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Scrutinizing Global Banking Fragility: Are Larger or Smaller Banks More Fragile?

Nur Hazimah Amran[1], Wahida Ahmad[2*], Amir Alfatakh Yusuf[3],

[1,2] *Arshad Ayub Graduate Business School, Kompleks Al-Farabi, Jalan Ilmu/1, Universiti Teknologi MARA, 40450 Shah Alam, Selangor*
[3] *United Overseas Bank Malaysia Bhd., Ground Floor, UOB Plaza 1, 7, Jalan Raja Laut, 50350 Kuala Lumpur*

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ABSTRACT

The study focuses on the funding fragility arising from the nature of the banking business due to asset-liability mismatches. Incorporating seven (7) countries with dual banking systems, the study aims to assess the global funding fragility of Islamic and conventional banks. The study employs a random effect model with a robust standard error that spans the period from 2009 to 2018, made up of 10-year unbalanced panel data. Islamic and conventional banks should be more cost-efficient and earn greater profitability to reduce funding fragility. Banks with wider income diversification and a higher capital level have a better advantage in lessening funding fragility. Banks that offer high financing growth are exposed to greater credit risk but empirically manage to control the funding fragility. The interaction effect reveals that larger conventional banks are less fragile than smaller conventional banks. On the contrary, larger Islamic banks are found to be more fragile than smaller Islamic banks.

INTRODUCTION

The inability of banks to fund sudden demand withdrawals from customers leads to banks' funding fragility. The fragility disrupts banking operations and activities, thus making the banks more vulnerable to crises. At the same time, fragility threatens the whole financial system of a country. There is a high tendency for banks to default and collapse in cases of funding fragility. Vo (2018) states the impacts of banking crises are severe and may end up as a global financial crisis. To the worst extent, the banking crisis could jeopardize the whole country, such as Greece. Interruption of the financial system in Greece results in the deterioration of the country's growth and development. Therefore, the importance of banks in a country

[2*] Corresponding author. *E-mail address*: wahida@uitm.edu.my
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demonstrates the urgency of having a sustainable financial system that can assure the soundness of the economy.

Vast studies show most of the banking defaults are due to lack of capital, low quality of assets, inefficient management, low earnings, and inadequate liquidity (Chen et al., 2021). Prior banks defaulted in 2008; for instance, Lehman Brothers and Northern Rock caused chaos in the banking industry. The chaos interrupts banking operations and activities, which consequently stirs up the entire banking system. The bank default starts at the individual bank level, with later contagion to other banks (Rizwan et al., 2020). This is because the banks are not stand-alone; they are interrelated in the sense of an inter-financing relationship.

Traditionally, banks generate income by providing financing and accepting deposits. However, too much financing could harm the health of asset quality (Alandejani & Asutay, 2017; Sobarsyah et al., 2020). This may be due to the less stringent of credit assessment, which results in a large number of defaulters particularly when there is a shock in the economy. Because providing financing is part of banks' income sources, a prominent level of financing growth may have a significant impact on the bank's financial position, especially for those banks with a high level of credit risk. This would expose the banks to greater funding fragility, which is uncertain and may result in losses for the banks.

It has been noted by Louhichi et al. (2020) that while bank size contributes to the stability of conventional banks in the Middle East and Asia, the same does not hold true for Islamic banks. This suggests that conventional banks in these regions are more stable than their Islamic counterparts. However, Ibrahim and Rizvi (2017) discovered that Islamic banks tend to be more stable after a certain threshold.

To address these issues, this study aims to investigate the underlying factors responsible for funding fragility, followed by an assessment of the impact of financing growth on the relationship between credit risk and funding fragility. Additionally, the study seeks to explore how bank size influences the relationship between the type of bank and funding fragility.

