International Journal of Economics, Management and Accounting 25, no. 2 (2017): 381-410
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A PANEL SURVIVAL ANALYSIS FOR ISLAMIC BANKS

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ABSTRACT

This study aims at exploring the significant predictors of Islamic bank survival within the time-varying covariate of risk time exposure. Thus, limited survival studies on the Islamic banks divert the attention of policymakers and practitioners on the failure hazard likelihood and other means to mitigate its menace. The paper adopted panel survival analysis on the Islamic banks of 24 countries. Subsequently, mixed effect and logit model were employed to confirm the earlier predictions and to ascertain the most promising determinants for Islamic bank survival. The findings reveal that non-interest liabilities, assets quality, liquidity and per capita income have a strong influence in explaining Islamic bank survival. Additionally, managerial efficiency and time-varying covariate are better explained in the time survival models. Future survival studies have the opportunity to incorporate *Maqāṣid Al-Sharī'ah* index and outreach to verify the social justice compliance of the Islamic banks. Consequently, employing accelerated failure time model will provide other evidence in relation to time length to the event. The paper suggested monitoring the banks' failure predictors and urged the banks to focus on the real economic sector investment coupled with efficient resource utilization for longer survival.

JEL Classification: C41, G21, C23, G20

Key words: Survival analysis, Islamic banks, Mixed effect, Logit regression

1. INTRODUCTION

Islamic bank growth and survival is becoming an attractive area of research immediately after the recent global financial crisis. The earlier literature of corporate finance viewed specialists in the field as those concerned about the techniques for estimating the survival and growth, capital budgeting and investment behavior of the institutions

(Modigliani and Miller, 1958). In a specific context, the bank as one of those institutions is a mediating channel that manages fund flow from the surplus to deficit agents of the economy. Therefore, survival of the banking institution in the first place is of paramount importance since it can pave the way to sustainable economic growth and development. The argument is apparent from the recent global financial crisis in which its menace has affected not only the financial institutions but also the world economic system in general. However, some studies have focused on the survival of the very few concentrated global financial institutions on the cross-country issues of Islamic banks. More specifically, the different outcomes on the distance to failure risk leave policymakers and nonprofessionals in corporate finance with an inconclusive direction toward Islamic banking solvency. Those studies were conducted within a close range of data interval and close objective toward predicting risk to failure.

Most recent findings claimed that Islamic banks are relatively higher in survival rate compared to conventional banks (Pappas et al., 2017). However, the prior comparative study concluded that Islamic banks have lower solvency positions compared to traditional banks (Beck, Demirgüç-Kunt and Merrouche, 2013). After all, some banks are found incapacitated after the sample periods of the studies above (see Table 1) [1]. Moreover, the issues of Islamic banking survival is not only reliant on the comparative analysis with conventional banks, rather the possible activities that cause those banks to fail are of paramount importance. At the same time, Pappas et al. (2017) argued that the business model for Islamic banks differs from that of conventional banks which is merely built on profit maximization (cost-minimization). Though Islamic banks are not banned from earning profit, certain *Sharī'ah* laws constrained the institutions from participating in other businesses involving speculation, gambling, uncertainty and interest-based transactions. Therefore, the methodology to be used in assessing the viability of such an institution has to be different from those developed to satisfy the conventional banking practices. For instance, Islamic banks are based on real activities that share profit and loss upon the outcomes of a particular transaction. Again, contrary to the conventional practices, investment account holders are considered part of the business ownership of the bank, and equity is more acceptable compared to debt financing. In this case, debt based hybrid capital that allows some elements of usury

will not reflect the actual picture of this model; likewise transactions on complex derivatives (Khan, 2010).

Furthermore, the objective that founded the Islamic banks is within the *Maqāṣid Al-Sharī'ah* principles which advocated establishing social justice and enhancing societal well-being (Platonova, 2013). Aliyu et al. (2017) concluded that Islamic banks are expected to have a long-term impact that will improve sustainable societal development. As a result, investigating Islamic bank viability based on time-dependent analysis will reflect the theoretical foundation of their establishment. The banks are expected to have a longer period in providing related social services that will sustain the institution, society, and environment through proper financial decisions and capital allocations. Even though some Islamic banks may not live longer, their impacts on social well-being are of paramount importance. Thus, the panel survival analysis of the tri-variate response of time to an event, failure and establishment period of the banks is adopted for this study since other techniques such as Cox model has been utilized in previous banking studies (Lane, Looney and Wansley, 1986; Whalen, 1991; Cole and Gunther, 1995; Henebry, 1996; Wheelock and Wilson, 2000; Molina, 2002; Cole and Wu, 2009; Hong, Huang and Wu, 2014). Although Pappas et al. (2017) carefully investigated a comparative analysis between Islamic and conventional bank survival within 20 countries of the Middle East and Far Eastern countries for the period between 1995 and 2010, their study neglected other Islamic banking activities before 1995. This study, in contrast, incorporates a long time span dating back to 1987, where failed banks before 1995 are also considered[2]. Consequently, Aliyu et al. (2017) reported that other banks became incapacitated after the period of their study, which motivates the current study to further investigate the situation based on 170 Islamic banks from 24 countries. Furthermore, the present study differs from previous Islamic banking studies of survival analysis in terms of methods of analysis. As such, panel survival and mixed effect model are employed other than the Cox model. The techniques are set to explore time to an event to predict the factors responsible for Islamic banking failure. Meanwhile, confirming bank failure prediction through mixed effect and logit model will strengthen the confidence in the findings. Despite the advantages of survival model regarding tri-variate response (initial time, failure and censored period), recent studies are still employing

the logit model (Berger and Bouwman, 2013; Chiaramonte and Casu, 2017) on bank failure predictions. This study predicts determinants of bank survival from the two perspectives and added the mixed effect model in order to ascertain the most influential factors that will guide to best practices and policy formulation. Therefore, the findings are expected to present insightful ideas to decision makers for designing policies reflecting the real position of the institutions.

