23	25	100	135	132
Indonesia	1	74	75	1	72	73	100	103	103
Iran	15	0	15	16	0	16	94	100	94
Jordan	2	11	13	3	10	13	67	110	100
Kuwait	8	6	14	7	7	14	114	86	100
Malaysia	14	35	49	16	28	44	88	125	111
Mauritania	1	2	3	1	7	8	100	29	38
Pakistan	6	21	27	9	22	31	67	95	87
Palestine	1	1	2	1	3	4	100	33	50
Qatar	4	6	10	4	7	11	100	86	91
Saudi Arabia	3	10	13	3	9	12	100	111	108
Sudan	8	2	10	11	12	23	73	17	43
Tunisia	1	11	12	1	16	17	100	69	71
Turkey	4	41	45	4	29	33	100	141	136
UAE	9	16	25	10	18	28	90	89	89
Yemen	4	5	9	4	5	9	100	100	100
Total	**106**	**315**	**421**	**116**	**327**	**443**	**91**	**96**	**95**

Table 2 Dependent and explanatory variables used in the analysis. The table shows the variables considered in our analysis and their definitions. The source is Bankscope for all variables except the Growth of Real GDP, the Inflation, and the FX Rate that are obtained from Datastream and the Sovereign Rating from Standard and Poor's

Name	**Type**	**Definition**
Failure	Qualitative	Binary indicator equal to 1 for failed banks in the year immediately prior to the failure event 0 in all other years. The variable equals 0 for surviving banks in all sample years.
Islamic Bank	Qualitative	Binary variable equal to 1 if the bank operates under Shariah law, 0 otherwise.
Assets	Balance Sheet	Total earning assets, cash and assets due from banks, foreclosed real estate, fixed assets, other assets and goodwill.
Equity	Balance Sheet	Common equity, non-controlling interest, securities revaluation reserves and foreign exchange revaluation reserves.
Liabilities	Balance Sheet	Total interest-bearing liabilities, fair value portion of debt, credit impairment reserves and tax liabilities.
Loans	Balance Sheet	Net loans minus reserves for impaired loans.
Deposits	Balance Sheet	Customer deposits, bank deposits, other deposits and short-term borrowings.
Other Earning Assets	Balance Sheet	Earning assets not otherwise categorized, including non-current assets held for sale which are not loans.
Reserves Imp Loans	Balance Sheet	Reserve against possible losses on impaired or nonperforming loans.
Liquid Assets	Balance Sheet	Trading securities, loans and advances to banks, reverse repos and cash collateral, cash and due from banks.
Net Income	Income Statement	Pre-tax profit, profit/loss from discontinued operations minus tax expenses.
Net Interest Revenue	Income Statement	Gross interest and dividend income minus total interest expense
Other Operating Income	Income Statement	Any other sustainable income which is related to the company's core business.
Overheads	Income Statement	Personnel expenses and other operating expenses.
z-score	Financial Ratio	A measure inversely related to the probability of bank's insolvency.
Tier 1 Ratio	Financial Ratio	Shareholder funds plus perpetual non-cumulative preference shares as a percentage of risk weighted assets and off balance sheet risks.
Loan Loss Reserves/Loans	Financial Ratio	Indicates how much reserves have been put aside for potential losses.
Equity/Assets	Financial Ratio	Measures the amount of protection the bank enjoys by its equity
Equity/Net Loans	Financial Ratio	Measures the equity cushion available to absorb losses on the loan book
Equity/Deposits	Financial Ratio	Measures the amount of permanent funding relative to short term funding.
Equity/Liabilities	Financial Ratio	Also known as the capitalisation ratio and it is the inverse of the leverage ratio.
Net Interest Margin	Financial Ratio	Net interest income expressed as a percentage of earning assets.
ROA	Financial Ratio	Measures the returns generated from the assets financed by the bank.
ROE	Financial Ratio	A measure of the return on shareholder funds.
Cost/Income	Financial Ratio	Measures the overheads or costs of running the bank, the major element of salaries, as percentage of income generated before provisions.
Net Loans/Assets	Financial Ratio	Indicates what percentage of the assets of the bank are tied up in loans
Liquid Assets/Deposits	Financial Ratio	A deposit run off ratio that proxies for what percentage of deposits withdrawn suddenly could be met.
Sector Concentration	Market Structure	Herfindahl index computed as the sum of squared market shares (assetwise) of banks per country per year.
Islamic Bank Share	Market Structure	Market share of Islamic banks per country per year.
Growth of Real GDP	Macroeconomic	Growth rate of inflation corrected GDP.
Inflation	Macroeconomic	Year-on-year logarithmic change of the GDP deflator.
FX Rate Depreciation	Macroeconomic	Year-on-year logarithmic change of the spot exchange rate, defined as local per US dollar currency.
Sovereign Rating	Macroeconomic	Equals 1 for countries rating BBB^{-} or better (investment grade), 0.5 for rating BB^{+} (junk) and 0 for unrated.