The study contributes to the Islamic and conventional banking literature review in many ways. Among others, the study offers both theoretical and empirical findings on funding fragility. The study disclosed cost efficiency, profitability, income diversification, credit risk, capital, and type of bank, which revealed significant impacts on funding fragility. However, financing growth and bank size are disclosed the other way around. Interestingly, both show a significant interaction effect on the relationship between credit risk and funding fragility, as well as the type of bank and funding fragility, respectively.

The rest of the paper is structured as follows: Section 2 theoretically and empirically discusses a survey of literature related to funding fragility. Meanwhile, Section 3 explains the data description and research methodology. The study continues to further interpret and exchange views on the funding fragility in Section 4, followed by concluding remarks in Section 5.

REVIEW OF LITERATURE

In this section, the study examines the nature of banking businesses that offer more long-term assets, that is, long-term financing, while accepting both short-term and long-term deposits from customers. The maturity mismatch contributes to the liquidity risk. Due to that reason, banks are encouraged to hold buffers of liquidity to cushion sudden withdrawals from customers (Chen et al., 2018).

According to Diamond and Rajan (2001), funding fragility can threaten the healthiness of the banks because of the unreasonable cost of borrowing funds (financing) or liquidating their assets to meet liquidity demands. Further, the funding fragility leads to a banking problem (Matz, 2006). The author further explains that insufficient liquidity levels in the banks induce sudden kills, while too much liquidity held by the banks induces slow kills. The author sheds light on the argument, in which the former portrays an increasing probability of banks' default while the latter portrays inefficient resource utilization.

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According to Hassan et al. (2019), Islamic banks and their conventional counterparts in the Organization of Islamic Cooperation (OIC) countries face liquidity risk in various ways. The reason for this diversity is that Islamic banks have limited investment facilities and fewer money market instruments. Therefore, Islamic banks need to keep more cash in hand to address liquidity problems. Similarly, Abdul-Rahman et al. (2018) have highlighted some causes that lead to ineffective liquidity risk management in Islamic banks, including limited Sharia-compliant money market instruments and a lack of investor participation in the money market. These factors expand the scope of liquidity risk exposure.

Chen et al. (2018) postulate that the inefficiency of cost management induces banks to hold a higher level of liquidity, thus becoming less fragile. The banks hold higher levels of liquidity for the sake of precautionary measures. This is to protect themselves from any possible danger or failure that is caused by inefficient management of the costs involved in their day-to-day business banking activities. Srairi (2019) finds the inefficiency of banks contributes to greater risk exposure, which makes the banks less resilient in case of sudden shocks. This is because these banks are fragile due to their lower efficiency level, in which the profits generated are relatively less than the obligation costs.

Hassan et al. (2019) depict Islamic banks as having a higher tendency to engage in greater risk-taking activities, for example, investment in property development to increase the profitability position of the bank. Due to this, the bank increases its financing activities. Therefore, greater liquidity risk exposure, in the meantime, encourages greater funding fragility. In contrast, Mahmood et al. (2018) emphasize that outperformed Islamic banks face lower funding fragility levels. This is because Islamic banks' profits are naturally procyclical. The increase in Islamic banks' profits encourages the banks to offer more liquidity. As banks earn more profits, it shows they can make profits from financing businesses or investments, thus smoothing the asset-liability structure in which different tenures exist. Therefore, the greater profitability of Islamic banks raises the liquidity position, thus lessening the funding fragility level. Similarly, Mohammad et al. (2020) found that less profitable banks induce greater funding fragility.

Chunyang and Yongjia (2018) conjecture that diversification in Chinese banking, specifically income diversification, leads to the deterioration of banks' operating stability. This is due to the early phase of the implementation of non-interest activities. Thus, the Chinese banks face a lack of control over non-interest activities. Moreover, the increase in non-interest activities causes a focus reduction in the primary business activities among the Chinese banks. The reliance of Chinese banks on non-traditional banking businesses portrays their involvement in riskier business models. Thus, the banks are exposed to the instability of banking operations and activities, which is the bankruptcy risk, hence creating income (assets return) volatility. As a result, the banks become more vulnerable to upcoming shocks and risks. Similarly, DeYoung and Roland (2001) report that banks in the United States (US) that focus on fee-based activities face greater risk in the sense of earnings volatility.