Recent evidence confirmed the resilience of Islamic banks during the crisis through higher liquidity, capitalization and assets quality (Beck, Demirgüç-Kunt and Merrouche, 2013), and contradicting findings were obtained on data that extended beyond the crisis period (Alqahtani, Mayes and Brown, 2016). Meanwhile, other banks fall into either acquired or merged as result of operational difficulties (Aliyu et al., 2017). Thus, it is unclear whether liquidity, capitalization, asset performance and quality will influence Islamic bank survival or not. Therefore, the specific objective of this article is to determine the influence of these variables due to their unstable effect on Islamic banks during and after the recent global financial crisis. The remaining four sections of this article begin with a review of related literature which stresses the link between the banks' failure and other banking activities to survive longer. Data and methodology are the subsequent sections that focus on the sample banks and countries, variable categorization and methods, while results are discussed in section four. Finally, the article concludes by highlighting major findings, policy recommendations, and future research suggestions.

2. LITERATURE REVIEW

Islamic banks are operating within the standing capital ground similar to conventional practices of the banking institutions. Nonetheless, the restrictions on the operational mode of the Islamic bank make the institution different compared to other commercial banks. At the same time, the management staff of the banks are expected to be operating efficiently and not to raise dispute between them and the capital owners. As a result, the bank assets quality and earnings management have to be continuously improving in order to hedge against any other external expenses accrued to the bank. Islamic bank survival thus is assessed within the capacity of capital adequacy, assets quality, management efficiency, improvement in earnings performance, and

liquidity position-CAMEL (El-Hawary, Grais and Iqbal, 2007; Pappas et al., 2017). Islamic bank capitalization was found enough to absorb the external shock of the financial crisis (Beck, Demirgüç-Kunt and Merrouche, 2013; Rosman, Wahab and Zainol, 2014). Nonetheless, some banks were merged or acquired due to operational failure and insolvency position (see Table 1). The growing literature on the banks' failure and survival prediction studies (Lane, Looney and Wansley, 1986; Whalen, 1991; Cole and Gunther, 1995; Henebry, 1996; Wheelock and Wilson, 2000; Molina, 2002; Cole and Wu, 2009; Hong, Huang and Wu, 2014; Chiaramonte and Casu, 2017) left few (Pappas et al., 2017; Baele, Farooq and Ongena, 2014) of them focused on the Islamic banks despite their importance. Islamic banks will not be an exception to systematic and unsystematic risks that can lead to banks distress. Kassim and Majid (2010) supported this assertion despite the earlier belief that Islamic banks can survive even with external shocks so long as they operate on asset-based principles.

However, cost inefficiency is one of the deficiencies highlighted in Islamic banking practice compared to conventional banks (Beck, Demirgüç-Kunt and Merrouche, 2013). Today, it is unclear whether the Islamic banks' managerial inefficiency will predict their probability of failure as a result of bad luck or bad management hypothesis (Berger and DeYoung, 1997). In this situation, a positive relationship between inefficiency and bank failure is explained in the context of bad management hypothesis which is extended to Islamic banks' negligence towards *Sharī'ah* compliance (Saeed and Izzeldin, 2014). Therefore, the functions of regulators are highly desirable in order to establish sustainable Islamic banking practices within the prudential guidance of *Sharī'ah* (Aliyu, 2014; Aliyu and Yusof, 2016). Apart from efficiency, Islamic banks are urged to have enough liquidity to supplement unexpected demands from their clients. Excess liquidity available to especially large Islamic banks might push the institution toward liquidity risk (Čihák and Hesse, 2010). However, it is not known with precise confidence whether the liquidity risk of the Islamic bank will increase survival likelihood or not.

Additionally, Islamic banks are designed to intermediate financial resources through channelizing funds to the real economic sectors (Khan, 2010). Therefore, external economic shocks are liable to influence their operational performance. For instance, the banks are

expected to outreach the public through entrepreneurial financing in the form of participatory finance. Hence, the banks' survival relies on the outcome of the business, which is also affected by the other macroeconomic indicators such as inflation and income level of the citizens. Moreover, Grossman (1993) found that small banks failure reduced 2 percent of the gross national product while one fifth was declined as a result of large bank failure. Therefore, bank failure, and economic activities are just like a life cycle that reveals the impacts of the macroeconomic factors on banks survival apart from bank-specific indicators.

In sum, there is a consensus in the existing literature that banking survival analysis can be assessed in line with the CAMEL rating. The scale accommodated various compositions of the financial institutions' activities and performance measures. In a specific context to Islamic banks, negligence towards *sharī'ah* compliance is resulting from poor management practices which also require a rating scale in addition to CAMEL in assessing Islamic banks' performance. Therefore, providing *sharī'ah*-based rating will deliver a clear picture of Islamic financial institutions since they are framed to operate within the real economic activities.

3. METHODOLOGY AND DATA

3.1 METHODOLOGY

Survival analysis is commonly used in the conventional literature to explore the time to failure of the banks. Lane, Looney and Wansley (1986) is regarded as the earliest survival application that employed Cox proportionate hazard model to the banking literature. The Cox (1972) model directed focus of the subsequent studies on the banks time to failure (Whalen 1991; Wheelock and Wilson 2000; Pappas et al. 2017). Meanwhile, survival analysis is originated from the statistical concept of probability theory. Following Royston and Lambert (2011), the primary three relationships in survival analysis are transformation of survival $S(t)$ to hazard function $h(t)$ and later the cumulative $H(t)$ of the hazard function. Moreover, the survival time is randomly denoted as T and the bank establishment period begins at time $t = 0$ In a nutshell, their relationship can be express as follows:

$$(1) \qquad S(t) = \Pr(T > t)$$

Equation (1) represents the survival function of the banks during the establishment period of not experiencing any event in relation to failure components.

$$h(t) = \lim_{\delta \to 0} \frac{\Pr(t \leq T < t + \delta t | T \geq t)}{\delta t} = -\frac{d \ln S(t)}{dt} \quad (2)$$