Table 3 Descriptive statistics. The table reports the descriptive statistics for the variables considered in our analysis**.** The observation period is 1995 to 2010. The $m denotes US dollars in millions. The StDev is the standard deviation. The Obs is the number of bank-year observations available for the bank-level variables and the number of years for the market structure and macroeconomic variables

	Units	**Mean**	**StDev**	**Min**	**Max**	**Median**	**Obs**
Panel A: Bank-specific variables							
Islamic Bank		0.25	0.4	0	1	0	4,583
Assets	$m	4,681.26	9,325.13	0.2	103,993.48	1,139.80	4,583
Equity	$m	466.02	1,032.34	-5,062.74	12,213.74	113.12	4,583
Liabilities	$m	4,215.24	8,405.94	0	95,140.01	1,017.40	4,583
Loans	$m	2,383.95	4,882.87	-3,518.72	63,487.97	554	4,564
Deposits	$m	3,754.92	7,435.76	-9.28	81,427.03	894.15	4,558
Other Earn. Assets	$m	1,679.30	3,789.99	0	51,757.19	325.55	4,571
Reserves Imp Loans	$m	150.09	316.69	-20.14	4205.65	38.2	3,905
Liquid Assets	$m	1,202.37	2,398.85	0.05	31,139.28	261.25	4,579
Net Income	$m	215.1	553.36	-2,260.36	11,128.26	47.61	4,532
Net Interest Revenue	$m	145.52	379.65	-1,832.96	7,285.03	28.4	4,559
Other Operating Income	$m	69.74	287.62	-2,788.28	10,040.68	15.3	4,549
Overheads	$m	105.94	325.37	-2.4	9,761.35	23.51	4,570
z-score	%	17.02	39.24	-15.28	1,742.13	11.64	4,575
Tier 1 Ratio	%	17.23	20.35	-122.6	295.5	13.3	1,754
Loan Loss Res./Loans	%	7.7	9.18	-7.5	96.35	4.48	3,991
Equity/Assets	%	12.99	15.06	-129.21	100	9.74	4,580
Equity/Net Loans	%	35.5	72.28	-305.98	948.73	18.93	4,514
Equity/Deposits	%	25.29	70.55	-536.99	974.53	11.84	4,531
Equity/Liabilities	%	21.73	64.28	-56.37	917.37	10.76	4,553
Net Interest Margin	%	4.57	10.86	-41.73	472.87	3.47	4,552
ROA	%	1.18	5.44	-123.68	71.32	1.33	4,578
ROE	%	13.53	44.54	-724.52	967.12	13.26	4,577
Cost/Income	%	57.66	55.97	0	984.69	47.93	4,493
Net Loans/Assets	%	51.18	18.89	0	100	53.71	4,561
Liquid Assets/Deposits	%	43.29	56.23	0.16	945.13	32.01	4,543
Panel B: Macroeconomic variables							
Growth of Real GDP	%	4.93	3.9	-14.28	25.71	5.23	16
Inflation	%	11.5	17.71	-22.41	137.96	7.54	16
FX Rate Depreciation	%	6.4	19.1	-23.51	150.72	0.11	16
Sovereign Rating	%	35.87	47.97	0	100	0	16
Panel C: Market structure variables							
Sector Concentration	%	16.2	10.15	6.9	100	12.6	16
Islamic Bank Share	%	11.28	21.26	0	100	2.83	16

Table 4 Accounting profile by bank category. The table summarizes the accounting profiles according to bank type (Islamic/conventional) and/or operating status (survive/fail) and reports the t-tests on the mean differences. All amounts are in US$ millions except financial ratios that are in percent. Survive are surviving banks and Fail are banks that failed in one of the sample years from 1995 to 2010. Columns labeled Fail report averages of the accounting indicators on the year prior to the failure event. The NA refers to data unavailability for the particular cohort