Oppositely, Nguyen (2018) documents that banks in Cambodia, especially large banks, have a high tendency to engage in banking diversification to mitigate the possibility of bankruptcy. The large banks affirm that diversification across their assets, funding, and income can lessen the risk of an unsound banking system. These banks manage to manipulate their diversification to reduce fragility. Therefore, diversification in banking discourages the fragility of banks. Supporting the argument, Hryckiewicz and Kozlowski (2018) find a similar finding that indicates a lack of diversification contributing to the greater funding fragility level of banks, especially in emerging countries.

Pérignon et al. (2018) suggest banks with a greater capital ratio have a greater proportion of short-term funding. Therefore, these banks are less exposed to the vulnerability of liquidity risk and, hence, less fragile. The negative relationship between capital position and funding fragility level substantiates the proposed theory of financial fragility crowding out deposits (Berger & Bouwman, 2009). The theory indicates that a greater capital position hinders the liquidity creation of the banks because the banks find less urgency to create a higher liquidity level, given their greater capital position. On the other streams of literature, Davydov et al. (2018) reveal banks with higher capital levels face greater funding fragility due to the bank's trade-off between capital level and bank liquidity. The banks opt to hold lower liquidity since they have a

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higher capital level to buffer for losses. This supports the theory of risk absorption (Allen & Gale, 2004; Berger & Bouwman, 2009; Bhattacharya & Thakor, 1993; Diamond & Dybvig, 1983). The theory depicts the role of capital as a cushion for the banks. Indeed, the greater capital position facilitates a cushion for the losses in banking operations in this case, providing liquidity to customers.

Abdul-Rahman et al. (2018) uncover that higher credit risk manifests a greater amount of toxic debt in banks. Therefore, the lower quality of financing contributes to greater credit risk, thereby lessening the bank's profitability. Due to this reason, the banks experience greater liquidity risk exposure, which raises their fragility. Thus, the banks are more vulnerable to uncertain shocks because of their greater liquidity risk exposure. According to Mohammad et al. (2020), Islamic banks are more fragile in the sense of greater liquidity risk exposure. In contrast, Berger et al. (2022) emphasize that bank fragility is compensated with lower credit risk since the banks are aware of the incremental level of credit risk. Therefore, the banks tend to hold more liquid assets in the banks to accommodate a greater credit risk level. Indirectly, the greater amount of liquid assets lessens the fragility of the banks. Amin et al. (2018) discovered that an increase in credit risk leads to lower funding fragility for banks in the Organization of Islamic Cooperation (OIC) countries. The increase in the credit risk ratio depicts the poor credit quality of banks. Due to this reason, the banks indeed have to provide more capital allocation to buffer for the losses. Consequently, it raises the urgency of the banks to create more liquidity, thus lessening the funding fragility level.

Altunbas et al. (2017) discovered that abnormal financing growth contributes to the accumulation of systemic risk for other banks. Megeid (2017) expresses that the unanticipated growth of financing somehow threatens the liquidity of the bank in Egypt primarily due to the insufficient liquidity buffer that leads to funding fragility. The author further elaborates that the increase in financing growth is an indicator of the low financing rate charged to borrowers.

Mahmood et al. (2018) document that larger full-fledged Islamic banks expose themselves to greater liquidity risk, thereby making them more fragile. The authors postulate that the full-fledged Islamic bank is more attracted to engage in a higher volume of financing (illiquid assets) to earn more profits. Yet, the bank has to face greater liquidity risk, which raises the fragility of the bank. According to Ibrahim (2016), Islamic banks focus on the asset side to maintain a stable banking system; thus, they engage in active financing. Due to that reason, large Islamic banks have a high tendency to expose themselves to risk in financing activities, for instance, credit risk, to stabilize the banking system.