Equation (2) above is derived from the termed conditional failure rate due to limit interval of time and the possibilities of the bank to survive from the establishment period to an interval time (Cleves et al., 2010; Rabe-Hesketh and Skrondal, 2012). Equation (2) accounted for the accumulated bank's risk from the establishment of the time to an event. Let:

$$H(t) = \int_0^t h(u)du \quad (3)$$

Hence, $S(t)$ can be expressed as the inverse of $H(t)$:

$$S(t) = \exp\{-H(t)\} \quad (4)$$

$$H(t) = -ln\{S(t)\} \quad (5)$$

$$h(t) = f(t)/\, S(t) \quad (6)$$

From (4), $1 - S(t)$ is the cumulative distribution function while the probability density function is expressed as: $f(t)$ In a broader sense that examine the case of survival analysis in the form of panel dataset with the vector of a covariate X may influence the bank's survival. Therefore, the functional equation can be extended with the inclusion of other assumptions that will give the real picture of the scenario. Let us consider individual banks $1, \ldots, n$ and the panel, $j = 1, \ldots, n$ represent the structure of survival dataset with time to event t and have a tri-variate response (t_0, t, d). The t_0 is the bank's establishment period $(t_0 \geq 0)$ while t is last observation period for the bank $(t \geq t_0)$ and d is the failure indicator which is representing $d = 1$ or right censoring of; $d = 0$. Similarly, adding $v_i s$ unobserved random effects to the panel is assumed to satisfy the properties of independent and identically distributed (iid) $N(0, \sigma_v^2)$.

Equation (7) can be deduced through the integration of the banks' panel properties with unobserved random effects to the proportional hazard model, and the covariates which have multiplicative consequences for the hazard function:

$$h(t_{ij}) = h_0(t_{ij})\exp(X_{ij}\beta + v_i) \quad (7)$$

The first estimation of this study is derived from (7) in which the proportional hazard $h(t_{ij})$ depends on the conditional influence of the predictor's vector X_{ij}. The predictors include banks' specific and macroeconomic control variables. The parametric assumption is also applied to the baseline hazard function. The second estimation of the mixed effect model, expressed in (8), focuses on the intra-cluster correlation due to random effects of common cluster-level of a group (banks) of the panel observation. In similar expression with equation (7), the multiplicative effects of covariates have an influence on the hazard function. Moreover, the model also has a tri-variate response (t_0, t, d) that matches with the period of observation.

$$h(t_{ij}) = h_0(t_{ij})\exp(X_{ij}\beta + z_{ij}u_j) \quad (8)$$

Furthermore, z_{ij} is a vector of 1 x q that enclosed the random effects covariates and also can be utilized for random intercept and coefficient. Henceforth, u_j random effects are realized from the cluster multivariate normal distribution which is not directly estimated as a parameter, rather through variance components of the model. For this reason, the second model is estimated to confirm the validity of (7) in predicting Islamic bank survival.

Recent banking literature predicted bank survival using logistic regression (Berger and Bouwman, 2013; Chiaramonte and Casu, 2017). However, it is unclear whether the estimation through logistic modeling will predict a similar outcome with that of the survival and mixed effect models. Thus, panel logistic regression model has been adapted to investigate the phenomenon further. As a result, we set failure indicator as a response variable of the model against the predictors. For consistency with the previous models, random-intercept is applied to the logistic regression. Following Rabe-Hesketh and Skrondal (2012) the model can be expressed as follows:

$$\text{Prob}(y_{ij} = 1|X_{ij}, u_j) = \beta_0 + X_{ij}\beta + u_j \quad (9)$$

where the vector of the predictors X_{ij} is multiplied with coefficient β, and $u_j \sim N(0, \sigma_u^2)$ is a random intercept with the assumption of iid across the bank's cluster j and independent of the covariates X_{ij}.

3.2 DATA DESCRIPTION

The sample of this study consists of 170 Islamic banks in 24 countries in Africa, Asia, Europe, and the Middle East between 1987 and 2014. The samples are drawn from BankScope for both financial (ratios and balance sheet) and non-financial (failure time) data of each bank. Similarly, data from International Monetary Fund (IMF) are used as control variables for the macroeconomic situations of each country. Considering the objective of this study, both failed and sustained banks' information is relevant for the analysis.

TABLE 1
Sample Countries and Banks

Country	Banks	Percent	Survived	Failed
Bahrain	24	14.1	18	6
Bangladesh	8	4.7	8	-
Brunei	3	1.8	1	2
Cayman Islands	1	0.6	-	1
Egypt	3	1.8	3	-
Gambia	1	0.6	0	1
Great Britain	6	3.5	6	-
Indonesia	10	5.9	10	-
Iran	16	9.4	12	4
Jordan	3	1.8	3	-
Kuwait	11	6.5	9	2
Lebanon	3	1.8	2	1
Malaysia	19	11.2	18	1
Mauritania	2	1.2	1	1
Pakistan	9	5.3	8	1
Palestine	2	1.2	2	-
Qatar	6	3.5	5	1
Saudi Arabia	5	2.9	5	-
Singapore	1	0.6	1	-
Sudan	16	9.4	12	4
Tunisia	1	0.6	1	-
Turkey	5	2.9	4	1
United Arab Emirates	11	6.5	9	2
Yemen	4	2.4	4	-
Total	170	100	142	28

Table 1 presents the composition of the selected banks. Islamic banks from one of the Middle East countries (Bahrain) have a higher representation of 14.1 percent and 11.2 percent from Malaysia which is one of the South East Asian countries. Similarly, Iran and Sudan from the Middle East and Africa regions have equal sample proportion of 9.4 percent respectively. Moreover, Kuwait and United Arab Emirates share a similar percentage of 6.5 percent in the sample, and 5.9 percent from Indonesia. The least are those countries (Cayman Islands, Gambia, Singapore and Tunisia) with 0.6 percent. It is clear that based on the available sample, Islamic banks are predominantly represented by the Middle East and Southeast Asian countries.