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
					Islamic		Conventional		Survive		Fail	
	Islamic	Conventional	Survive	Fail	Survive	Fail	Survive	Fail	Islamic	Conventional	Islamic	Conventional
Number of Banks	106	315	324	97	98	8	226	89	98	226	8	89
Balance Sheet												
Assets	3,651	4,941***	5,140	1,810**	3,858	941***	5,492	1,888**	3,858	5,492**	941	1,888*
Equity	400	482***	5,120	184***	418	163***	537	186***	418	537***	163	186
Liabilities	3,251	4,459***	4,628	1,625**	3,440	778***	4,954	1,701**	3,440	4,954**	778	1,701*
Loans	2,107	2,452**	2,617	1,013**	2,237	385***	2,720	1,070**	2,237	2,720**	385	1,070**
Deposits	2,782	3,996***	4,115	1,455**	2,914	857***	4,442	1,502**	2,914	4,442**	857	1,502
Other Earning Assets	1,003	1,848***	1,845	557.1**	1,048	484**	2,062	562***	1,048	2,062**	484	562
Reserves Impaired Loans	114	156***	165	60.45**	119	43**	175	61***	119	175***	43	61
Liquid Assets	867	1,287***	1,320	357.1**	910	341***	1,433	358***	910	1,433**	340	358
Income Statement												
Net Interest Revenue	104	156***	159	59***	110	13***	173	63***	110	173***	13	63***
Other Operating Income	64	71	78	23***	68	13***	80	23***	68	80	13	23
Net Income	166	227***	237	81***	175	27***	253	86***	175	253***	27	86***
Overheads	85	111***	116	46***	89	17***	123	48***	89	123***	17	48***
Financial Ratios												
z-score	22.87	15.55***	16.62	35.56**	22.88	21.29	15.03	36.68**	22.88	15.03**	21.29	36.68
Tier 1 Ratio	25.01	15.85***	17.51	13.1**	25.08	NA	16.05	13.10	25.08	16.05**	NA	13.1
Loan Loss Reserves/Loans	6.68	7.88***	7.81	8.11	6.49	10.57	8.082	8.01	6.49	8.08***	10.57	8.01
Equity/Assets	21.68	10.81***	13.22	8.54***	21.25	28.15	11.02	6.99***	21.25	11.02**	28.15	6.99***
Equity/Net Loans	68.23	27.67***	36.19	21.56**	66.26	97.6	28.36	15.51**	66.26	28.36**	97.60	15.51*
Equity/Deposits	55.06	18.09***	25.88	15.29**	55.35	43.14	18.03	13.41	55.35	18.03**	43.14	13.41
Liabilities/Equity	9.05	15.82***	15.08	10.87	9.42	3.75	16.6	11.43	9.42	16.60**	3.75	11.43
Net Interest Margin	6.56	4.08***	4.49	4.41	6.72	1.99***	3.887	4.59	6.72	3.89***	1.99	4.59*
ROA	2.13	0.94***	1.29	-0.73***	2.16	1.13	1.055	-0.89***	2.16	1.06***	1.13	-0.89**
ROE	11.26	14.10**	13.13	9.73	11.17	13.11	13.67	9.42	11.17	13.67*	13.11	9.42
Cost/Income	62.61	56.48**	57.31	78.06*	63.09	60.7	55.79	79.33**	63.09	55.79**	60.70	79.33
Net Loans/Assets	49.82	51.52**	50.82	55.49**	50.05	46.32	51.02	56.22**	50.05	51.02	46.32	56.22
Liquid Assets/Deposits	55.56	40.29***	43.60	40.11	55.71	39.79	40.34	40.14	55.71	40.34	39.79	40.14

*, **, *** denote significance of the t-statistic for the mean equality of each pair of columns from left to right at the 10%, 5%, and 1% levels, respectively

Table 5 The Cox survival model based on balance sheet variables and country variables. The table reports the β sensitivities and the standard errors in parentheses from the Cox model, eq. (6), estimated for pooled banks (Model I and II), Islamic banks (Model III), and conventional banks (Model IV). In each model the first (second) column reports a specification that considers only bank-specific conditioning variables (both bank- and country-specific conditioning variables). The selection of conditioning factors is based on a forward-and-backward algorithm on the basis of individual significance (LR tests) and overall goodness-of-fit according to the Akaike Information Criterion (AIC). The conditioning factors are bank-level balance sheet variables and country-level market structure and macroeconomic variables. The LR test θ=0 is for the null that the latent country factors or shared frailty are insignificant; the hypothesis is not rejected for Islamic banks so the baseline Cox model without shared frailty is reported. The Wald test β=0 is for the joint significance of all variables. The PH test is the Schoenfeld residual-based test for the proportional hazards assumption. The BIC is Bayesian Information Criterion. LogL is the log-likelihood. The Pseudo-R^2 is the McFadden goodness-of-fit criteria