On the other hand, Vazquez and Federico (2015) conclude that small banks in the United States (US) and Europe are more vulnerable to liquidity risk exposure and thereby have high funding fragility. The authors indicate that small bank has weaker structural liquidity management. Due to that reason, the bank is unable to meet the associated liquidity needs. Hence, it destabilizes the funding position, resulting in funding fragility. Similarly, Horváth et al. (2014) find that larger banks lead to less funding fragility. This is due to larger banks creating more liquidity, thereby lessening the funding fragility. The statement is in line with Berger and Bouwman (2009). The authors further point out the reason large banks in the United States are exposed to greater funding fragility exposure, which include the significant growth of less liquid guarantees, liquid liabilities, and illiquid assets. The growth of these items dominates the little increment of liquid assets, less liquid liabilities, and less equity.

Based on the theoretical and empirical evidence, the study hypothesizes that there is a significant relationship between cost efficiency, profitability, income diversification, capital level, credit risk, financing growth, type and size, and the funding fragility of dual banks. The study further proposes that there is a significant difference in funding fragility levels between Islamic and conventional banks. Given the ambiguous effect of financing growth and size, the study postulates that financing growth interacts with the relationship between credit risk and funding fragility. Also, the study contends that size interacts with the relationship between the type of bank and funding fragility.

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DATA DESCRIPTION AND METHODOLOGY

The study proposes (i) to examine the driving factors that influence funding fragility; (ii) to analyse the interaction effect of financing growth on the relationship between credit risk and funding fragility; and (iii) to probe the interaction effect of bank type on the relationship between bank size and funding fragility. The following Table 1 shows a list of variables and their proxies.

This study uses secondary data which was obtained from the FitchConnect database. This study estimates unbalanced panel data and employs 99 Islamic and conventional banks from seven (7) countries that practice dual banking: Bahrain, Kuwait, Saudi Arabia, the United Arab Emirates, Bangladesh, Qatar, and Malaysia. On top of that, these countries have a similar characteristic, namely that they have more than 15 percent of Islamic banking assets in their total domestic banking sector. This study spans from 2009 to 2018, which is equivalent to ten (10) years. The study limits the sample size of the country to at least four (4) Islamic banks to ensure prudent estimation and analysis. Thus, the countries that have less than four (4) Islamic banks have been excluded.

The study hypothesizes that banks with higher financing growth have to focus on credit risk management. This is due to improper credit risk management, which simultaneously puts the banks in a dangerous situation. Uncontrolled financing growth may deteriorate the quality of assets and increase the credit risk level, thereby increasing funding fragility. Other than that, the study intends to examine the impact of bank size on the relationship between the type of bank and funding fragility. The study proposes that large banks have low exposure to funding fragility. In this study context, conventional banks are expected to experience less finding fragility because they are relatively more established than their counterparts. The study estimates the following equation for achieving the research objectives:

$$FF_{it} = \beta_0 + \beta_1 CEFF_{it} + \beta_2 PRO_{it} + \beta_3 YDIV_{it} + \beta_4 CR_{it} + \beta_5 FG_{it} + \beta_6 CAP_{it} + \beta_7 SIZE_{it} + \beta_8 TYPE_{it} + \beta_9 (CR_{it} * FG_{it}) + \beta_{10} (TYPE_{it} * \beta_7 SIZE_{it}) + e_{it}$$

Table 1. Proxies and measurement

	Symbol	*Proxy Measurement*
Dependent Variable		
Funding Fragility	FF	Net financing to total assets (%)
Independent Variables		
Cost Efficiency	CEFF	Expenses to revenues (%)
Profitability	PRO	Net income to average total assets (%)
Income Diversification	YDIV	Non-interest income to gross revenue (%)
Credit Risk	CR	Impaired financing to gross financing (%)
Capital Level	CAP	Tangible common equity to tangible assets (%)
Control Variable		
Type	TYPE	1 for Islamic banks; 0 for conventional banks
Interaction Variables		
Size	SIZE	Natural logarithm of total assets (%)
Financing Growth	FG	(Total financing$_1$ – total financing$_0$) to total financing$_0$ (%)

The study also conducts relevant diagnostic tests to identify and rectify issues that could affect the results. It includes a heteroscedasticity test, a multicollinearity test, a stationary test, and a serial correlation test. The study utilises the Stata statistical package for all testing and estimation.