According to Table 1, 28 banks are reported failed with six from Bahrain, Iran and Sudan recorded four banks each while two banks each are accounted for by Brunei, Kuwait, and United Arab Emirates. The last category comprised those countries with one failed bank, and those include Cayman Islands, Gambia, Lebanon, Malaysia, Mauritania, Pakistan, Qatar, and Turkey. As a result of higher banks failure in Bahrain compared with other countries, the number of survived sample banks in the country became equal with that of Malaysia. Likewise, Sudan and Iran shared the same proportion of survived banks while Cayman Islands and Gambia lost Islamic banks completely. However, our sample remains the same for surviving and failed banks in some countries such as Bangladesh, Egypt, Great Britain, Indonesia, Jordan, Saudi Arabia, Singapore, Tunisia and Yemen.

Table 2 presents the variables categorization and definitions. Considering the theoretical foundation of the Islamic banking transactions, non-interest expenses to average assets is selected to proxy managerial efficiency. The Islamic banks' business model is guided based on the principle of *Sharī'ah* that promotes profit and loss sharing without speculation and gambling (Beck, Demirgüç-Kunt and Merrouche, 2013; Aliyu, 2014; Aliyu and Yusof, 2016). With this, the banking system under this principle is expected to operate on the tangible assets that eliminate uncertainty and ambiguity in the system(Khan, 1986; Siddiqi, 2006). Therefore, equity as the most acceptable medium for capitalization is divided by total assets. Similarly, the cushion to absorb loans losses, asset quality, and other income are all set to the strength of the equity in the Islamic banks. However, failure is a binary indicator of one in the event of failed and

zero otherwise. The study also incorporated "recent" to predict whether the relapse-free survival time to failure has been improved across the period or not (Royston and Lambert, 2011). Therefore, an interval of one year difference to each bank time frame was considered within the duration of the study as a time-varying covariate which is similar to the previous study of survival analysis (Molina, 2002). Finally, the currency purchasing power measure and per capita income are used to predict the influence of the macroeconomic activities on the Islamic banking business.

TABLE 2
Variable Category and Definition

Variable	Category	Definition
Failure	Qualitative	Binary indicator of 1 in the event of failed and 0 otherwise
Recent	Interval period	Period interval difference to recent time
Equity/ Net Loans	Financial ratio	Equity cushion to absorb loan losses.
Liquidity Assets/Deposit & STF	Financial ratio	Short term funds to meet sudden demands (withdrawals)
Loans Loss Reserves/ Impaired Loans	Financial ratio	Provision kept aside against impaired loans
Equity/Total Assets	Financial ratio	Quantify the banks' capitalization
Net Loans/Total Assets	Financial ratio	Assets quality ratio
Other Oper. Income/ Average Assets	Financial ratio	Measures operational income relative to banks' assets
Non-Interest Expenses/Average Assets	Financial ratio	Measures operational efficiency of the banks
Size	Balance sheet	Logarithm of total assets
Other Non-Interest Bearing Liabilities	Balance sheet	Short-term non-interest banks' payable owes amounts.
Inflation	Macroeconomics	The rate measures particular currency purchasing power
GDP per capita	Macroeconomics	The proportion of GDP to the total population of a country

Table 3 reports descriptive statistics of the explanatory variables. The list of the variables is given in the first column, and the observation in the third column. The banks' specific variables have 1,476 observations, whereas macroeconomic variables accounted for 1,455. The variation appeared due to the insufficiency of macroeconomic data to cover for Cayman Island and Palestine which necessitate our banks' observation reduction by 167. Therefore, the survival analysis in Table 5 excluded those countries. The explanatory variables are in percentages except recent and other non-interest bearing liabilities. The average mean for the non-interest liabilities has accounted for $704 with $404 as dispersion from the mean. The variation on the liabilities revealed that the banks' recurrent liabilities have a wider gap between small and large banks. Likewise, the equity cushion ratio shows a standard deviation of 391 percent. The study incorporated size to control for the variation (see Čihák and Hesse, 2010; Beck, Demirgüç-Kunt and Merrouche, 2013).

TABLE 3
Descriptive Analysis

Variables	Unit	Obs	Mean	Std. Dev.
Recent		1,476	120.8117	28.13989
Other non int. bearing liabilities	$th	1,476	704.0684	403.843
Equity/ Net loans	%	1,476	669.8144	390.5641
Net loans/Total assets	%	1,476	663.0528	381.9667
Loans loss reserves/Impaired loans	%	1,476	437.3808	160.8528
Other oper. Inc./ Average assets	%	1,476	248.5014	180.2055
Non int. exp/Average assets	%	1,476	341.2405	200.1146
Asset Size	%	1,476	13.94709	1.946411
Equity/ Total assets	%	1,476	24.99253	26.12119
Liquidity assets/Deposit & STF	%	1,476	678.6416	389.3618
GDP per capita	%	1,455	0.652592	0.701471
Inflation	%	1,455	127.6138	69.64893

The correlation matrix in Table 4 revealed the direct association between a pair of variables. The split time interval of time-varying covariate has a negative association with other non-interest

TABLE 4
Correlation Matrix

	Recent	ONIL	ENL	NLTA	LLI	OOIA	NIEA	LTA	ETA	LADF	GDPP	INF
Recent	1											
ONIL	-0.0591	1										
ENL	0.0466	-0.0495	1									
NLTA	0.1004	-0.0017	-0.138	1								
LLI	-0.1823	0.0769	0.1828	-0.0919	1							
OOIA	0.0474	-0.0215	0.1312	-0.1338	0.2159	1						
NIEA	0.0654	0.0119	0.1228	-0.0781	0.1838	0.4211	1					
LTA	0.1527	-0.0386	-0.2401	0.2334	-0.2992	-0.2359	-0.2571	1				
ETA	0.0782	0.002	0.2992	0.0164	0.1903	0.1506	0.1384	-0.4289	1			
LADF	-0.0739	0.0231	0.1215	-0.2083	0.1104	0.094	0.0113	-0.2627	0.2576	1		
GDPP	0.1027	-0.0598	-0.0481	0.2534	-0.0748	-0.1266	0.084	0.2346	-0.0821	-0.135	1	
INF	0.4332	-0.0358	-0.0202	0.0398	-0.15	-0.0045	-0.0391	0.0753	-0.0365	-0.0911	-0.1663	1

Recent, ONIL, other non-interest liabilities; ENL, equity to net loans; LLI, loans loss reserves to impaired loans; OOIA, other operating income to average assets; NIEA, non-interest expenses to average assets; LTA, log of total assets (size); ETA, equity to total assets; LADF, liquid assets to deposit and short-term funds; GDPP, gross domestic product per capita; INF, inflation.

liabilities, loans loss provisions, and liquidity to short-term funds. The associations of the remaining explanatory variables in the matrix did not strongly correlate with each other indicating the absence of multicollinearity.