		Model I *Pooled banks*		**Model II** *Pooled banks*		**Model III** *Islamic banks*		**Model IV** *Conventional banks*	
Bank specific	Islamic bank	-1.079**	-0.970**	-0.370***	-2.147***				
		(0.454)	(0.471)	(2.696)	(3.526)				
	Assets	0.799***	0.842***	0.794***	0.864***	0.745	0.759	0.782***	0.851***
		(0.189)	(0.190)	(0.208)	(0.220)	(0.469)	(0.530)	(0.209)	(0.220)
	Other Earning Assets	-0.510***	-0.603***	-0.454***	-0.564***	-0.424*	-0.535**	-0.440**	-0.545***
		(0.142)	(0.140)	(0.173)	(0.184)	(0.248)	(0.261)	(0.173)	(0.183)
	Liquid Assets	-0.001***	-0.001***	-0.001***	-0.001***	-0.001	-0.001	-0.001***	-0.001***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
	Growth of Loans	-1.064***	-0.863**	-1.267***	-1.001***	-0.198	-0.142	-1.240***	-1.005***
		(0.352)	(0.347)	(0.379)	(0.374)	(0.556)	(0.482)	(0.381)	(0.378)
	Growth of Equity	-0.088**	-0.050	-0.086**	-0.049	-0.395	-0.373	-0.106**	-0.071
		(0.035)	(0.037)	(0.036)	(0.038)	(0.725)	(0.811)	(0.045)	(0.051)
Country specific	Growth of Real GDP		-0.064***		-0.077***		-0.030		-0.075***
			(0.024)		(0.025)		(0.133)		(0.025)
	Inflation		0.014***		0.012**		0.035**		0.011**
			(0.005)		(0.005)		(0.016)		(0.005)
	Sector Concentration		-0.076**		-0.099***		0.025		-0.079**
			(0.030)		(0.036)		(0.043)		(0.034)
Islamic bank interactions	Islamic bank × Assets			-0.188	-0.149				
				(0.509)	(0.537)				
	Islamic bank × Other Earning Assets			-0.115	-0.218				
				(0.273)	(0.001)				
	Islamic bank × Liquid Assets			0.001	0.001				
				(0.001)	(0.001)				
	Islamic bank × Growth of Loans			1.244**	0.993**				
				(0.529)	(0.401)				
	Islamic bank × Growth of Equity			-0.391	-0.545				
				(0.582)	(0.654)				
	Islamic bank × Growth of Real GDP				0.171				
					(0.112)				
	Islamic bank × Inflation				0.031***				
					(0.012)				
	Islamic bank × Sector Concentration				0.078				
					(0.055)				
Diagnostics	Theta (θ)	1.419	1.356	1.476	1.798			1.150	0.984
	LR test θ=0	41.90***	24.91***	41.97***	26.59***			36.50***	18.85
	Wald test β=0	44.89***	66.27***	48.40***	71.61***	10.38*	10.850***	38.81***	55.490***
	PH test (χ^2)	5.88	9.36	6.18	7.76	3.49	3.55	5.68	7.36
	AIC	668.92	660.07	676.07	656.14	49.28	48.65	586.15	570.36
	BIC	707.07	706.76	745.67	763.21	72.68	85.07	616.72	619.22
	LogL	-328.55	-316.034	-327.03	-311.07	-19.64	-16.33	-288.07	-277.18
	Pseudo-R^2	34.61	37.15	34.96	38.13	39.78	49.95	34.82	37.33
	Banks	421	421	421	421	106	106	315	315
	Failures	97	97	97	97	8	8	89	89
	Observations (bank-year)	4,583	4,583	4,583	4,583	923	923	3,660	3,660

*, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively

Table 6 The Cox survival model based on income statement variables and country variables. The table reports the β sensitivities and the standard errors in parentheses from the Cox model, eq. (6), estimated for pooled banks (Model I and II), Islamic banks (Model III), and conventional banks (Model IV). In each model the first (second) column reports a specification that considers only bank-specific conditioning variables (both bank- and country-specific conditioning variables). The selection of conditioning factors is based on a forward-and-backward algorithm on the basis of individual significance (LR tests) and overall goodness-of-fit according to the Akaike Information Criterion (AIC). The conditioning factors are bank-level balance sheet variables and country-level market structure and macroeconomic variables. The LR test θ=0 is for the null that the latent country factors or shared frailty are insignificant; the hypothesis is not rejected for Islamic banks so the baseline Cox model without shared frailty is reported. The Wald test β=0 is for the joint significance of all variables. The PH test is the Schoenfeld residual-based test for the proportional hazards assumption. The BIC is Bayesian Information Criterion. LogL is the log-likelihood. The Pseudo-R^2 is the McFadden goodness-of-fit criteria

		Model I *Pooled banks*		**Model II** *Pooled banks*		**Model III** *Islamic banks*		**Model IV** *Conventional banks*	
Bank specific	Islamic bank	-0.625	-0.531	-0.637	-3.660**				
		(0.445)	(0.462)	(0.467)	(1.496)				
	Growth of Overheads	-0.064	-0.028	-0.048	-0.008	1.043**	0.937**	-0.046	-0.005
		(0.069)	(0.073)	(0.085)	(0.074)	(0.532)	(0.549)	(0.085)	(0.067)
	Net Interest Revenue	-0.002**	-0.002**	-0.002***	-0.002**	0.012	-0.017*	-0.002**	-0.002**
		(0.001)	(0.001)	(0.001)	(0.001)	(0.014)	(0.016)	(0.001)	(0.001)
	Net Income	0.006***	0.007***	0.006**	0.007***	-0.144***	-0.141*	0.006***	0.007***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.031)	(0.082)	(0.002)	(0.002)
Country specific	Growth of Real GDP		-0.063***		-0.065***		-0.016		-0.074***
			(0.023)		(0.024)		(0.171)		(0.024)
	Inflation		0.019***		0.015***		0.035**		0.017***
			(0.005)		(0.005)		(0.016)		(0.005)
	Sector Concentration		-0.087***		-0.115***		0.007		-0.105***
			(0.031)		(0.037)		(0.049)		(0.036)
Islamic bank interactions	Islamic bank × Growth of Overheads			-0.583**	-0.717**				
				(0.285)	(0.305)				
	Islamic bank × Net Interest Revenue			-0.001	-0.001				
				(0.002)	(0.002)				
	Islamic bank × Net Income			-0.057*	-0.058*				
				(0.033)	(0.035)				
	Islamic bank × Growth of Real GDP				0.142				
					(0.118)				
	Islamic bank × Inflation				0.020*				
					(0.011)				
	Islamic bank × Sector Concentration				0.114				
					(0.055)				
Diagnostics	Theta (θ)	2.175	1.757	2.419	2.195			1.645	1.015
	LR test θ=0	55.37***	26.22***	57.35***	26.89***			47.27***	17.83***
	Wald test β=0	16.06***	24.90***	21.77***	49.08***	35.27***	61.02***	13.74***	38.3***
	PH test (χ^2)	0.82	5.53	2.82	5.53	0.47	1.33	1.37	3.47
	AIC	659.99	637.80	662.44	639.58	40.52	40.43	577.71	555.65
	BIC	685.62	681.84	706.68	721.38	54.54	67.71	596.03	592.25
	LogL	-326.17	-311.90	-324.22	-306.79	-17.26	-14.22	-285.85	-271.82
	Pseudo-R^2	32.59	35.53	35.52	38.98	47.08	56.40	35.32	36.96
	Banks	421	421	421	421	106	106	315	315
	Failures	97	97	97	97	8	8	89	89
	Observations (bank-year)	4,583	4,583	4,583	4,583	923	923	3,660	3,660