EMPIRICAL FINDINGS AND DISCUSSION

Table 2 displays the proposed global banking fragility models of Islamic and conventional banks in seven countries, pooled together and estimated using the random effect model. The study identifies several data issues from the diagnostic testing resulting[i] in a basic and extended funding fragility model. The

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autocorrelation issue and heteroscedasticity issue are rectified using the cluster standard error random effect model (Hoechle, 2007). There is no serious multicollinearity or unit root issue identified in the estimation.

Consisting of 645 observations from an unbalanced panel, the estimation comprises 99 groups of banks from seven countries. The study gathers samples from both Islamic and conventional banks from each country, resulting in a fraction of 25 percent for the Islamic banks and 75 percent for the conventional banks. The Wald Chi2 values for the basic and extended models are 61.75 and 104.86, respectively, which indicates the models are significant at the 1 percent level. The model shows that both basic and extended models can explain 33 percent of funding fragility variation.

The study reveals a fairly consistent finding between the basic and extended models. Both estimations identify cost efficiency, profitability, income diversification, and capital as the core determinants of funding fragility for Islamic and conventional banks. The findings suggest that banks with greater cost efficiency end up with less funding fragility. This is justifiable, as banks that efficiently control their costs are capable of optimising their deposits and financing activities, hence being less exposed to funding fragility. Furthermore, cost-efficient banks are most likely to obtain higher profits. Banks that earn greater profits have greater potential to be more prudent in their financing activities (Mahmood et al., 2018). This explains that the more profitable the banks are, the lesser the funding fragility they encounter.

While banks accept deposits and provide financing remain the core activities in the banking business, it is not limited to these activities. In fact, nowadays, almost all banks offer a variety of products and services to generate more income diversification. The study reports that income diversification has an inverse impact on Islamic and conventional banks' funding fragility. Banks with more income diversification is exposed to less funding fragility (Hryckiewicz & Kozlowski, 2018; Nguyen, 2018). Banks with more diversified income are not solely relying on deposits and financing activities but secure more assets generated from other business activities.

Table 2. Global banking fragility estimation

	Basic Model	Interaction Model
Cost Efficiency	**-0.125*** **	**-0.116*** **
	(0.029)	(0.027)
Profitability	**-1.313*** **	**-1.235** **
	(0.481)	(0.483)
Income Diversification	**-0.081*** **	**-0.081*** **
	(0.023)	(0.024)
Credit Risk	-0.174	**-0.277***
	(0.128)	(0.145)
Financing Growth	0.015	-0.010
	(1.24)	(1.434)
Capital Level	**-0.277*** **	**-0.28*** **
	(0.09)	(0.088)
Size	-0.161	-0.479
	(0.373)	(0.434)
Type	1.164	**-13.241***
	(0.954)	(7.212)
Credit Risk*Financing Growth		**0.007*** **
		(0.235)
Type*Size		**1.584** **
		(0.779)
Constant	78.997***	81.882***
	(4.024)	(4.567)
Observations	645	645
Number of groups	99	99
Minimum Number of Groups	3	3
Average Number of Groups	6.515	6.515
Maximum Number of Groups	10	10
Wald Chi^2	61.75***	104.86***
Within R-squared	0.067	0.084

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Overall R-squared	0.247	0.248
Between R-squared	0.336	0.335