3.2.1 TRI-VARIATE RESPONSE AND EXPLANATORY VARIABLES

The dependent variable to the survival model is the time to an event (for instance, failure) from inauguration period. The events are observed in binary of one when the bank failed in a particular year and zero for the survived bank. In sum, the tri-variate response to this study considered the bank's establishment period, the event, and the censored time. The failed banks are those that are not operationally and/or financially self-sufficient at a particular period. Specifically to this study, banks are considered to have failed when they are bankrupted, liquidated, dissolved, merged or acquired, and/or intervened through bailout (Heffernan, 2005; Chiaramonte and Casu, 2017). Similarly, the confirmatory check was also conducted through various banks websites, Zawya and Islamic financial data of the Islamic Development Bank (IFD-IDB) database.

The remaining explanatory variables are classified based on CAMEL rating which has been considered in the previous similar studies (Lane, Looney and Wansley, 1986; Pappas et al., 2017). This study also introduced time-varying covariate to leverage each time split period to be treated on its own distribution (Rabe-Hesketh and Skrondal, 2012). Additionally, apart from bank-specific indicators, GDP per capita and inflation are also used as macroeconomic control variables.

3.2.2 EXPLANATORY VARIABLES

This study introduced an explanatory variable of a time-varying covariate to affect the distribution since the risk time was observed at the discrete point of the financial year ending with positive probability ties (Wheelock and Wilson, 2000; Molina, 2002). Survival analysis is best to explain using time-varying covariate (Pappas et al., 2017). However, other explanatory variables such as capitalization are regarded as an important factor in bank survival analysis. Meanwhile, banks capital structure varies depending on their objectives and theoretical conceptualization that formed their establishment. Islamic banks are equity-based proponent compared to conventional which

prioritized on debt-based finance (Saeed and Izzeldin, 2014). The earlier conventional literature advocated for debt to reduce agency cost (Jensen 1986). The recent claim of Admati et al. (2013) supported equity financing instead of debt. Meanwhile, to all Basel member countries, fulfilling capital requirement is one of the necessary conditions for the banks to continue in operation. Therefore, the relationship between capital adequacy (total capital to total assets) and bank failure is expected to have a negative relation (Lane, Looney and Wansley, 1986; Molina, 2002; Hong, Huang and Wu, 2014). However, previous studies (Bichsel and Blum, 2004; Estrella, Park and Peristiani, 2000) found positive relations between risk taking and a capital ratio of commercial banks. As such, risk-taking increases in the same direction with the capital ratio. In the same view, a similar finding was documented in the case of Swiss banks, and no evidence of default was established despite the positive relations between capital and risk (Bichsel and Blum, 2004). In a nutshell, Tanda (2015) presented mixed findings on the capital ratio relation with risk which in turn have other implications on bank failure.

It is evidently clear that sufficient capitalization is expected to absorb external shocks that are related to the default of the clients to settle their debt which is tantamount to bank failure. In this regard, previous studies found equity increases the survival likelihood of the banks through absorbing losses (Wheelock and Wilson, 2000; Admati et al., 2013). Therefore, it is expected to have negative relations with failure likelihood. Regarding other explanatory variables such as liabilities and expenses are practically reducing the net income of the banks. As such, their excess magnitude reduces the financial sufficiency and strength which in turn lead to failure. Specifically to Islamic banks, non-interest liabilities and expenses will be disposed to explain their operational activities since they are non-interest inclined. With this, other non-interest expenses and liabilities are expected to have negative relations with banks' survival rate (Cole and Gunther, 1995). However, previous survival studies (Cole and Gunther, 1995; Wheelock and Wilson, 2000; Cole and White, 2012; Hong, Huang and Wu, 2014) used natural logarithm of total assets as a proxy for the banks' size and presumed that small banks are liable to fail compared with large banks. Therefore, it is expected that size of the banks will positively affect bank survival time. A recent study of Chiaramonte and Casu (2017) revealed that large banks are surviving with the

higher capital ratio while holding liquidity will reduce failure likelihood of the banks in general. Likewise, Lane et al. (1986) predicted banks failure through loans to assets as functions in quantifying their liquidity. This study also employed liquid assets to deposit and short-term funds to forecast bank viability to meet sudden demands on current withdrawals (Čihák and Hesse, 2010). The indicator can serve as an important signal to customers; in fact, banks without sufficient liquidity are liable to lose their clients and subsequently to be distressed (Beck, Demirgüç-Kunt and Merrouche, 2013). Nevertheless, clients are also contributing to bank failure due to written-off debt. As a result, banks keep aside a certain amount in anticipation of customer default on loans. Therefore, the higher the value of the loans loss provision the lower possible chance of the bank to survive since it has an inverse relation with profitability (Farook, Hassan and Clinch, 2014). Meanwhile, asset quality is assessed through loan loss reserve to impaired loans, and it has tendencies of increasing the failure rate of the banks since the non-performing loan is managed through the reserves (Cole and White, 2012).