*,**, and *** denote significance at the 10%, 5%, and 1% levels, respectively

Table 7 The Cox survival model based on financial ratios and country variables. The table reports the β sensitivities and the standard errors in parentheses from the Cox model, eq. (6), estimated for pooled banks (Model I and II), Islamic banks (Model III), and conventional banks (Model IV). In each model the first (second) column reports a specification that considers only bank-specific conditioning variables (both bank- and country-specific conditioning variables). The selection of conditioning factors is based on a forward-and-backward algorithm on the basis of individual significance (LR tests) and overall goodness-of-fit according to the Akaike Information Criterion (AIC). The conditioning factors are bank-level balance sheet variables and country-level market structure and macroeconomic variables. The LR test θ=0 is for the null that the latent country factors or shared frailty are insignificant; the hypothesis is not rejected for Islamic banks so the baseline Cox model without shared frailty is reported. The Wald test β=0 is for the joint significance of all variables. The PH test is the Schoenfeld residual-based test for the proportional hazards assumption. The BIC is Bayesian Information Criterion. LogL is the log-likelihood. The Pseudo-R^2 is the McFadden goodness-of-fit criteria

		Model I *Pooled banks*		**Model II** *Pooled banks*		**Model III** *Islamic banks*		**Model IV** *Conventional banks*	
Bank specific	Islamic bank	-1.062**	-0.997*	-0.620	-4.103**				
		(0.520)	(0.535)	(1.091)	(2.080)				
	Cost/Income	0.003***	0.003***	0.003***	0.003***	0.014	0.017	0.004***	0.004***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.016)	(0.026)	(0.001)	(0.001)
	Liquid Assets/Deposits	-0.013**	-0.015***	-0.001	-0.002	-0.012	-0.006**	-0.015**	-0.017***
		(0.005)	(0.005)	(0.003)	(0.003)	(0.013)	(0.003)	(0.006)	(0.006)
	Equity/Assets	-0.011	-0.004	-0.035***	-0.026*	0.046**	0.073**	-0.033**	0.022
		(0.011)	(0.011)	(0.012)	(0.013)	(0.021)	(0.034)	(0.013)	(0.014)
	Net Interest Margin	0.012	0.013	0.070***	0.065**	-0.242	-0.447	0.079***	0.072**
		(0.008)	(0.009)	(0.026)	(0.028)	(0.220)	(0.343)	(0.027)	(0.029)
Country specific	Growth of Real GDP		-0.063**		-0.065**		0.017		-0.074***
			(0.026)		(0.026)		(0.148)		(0.027)
	Inflation		0.013***		0.010*		0.059*		0.008
			(0.005)		(0.005)		(0.032)		(0.005)
	Sector Concentration		-0.068**		-0.092***		0.106		-0.081**
			(0.031)		(0.036)		(0.068)		(0.036)
Islamic Bank interactions	Islamic Bank × Cost/Income			-0.011	-0.015				
				(0.008)	(0.011)				
	Islamic Bank × Liquid Assets/Deposits			-0.009	-0.003				
				(0.014)	(0.012)				
	Islamic Bank × Equity/Assets			0.079	0.073***				
				(0.020)	(0.022)				
	Islamic Bank × Net Interest Margin			-0.197	-0.221*				
				(0.116)	(0.134)				
	Islamic Bank × Growth of Real GDP				0.112				
					(0.140)				
	Islamic bank × Inflation				0.042***				
					(0.014)				
	Islamic bank × Sector Concentration				0.126**				
					(0.063)				
Diagnostics	Theta (θ)	1.528	1.219	1.41	1.19			1.082	0.841
	LR test θ=0	49.55***	29.15***	38.55***	23.79***			36.76***	23.35***
	Wald test β=0	21.42***	42.07***	31.61***	53.42***	31.92***	66.3***	28.68***	45.20***
	PH test (χ^2)	0.92	3.33	2.30	3.92	0.10	3.54	2.03	3.38
	AIC	635.16	618.41	643.30	626.36	33.90	30.38	564.86	551.65
	BIC	666.72	668.69	700.13	720.66	52.44	61.93	589.29	594.35
	LogL	-312.58	-301.20	-312.58	-298.18	-12.95	-8.19	-278.43	-268.82
	Pseudo-R^2	37.11	39.40	37.82	40.69	60.29	75.78	36.24	38.44
	Banks	421	421	421	421	106	106	315	315
	Failures	97	97	97	97	8	8	89	89
	Observations (bank-year)	4,583	4,583	4,583	4,583	923	923	3,660	3,660

*, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively

Table 8 The relative predictive accuracy of Cox survival models. The table reports the mean, median, and the standard deviation of the hazard rate predictions from each model for surviving and failed banks, separately, in four categorizations: pooled banks, pooled banks with interacted Islamic bank dummy, Islamic banks, and conventional banks. The null hypothesis of the t-test (Mann-Whitney test) is that the mean (median) hazard rate is equal for surviving and failed banks within each category. The model with the highest t-statistic (discriminatory power) is considered best. The Gain is the log increase in the t-statistic between the best and second best models

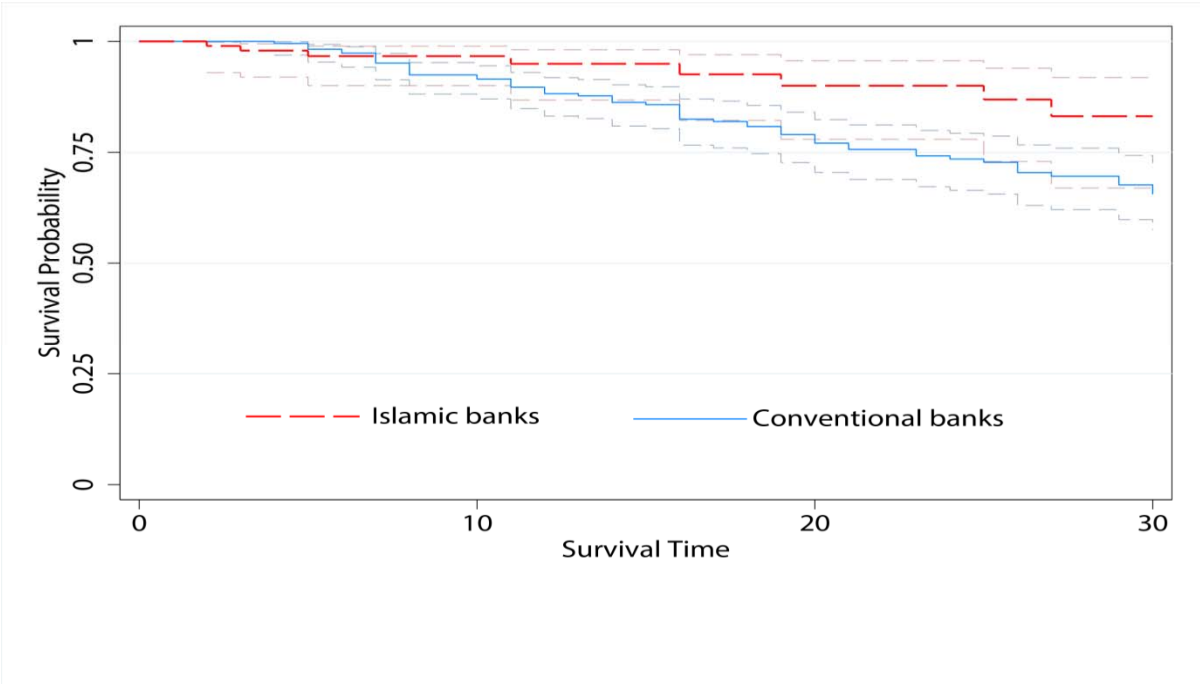
	Hazard rate predictions per bank category					
	Pooled banks		**Islamic banks**		**Conventional banks**	
	Survive	**Failed**	**Survive**	**Failed**	**Survive**	**Failed**
Panel A: Model I (Pooled banks)						
Mean	0.356	1.298	0.084	0.149	0.426	1.401
Median	0.140	0.560	0.030	0.120	0.230	0.620
StDev	0.739	2.211	0.345	0.143	0.794	2.280
t-statistic (*p*-value)	4.189 (0.000)		1.251 (0.247)		4.027 (0.000)	
Mann-Whitney statistic (*p*-value)	9.490 (0.000)		2.127 (0.033)		8.758 (0.000)	
Panel B: Model II (Pooled banks with interacted Islamic bank dummy)						
Mean	0.291	1.002	0.048	1.033	0.353	0.999
Median	0.094	0.497	0.011	0.084	0.173	0.522
StDev	0.627	1.856	0.203	1.699	0.681	1.879
t-statistic (p-value)	3.765 (0.000)		1.638 (0.145)		3.236 (0.002)	
Mann-Whitney statistic (*p*-value)	9.825 (0.000)		3.476 (0.001)		8.658 (0.000)	
Panel C: Model III (Islamic banks)						
Mean	0.347	1.247	0.029	0.135	0.404	1.387
Median	0.137	0.587	0.021	0.112	0.289	0.744
StDev	0.845	2.008	0.175	0.117	0.478	1.874
t-statistic (*p*-value)	1.457 (0.073)		2.987 (0.008)		1.178 (0.120)	
Mann-Whitney statistic (*p*-value)	2.225 (0.029)		8.223 (0.000)		1.598 (0.056)	
Panel D: Model IV (Conventional banks)						
Mean	0.401	1.372	0.244	0.484	0.441	1.452
Median	0.146	0.536	0.087	0.167	0.198	0.573
StDev	1.109	2.939	1.240	0.898	1.069	3.047
t-statistic (*p*-value)	3.248 (0.002)		0.749 (0.477)		3.125 (0.002)	
Mann-Whitney statistic (*p*-value)	9.000 (0.000)		1.087(0.277)		8.647 (0.000)	
Predictability ranking						
Best model (Gain)	I (25.40%)		III (87.00%)		I (25.30%)	