*Note: *** is significant at the 1% level, ** is significant at the 5% level, and * is significant at the 10% level. Standard errors are in parentheses. Funding fragility is measured by net financing to total assets (%); cost efficiency is measured by expenses to revenues (%); profitability is measured by net income to average total assets (%); income diversification is measured by non-interest income to gross revenue (%); credit risk is measured by impaired financing to gross financing (%); capital level is measured by tangible common equity to tangible assets (%); type is a dummy variable that notes 1 for Islamic banks and 0 for conventional banks; size is measured by the natural logarithm of total assets (%); and financing growth is measured by the annual percentage change in total financing relative to the previous year (%).*

The findings reveal a negative relationship between capital and funding fragility for banks in the seven countries. The relationship is explainable by the funding fragility crowding out deposit theory, where the theory hypothesizes banks with higher capital are facing a lesser liquidity risk, thus lower funding fragility (Berger & Bouwman, 2009; Pérignon et al., 2018). To maintain a sufficiently prominent level of capital, banks have less capacity to provide a high amount of financing. This is because banks with high capital spend less on monitoring activities and therefore grant less financing.

Surprisingly, neither in the basic model nor the extended model, financing expansion had a significant impact on the funding fragility of Islamic and conventional banks. This is true to a certain extent; the amount of expansion that banks can finance depends on their market share. There is no aberrant financing expansion in the observed banks in the samples that would have a major impact on funding fragility.

The basic model reveals there is no significant difference in funding fragility between Islamic and conventional banks. Size also does not play a significant role in determining a bank's funding fragility. Similarly, credit risk is found to be insignificant to funding fragility in the basic model. Interestingly, the extended model with interaction provides different insights into the funding fragility of Islamic and conventional banks. The extended model incorporates two interactions that are between credit risk and financing growth, as well as between type and size. The following Figure 1 shows the average marginal effect estimation of the former interaction.

The first interaction overturns the insignificant effect of financing growth and credit risk in the basic model. The extended model indicates banks with high financing growth need to be more careful when accepting credit risk because it will lead to greater exposure to funding fragility (Alandejani & Asutay, 2017). On the other hand, banks that have a small percentage of financing growth should take advantage of the credit risk, as it will reduce the bank's funding fragility. According to the interaction's marginal effect, banks that have financing growth of more than 5 percent have a positive relationship with credit risk and funding fragility, whereas banks with financing growth of 5 percent or less have the opposite association. The interaction is statistically significant at the 1 percent level.

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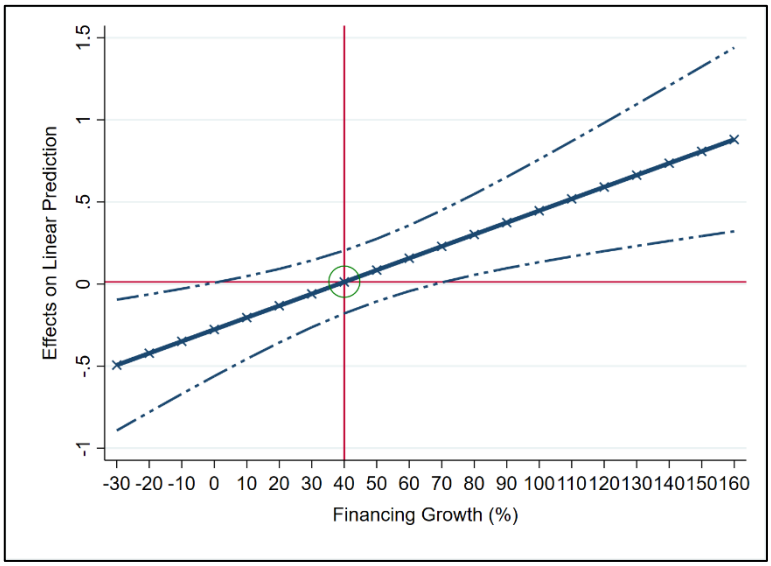

Fig. 1. Average Marginal Effects Estimation, Funding Fragility/Credit Risk on Financing Growth

Source: Authors's Generation based on the Research Findings

The second interaction in the extended model distinguishes the relationship between bank size and funding fragility for Islamic and conventional banks in the observed sample, as exhibited in the following Table 3. Unlike the insignificant results of size and type in the basic model, the extended model reveals another interesting story.