Moreover, managerial efficiency is another indicator that is commonly used in predicting banks survival with priority on the cost of income and overhead expenses which are expected to have a positive relation to failure (Heyliger and Holdren, 1991; Poghosyan and Čihak 2011; Pappas et al., 2017). However, considering the nature of Islamic banking operations, focus on the non-interest expenses to average assets will possibly predict the majority of their banking activities. The indicator was earlier used and expected to have an inverse relation with survival time (Cole and Gunther, 1995). Similarly, net loan to total assets is also used as banks proxy to efficiency determinants (Johnes, Izzeldin and Pappas, 2014). On the other hand, previous studies (Lane, Looney and Wansley, 1986; Heyliger and Holdren, 1991; Cole and White, 2012), proxy earnings with return on assets, net income to asset and other operational income to an average assets with an expected positive association with the banks' survival. Banking institutions are operating within a given businesses cycle that has other exogenous influence such as economic, political, regulatory and environmental risk. Therefore, banks survival is nested within the conducive economic performance of a country. With this, favorable macroeconomic situations provide a conducive business environment for banks to intermediate between the surplus

and deficit agents of the economy. As such, Poghosyan and Čihak (2011) employed GDP per capita and inflation to predict their influence on the bank distress. Surprisingly, the outcomes to these macroeconomic variables revealed insufficient evidence towards predicting bank failure in Europe. Nonetheless, the result was different to other studies (Chiaramonte and Casu, 2017; Pappas et al., 2017).

4. RESULTS AND DISCUSSIONS

In this section, the discussions are focused on the findings to the three models (panel survival, mixed effect, and logit) which are designed to predict bank-specific and macroeconomic activities that influence Islamic banks survival. The three models in Table 5 are presented based on their coefficient, hazard/odds ratio with their robust standard error estimate. The precise financial activities responsible for predicting outcomes are covered with consideration of the macroeconomic indicators. First of all, our analysis extends the period of investigation that covers between 1987 and 2014, which accounted for 28 failed Islamic banks compared to 8 in the previous study (Pappas et al., 2017) [3]. Therefore, this stands as an important signal to regulators toward strengthening the system to monitor and prevent future recurrence of such events. Consequently, the significant positive coefficient of the variable 'recent' predicts more than four percent likelihood of reducing survival chance of the banks at the last interval time of 2013-2014. Thus, the banks' risk time exposure is increasing as they continue indulging in various banking businesses which are related to liquidity, credit and performance risks (Begenau, Piazzesi and Schneider, 2015). Therefore, regulators have to strategize and enforce effective risk management measures in line with the nature of Islamic banking activities (Sundararajan and Errico, 2002; Venkataraman Sundararajan, 2007; Hassan et al., 2014). Thus strengthening risk management measures of Islamic banks is consistent with their differences compared to conventional banks in the banking business and formational restrictions. Additionally, the positive coefficient of other non-interest liabilities and expenses predicted likelihood to increase bank failure which is consistent with previous findings of similar studies (Cole and Gunther, 1995; Samad, 2011). The findings revealed that excessive liabilities that are not absorbed with the corresponding income impair bank survival.

TABLE 5
The Panel Survival Analysis for Islamic Banks

	Panel Survival Model				Mixed Effect Model				Logit Model			
	Weibull		Robust		Mixed Effect		Mixed Effect Robust		Logit		Logit Robust	
VAR.	Coeff.	Hz. Ratio	Coeff.	Hz. Ratio	Coeff.	Hz. Ratio	Coeff.	Hz. Ratio	Coeff.	Odd-Ratio	Coeff.	Odd-Ratio
Recent	0.0443***	1.045***	0.0443***	1.045***	0.0443***	1.045***	0.0443***	1.045***	0.0440*	1.045*	0.044	1.045
	(0.010)	(0.011)	(0.008)	(0.011)	(0.01)	(0.011)	(0.01)	(0.011)	(0.025)	(0.026)	(0.029)	(0.031)
ONIL	0.00152***	1.002***	0.00152**	1.002***	0.00152***	1.002***	0.00152**	1.002***	0.00175***	1.002***	0.00175**	1.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.00)	(0.001)	(0.00)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ENL	-0.00116**	0.999**	-0.00116**	0.999**	-0.00116**	0.999**	-0.00116**	0.999**	-0.00120*	0.999*	-0.00120*	0.999*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.00)	(0.001)	(0.00)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
NLTA	-0.001	0.999	-0.000842*	0.999	(0.00)	0.999	-0.000842*	0.999	-0.001	0.999	-0.001	0.999
	(0.001)	(0.001)	(0.000)	(0.001)	(0.00)	(0.001)	(0.00)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
LLI	0.00570**	1.006**	0.00570***	1.006**	0.00570**	1.006**	0.00570***	1.006**	0.00657**	1.007**	0.00657**	1.007**
	(0.003)	(0.003)	(0.002)	(0.003)	(0.00)	(0.003)	(0.00)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
OOIA	-0.00268**	0.997**	-0.00268**	0.997**	-0.00268**	0.997**	-0.00268**	0.997**	-0.00260*	0.997*	-0.003	0.997
	(0.001)	(0.001)	(0.001)	(0.001)	(0.00)	(0.001)	(0.00)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
NIEA	0.00182*	1.002*	0.00182*	1.002*	0.00182*	1.002*	0.00182*	1.002*	0.002	1.002	0.002	1.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.00)	(0.001)	(0.00)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
LTA	-0.089	0.915	-0.089	0.915	(0.09)	0.915	-0.09	0.915	-0.086	0.918	-0.086	0.918
	(0.126)	(0.115)	(0.105)	(0.115)	(0.13)	(0.115)	(0.11)	(0.115)	(0.167)	(0.153)	(0.153)	(0.140)