Table 9 Z-score regressions and logit regressions. The table reports the results from the OLS estimation with the *z*-score (dependent variable) inspired by Model (4) in Table 5 of Čihák and Hesse (2010). Model A is estimated with our current sample of surviving banks only, and Model B for surviving and failed banks. The logit regressions for the binary failure indicator (dependent variable) are estimated with the maximum likelihood. A one period lag is indicated as (-1). Pseudo-R^2 and McFadden R^2 are reported for the z-score and logit regressions, respectively. Income diversity is defined as $1 - |((\text{Net interest income} - \text{Other operating income})/(\text{Total operating income}))|$ so that higher values reflect a higher degree of diversification (Čihák and Hesse, 2010). Newey-West h.a.c. standard errors are reported for the z-score OLS estimations and ML standard errors for the logit regressions (in parenthesis). The p-values are in square brackets

	***Z*-score regressions**				**Logit regressions**			
	Model A		**Model B**		**Model C**		**Model D**	
	(*Survive banks*)		**(*Survive & Fail banks*)**		**(*Survive & Fail banks*)**		**(*Survive & Fail banks*)**	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Islamic bank	18.466**	(7.890)	13.33	(9.127)	-1.321***	0.446		
Loans / Assets (-1)	2.560**	(1.272)	3.065**	(1.361)				
Cost / Income (-1)	-0.014***	(0.001)	-0.014***	(0.001)				
Assets (-1)	-1.565***	(0.271)	-1.747***	(0.315)				
Income Diversity (-1)	0.002*	(0.001)	0.002*	(0.001)				
Income Diversity × Islamic bank (-1)	0.017	(0.049)	0.028	(0.039)				
Sector Concentration (-1)	-0.122***	(0.030)	-0.151***	(0.040)				
Islamic bank share (-1)	6.052**	(2.700)	3.675	(3.952)				
Islamic bank share × Islamic bank (-1)	-0.160*	(0.085)	-0.146*	(0.079)				
Exchange Rate Depreciation (-1)	0.001***	(0.000)	0.001***	(0.000)				
Inflation (-1)	0.013	(0.010)	0.013	(0.011)				
Growth of Real GDP (-1)	0.092**	(0.045)	0.087*	(0.045)				
z-score					0.003**	(0.002)	0.003*	(0.107)
Constant	20.988***	(3.667)	27.538***	(7.897)	-3.751***	(0.109)	-3.903***	(0.107)
Adjusted R^2 (McFadden R^2)	0.038		0.037		0.023		0.007	
F-statistic (LR-statistic)	12.877		12.691		21.188		6.497	
	[0.000]		[0.000]		[0.000]		[0.011]	
Observations (bank-year)	3,888		3,970		4,583		4,583	

*,**, and *** denote significance at the 10%, 5%, and 1% levels, respectively

Panel A. Unconditional survival estimates for Islamic and conventional banks



Panel B. Unconditional survival estimates for Islamic and conventional banks by size