Table 3. Average marginal effect, type of banks on the relationship between size and funding fragility

Type of Banks	Funding Fragility/Bank Size	Delta-method Standard Error	95% Confidence Interval	
Conventional Banks	-0.479	0.434	-1.330	0.372
Islamic Banks	1.105	0.673	-0.215	2.425

The relationship between size and funding fragility for Islamic and conventional banks is not moving in the same direction. The findings are in line with Louhichi et al. (2020). The marginal effect of this interaction discloses that conventional banks that are larger in size are exposed to lesser funding fragility. While smaller conventional banks may face greater funding fragility, On the contrary, the positive marginal effect on Islamic banks indicates that smaller Islamic banks have less funding fragility, while bigger Islamic banks have greater exposure to funding fragility. The interaction is significant at the 5 percent level. The basic model that pooled all the samples together may be handicapped as it cannot zoom in on the different effects of bank type on funding fragility. Hence, the study proposes an extended model with two interactions that are more plausible and explainable.

CONCLUSION

Funding fragility is one of the primary concerns of banks in every country. The study investigates crucial factors driving the funding fragility of Islamic and conventional banks in seven countries. The study compares two estimations, the basic model, and the extended model, which include two interactions to have a wider understanding of banks' funding fragility.

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There is a consensus outcome between the two models in determining the key factors of funding fragility. The models reveal cost efficiency, profitability, income diversification, and capital play crucial roles in influencing banks funding fragility. Banks that are lacking in cost efficiency and low profitability must be more cautious with their financing activities, as it may severely drag the banks into becoming fragile and risky. Similarly, banks that are more concentrated on core activities and have limited income diversification are exposed to a greater level of funding fragility. So, do the banks with low capital. Therefore, banks need to focus and aim to be more cost-efficient, generate high profitability, expand more income diversification in their business activities, and set high capital levels to lessen banks funding fragility whenever possible.

The null assumptions about credit risk, the basic model does not reject financing growth, size, and bank types to demonstrate their substantial influence on the funding fragility of banks. Fortunately, the goal is attainable because the interaction effects in the enlarged model show the relationship. The study examines a varied influence on the relationship between credit risk and funding fragility, given the varying percentages of financing growth and bank type, respectively, even though there is no direct relationship between the two.

According to the research, banks experiencing slow financing growth should make concessions by accepting a certain level of credit risk to reduce funding fragility. Banks with slower growth rates have less funding fragility since they are better equipped and have more expertise in managing their credit risk. Banks that aggressively pursue high financing growth, on the other hand, could find it challenging to manage their credit risk sensibly, which leaves them more vulnerable to funding instability. To mitigate funding instability, the extended model also suggests treating Islamic and conventional banks differently based on their respective sizes. Compared to smaller conventional banks, larger conventional banks have an advantage in reducing funding instability.

On the other hand, larger Islamic banks are more vulnerable to funding fragility than smaller Islamic banks. The distinct levels of maturity and experience between the two types of banks could be the cause of the discrepancy in results between Islamic and conventional banks. Due to their inexperience, Islamic banks that are significantly younger than their conventional counterparts are assumed to be making riskier mistakes as they grow larger.

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CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

AUTHORS' CONTRIBUTIONS

Nur Hazimah Amran carried out the research, wrote and revised the article. Amir Alfatakh Yusuf conceptualised the research idea and provided the practical scenario and industry implication. Wahida Ahmad designed the research, supervised research progress as well as reviewed, revised and approved the article submission.

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[i] The study does not present the results of diagnostic testing to preserve space. However, it is available upon request.