ETA	0.007	1.007	0.007	1.007	0.01	1.007	0.01	1.007	0.004	1.004	0.004	1.004
	(0.009)	(0.009)	(0.009)	(0.009)	(0.01)	(0.009)	(0.01)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)
LADF	-0.00110**	0.999**	-0.00110**	0.999**	-0.00110**	0.999**	-0.00110**	0.999**	-0.00130**	0.999**	-0.0013**	0.999**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.00)	(0.001)	(0.00)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
GDPP	-0.770**	0.463**	-0.770***	0.463**	-0.770**	0.463**	-0.770***	0.463**	-0.941	0.390	-0.941*	0.390*
	(0.364)	(0.168)	(0.264)	(0.168)	(0.36)	(0.168)	(0.26)	(0.168)	(0.587)	(0.229)	(0.504)	(0.197)
INF	-0.005	0.995	-0.005	0.995	(0.00)	0.995	(0.00)	0.995	(0.005)	0.995	(0.005)	0.995
	(0.004)	(0.004)	(0.003)	(0.004)	(0.00)	(0.004)	(0.00)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
Constant	-10.56***	2.59e-05***	-10.56***	2.59e-05***	-10.56***	2.59e-05***	-10.56***	2.59e-05***	-10.35**	3.20e-05**	-10.35**	3.20e-05**
	(2.704)	(0.000)	(2.536)	(0.000)	(2.70)	(0.000)	(2.54)	(0.000)	(4.813)	(0.000)	(5.097)	(0.000)
Observations	1,455	1,455	1,455	1,455	1,455	1,455	1,455	1,455	1,455	1,455	1,455	1,455
No. of Banks	167	167	167	167	167	167	167	167	167	167	167	167

Recent, ONIL, other non-interest liabilities; ENL, equity to net loans; LLI, loans loss reserves to impaired loans; OOIA, other operating income to average assets; NIEA, non-interest expenses to average assets; LTA, log of total assets (size); ETA, equity to total assets; LADF, liquid assets to deposit and short term funds; GDPP, gross domestic product per capita; INF, inflation. ***, **, *, donate significance of the level at 1%, 5%, & 10% respectively.

The conclusion at this juncture is consistent with the perquisite consumption that can lead to principal-agent conflict as established by agency cost theory (Jensen and Meckling, 1976). Therefore, the Islamic financial institutions must avoid this behavior as it is prohibited to "… consume one another's wealth unjustly but only [in lawful] business by mutual consent." (Qur'ān, 4:29).[4]

However, the negative coefficient of equity cushion predicts survival likelihood of Islamic banks through absorbing loans losses. The findings supported the earlier outcomes on the equity impacts to buffer banks' survival (Wheelock and Wilson, 2000; Cole and White, 2012; Admati et al., 2013). The Islamic bank's equity participation has a greater impact in absorbing external shocks in the banking system since it abolishes confounding financial distress cost (Lewis 2015; Myers and Hassanzadeh, 2013; Leathers, Raines and Richardson-Bono, 2015). The finding supported the earlier postulations that equity-based finance of Islamic finance can absorb failure shock particularly during financial crisis (Khan, 1986). Hence, Islamic banks are strongly suggested to embark on equity-based finance to reduce endemic failure effect and to survive longer. Similarly, the net loans to total asset coefficient present an interesting outcome of increasing banks survival likelihood after robust of standard error. The findings are only consistent to the coefficient of the first two survival models, whereas logit model has insufficient evidence to support the outcomes. As such, the variation of findings between the first two models and logit is not surprising since the former has tri-variate response variables while the later depend only on the failure event. Despite that, the result provides new evidence in the survival analysis of Islamic banks that expresses asset quality improve survivability which is not considered in the parameterization analysis of the earlier study (Pappas et al., 2017). In the same vein, the positive coefficient of the loans loss reserves to impaired loans is predicting a reduction in the Islamic banks' survival, which is indicating asset quality will consistently function with reducing loans loss provision. The outcome predicts that for Islamic banks to attain survival position, they must reduce loans loss reserves as pictured during the recent financial crisis where Islamic banks had lower loans loss reserves ratio compared to conventional banks (Beck et al., 2013). As such, our findings on the asset quality indicator is consistent with the previous related study (Arena, 2008). Therefore, Islamic banks have to improve their assets

quality through reducing impaired loans to improve their earnings (Shawtari et al., 2015).

On the other hand, despite the Chen, Huang and Zhang (2017) surprising positive result between non-interest income and banks risk, our finding supported earnings reduces banks risk to failure. Our finding on this variable supported the non-interest activities stood as another input that is not considered in the previous Islamic banks' survival analysis (Pappas et al., 2017). Thus, other operating income to average assets is part of the banks' earnings and have a greater influence on improving bank performance. The negative coefficient of earnings displayed an expected outcome on the Islamic banks' survival which also supported the previous banking studies (Demirgüç-Kunt and Huizinga, 2010; Mayes and Stremmel, 2013). Income from other non-interest sources such as trading will diversify risk, stabilize bank activities and increase their performance. Therefore, Islamic banks have to focus on these types of activities to comply with *Sharī'ah* regulations and survive longer. Nonetheless, the banks' managerial efficiency has met the expected signed which is consistent with the findings of the previous studies (Heyliger and Holdren, 1991; Männasoo and Mayes, 2009; Poghosyan and Čihak, 2011; Pappas et al., 2017), although Beck et al. (2013) found that Islamic banks are cost inefficient compared to conventional banks. Their findings did not preclude Islamic banks efficiency except on comparative situation of conventional banks which are relatively larger than the former in size. In view of this, Islamic banks can enhance their cost inefficiency through monitoring and training. Johnes et al. (2014) suggested that Islamic banks should invest in human capital development in order to close the managerial efficiency gap.

However, the significant negative sign on the liquidity ratio satisfied the expected outcome of increasing bank survival likelihood consistent with the earlier result of similar study (Arena, 2008). The higher liquidity of the Islamic bank has other implications to the customers and the bankers. For instance, excess liquidity will be able to meet sudden withdrawal and increase customer confidence to continue banking with the institution. Similarly, Islamic bank excess liquidity will bridge the *Sharī'ah* restriction gap on other prohibited transactions to have volumes of recurrent operations that required immediate settlement (Pappas et al., 2017). With regard to the

favorable macroeconomic environment, our results reveal that per capita income increase Islamic banking survival, while inflation is insufficient to provide any supporting evidence. Nonetheless, inflation outcome is consistent with an earlier study (Poghosyan and Čihak, 2011). Meanwhile, Wheelock (1995) related the banks' failure of 1929-1932 with the decline in per capita income which in turn resulted in farm production failure. The result of the study revealed the significant positive relationship between bank failure and the decline of real economic activities of farm products which also affected individual income. In essence, an increase in per capita income has a greater impact on bank survival. Therefore, Islamic banks have to increase their focus on the real economic activities that will enhance economic growth which in turn will sustain their operations through profit and loss sharing principle.