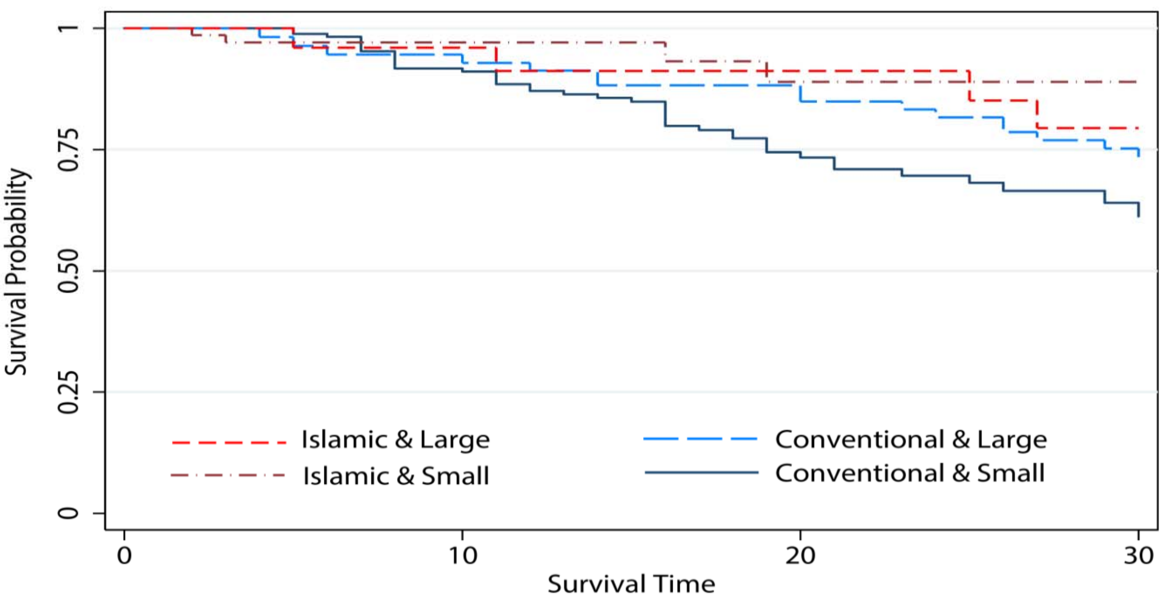


Fig. 1 Survival function estimates. Panel A reports the nonparametric Kaplan-Meier survival rate estimates and 95% confidence bands for up to 30 years. The survival rates are 91% (after 20 years) and 86% (after 30 years) for Islamic banks, and 84% (after 20 years) and 77% (after 30 years) for conventional banks. Panel B reports the survival rate estimates for the Islamic and the conventional banks grouped by size according to the median values of their asset distributions

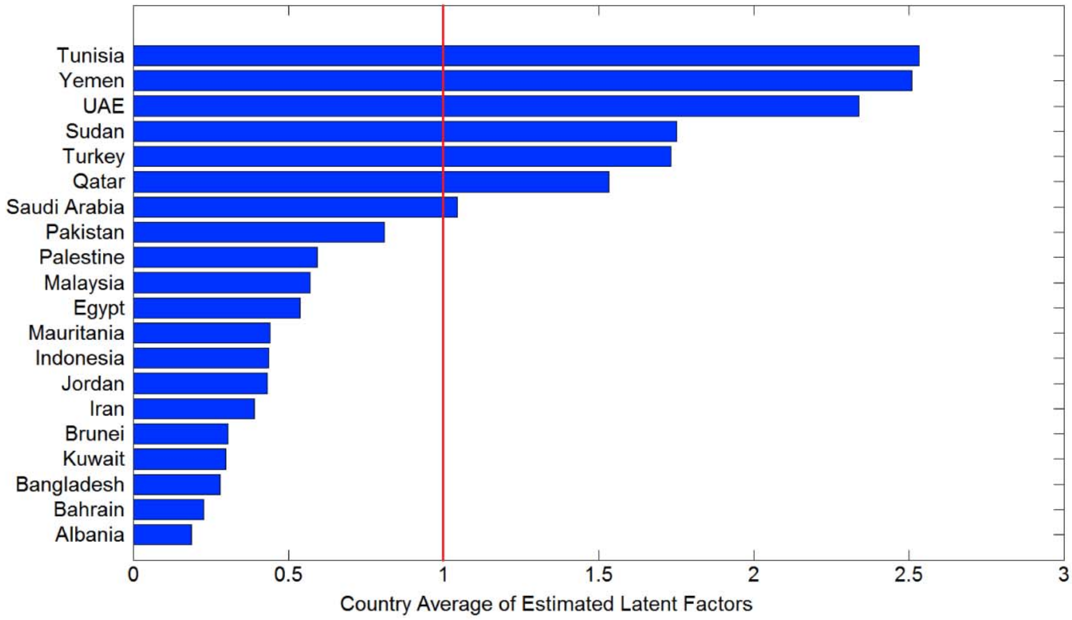


Fig. 2 The Cox model estimates of shared frailty. The figure plots the average shared-frailty estimates, $\hat{a}_c = e^{\hat{v}_c}$, from the Cox models in Tables 5 to 7 that are built from bank-level variables (balance sheet, accounting statement, and financial ratios respectively) and country factors (market structure and macroeconomic). The values $\hat{a}_c > 1$ ($\hat{a}_c < 1$) imply that country factors (latent or observed) besides the included ones have an upward (downward) effect on the banks' failure risk. For example, the average estimate for Jordan at about 0.50 means that the latent domestic factors reduce the hazard rate of Jordanian banks by 50%