In sum, we find that CAMEL rating is a sufficient indicator that aggregated and explained Islamic bank survival. Nonetheless, indicators related to other non-interest liabilities, asset quality, liquidity and GDP per capita have a strong influence in explaining banks survival other than the remaining explanatory variables across the three models. The remaining variables such as managerial efficiency and time-varying covariate are better explained in the time survival models. Moreover, our findings have insufficient evidence on the capitalization, size effect, and inflation.

5. CONCLUSION

Nowadays, researchers and policymakers are becoming interested in the factors influencing Islamic bank growth and survival. Until recently, apart from Pappas et al. (2017), no other evidence in the literature focused on Islamic bank survival analysis, though comparative analysis had been conducted. More specifically, limited studies on Islamic banking survival divert the attention of policymakers and practitioners on the failure hazard likelihood and other mitigating solutions. Survival models were developed on time to event analysis which predicts failure hazard based on the tri-variate responses. In this study, a confirmatory analysis is established with mixed effect and logit model to ascertain the outcome of the panel survival analysis. The analysis was conducted with the risk time exposure to recent time as an independent time-varying covariate. Consequently, CAMEL rating approximation has been utilized to

align consistently with the earlier studies. Thus, the outcomes of this study have other implications for practitioners, policymakers and future studies in the area.

The results of this study provide other evidence not considered in the previous Islamic banking survival analysis (e.g., Pappas et al., 2017). First of all, extending the period of before 1995 and beyond 2010 accounted for 28 failed banks in 24 countries with a sample of 170 banks. In this regard, Islamic bank regulators have to strengthen their efforts in monitoring failure indicators and ensuring stability in the system. It is noted that some Islamic banks became incapacitated some years after the financial crisis; this necessitates other investigation of the possible predictors that can prevent future recurrence. The undisputable evidence that Islamic banks are better capitalized with higher liquidity and assets quality ahead of conventional banks contradicted in the most recent findings that included the after crisis sample (Alqahtani, Mayes and Brown, 2016). Findings by Alqahtani, Mayes and Brown (2016) conclude that Islamic banks indicate worse performance than conventional banks including capitalization. Therefore, our insufficient evidence regarding capitalization is not a surprising issue since it also contradicts the earlier assertion in the industry. Thus, policymakers have to enforce the minimum requirements standard that is more appropriate to the context of Islamic banking rather than adopting other conventional benchmarks without a thorough evaluation of their implications. Apart from extending period, present study contributed to the Islamic banking survival by including other indicators that are not considered in the previous study (Pappas et al., 2017). These include the assets quality and other non-interest bearing liabilities. Their impacts on the Islamic banks' survival have been identified since they are significantly considered as integral components to the institutional survival. Similarly, this study considers the uniqueness of Islamic banking activities and use 'other operating income' in its parametrization analysis than net interest revenue of the earlier study. Likewise, the early warning on the indicators such as other non-interest bearing liabilities and loans loss reservations will guide the policymakers to strategize on the future guidelines on Islamic banks' processes to avoid failure likelihood.

Consequently, efficient resource utilization is required to hedge against unforeseen circumstances that might lead to bank

failure. Investing in human capital will strengthen bank managerial efficiency (Aliyu and Yusof, 2016). Moreover, Islamic banks are expected to diversify investment into real economic activities since they are found enhancing the per capita income and the banks' survival in turn. Hence, the institution has to focus on businesses built on real profit and risk sharing models to hedge against confounding risks and comply with *Sharī'ah* laws and principles. Islamic banking operators are urged to reduce perquisite expenses and other liabilities that might increase distress cost since it also reduces survival chance of the banks (Aliyu et al., 2017). Additionally, regulators have to strive ahead toward enforcing regulations and monitoring bank failure predictors to reduce its menace. In this regard, policymakers should not relax efforts towards providing policies that would enhance citizens' per capita income since it has significant influence in strengthening financial institutions' transactions. Thus, this becomes necessary not only for Islamic banks but the entire economy of the practicing countries since the institution is contributing toward financial inclusiveness. Moreover, our findings support the use of equity finance to serve as a cushion to absorb losses, which supported the earlier theoretical foundation of Islamic finance (Khan, 1986). Therefore, developing capital structure models accommodative to *Sharī'ah* principles is required. Finally, future survival studies can extend the scope of the analysis to other jurisdictions, incorporate *Maqāṣid Al-Sharī'ah* index and outreach to verify the social justice compliance of the Islamic banks. Consequently, employing accelerated failure time model will provide other evidence in relation to time length to an event.

ACKNOWLEDGEMENT

We would like to express our gratitude to the Editor and the anonymous reviewers for their helpful comments which greatly enhanced the quality of the paper. The first author also acknowledges a PhD scholarship grant from the Islamic Research and Training Institute of Islamic Development Bank IRTI-IDB Jeddah, Saudi-Arabia.

ENDNOTES

1. The study of Beck et al. (2013) compared the business models within the period of 1995-2009, whereas Pappas et al. (2017) extended their

analysis to one year and eight failed Islamic banks. Therefore, they might not be able to account for other events beyond their sample frame.

2. BankScope has data of Islamic banks as early as 1986, and other Islamic banks failed before 1995 and after 2010 (Aliyu et al. 2017).

3. The definition of failed banks are those in the position of being bankrupted, liquidated, dissolved, merged or acquired, and/or intervened through bailout (Heffernan 2005; Chiaramonte and Casu 2017).

4. Qur'ān Translation of Saheeh International.

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