Beyond Prudential Regulations: Dynamic Threshold Analysis of Credit Risk and Bank-Specific Factors Across Banking Models and Economic Contexts

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Abstract

Despite the accrued prudential regulations addressed to risk mitigation, the credit risk shadow still traces banks. Existing financial reforms remain generic, failing to account for the structural difference between banking models, the counter-cyclical macroeconomic dynamics, and bank-specific factors. This study extends the one-size-fits-all approach of standardized banking regulations through dual-track thresholds. Using the dynamic panel threshold model, our work provides evidence that key financial indicators, including ROA, ROE, NIM, LTD, DTA, DIV, and CAR, display distinct threshold impacts within conventional and Islamic banks across developed and developing economies. While Basel reforms impose uniform thresholds (e.g., 10.5% CAR, 3% LR...), our analysis reveals three context-contingent threshold insights. The ROA, ROE and NIM exhibit bank-based threshold effects, where CBs in developed countries admit a critical ROE threshold of 8.69% (consistent with the IMF 2017 guidelines). Conversely, the CAR and the DIV ratios highlight the economic context dependence. Banks in developed economies need a high CAR of up to 15.19% versus Basel's 10.5% benchmark, aligning with EBA recommendations. While IBs' PLs mechanisms and Sharia compliance require higher capital buffers needs (+18.12%) as recommended by the Islamic Financial Services Board. In contrast, liquidity measures DTA and LTD thresholds maintain cross-model consistency, leveraging liquidity buffers.

Keywords: Credit risk, Islamic banks, conventional banks, macroeconomic factors, bank-specific factors, GMM, non-performing loans, dynamic panel threshold model.

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1 Introduction

The exacerbation of credit risk manifested by expansion of non-performing loans (NPLs) has been very often central to costly financial crises and widespread economic distress. High levels of non-performing loans could disrupt the smooth transmission of monetary policy and weaken the efficiency of the financial system; the subprime crisis is no exception. Its devastating remnants have affected both developing and advanced economies and underscore the burden of non-performing loans on the global banking system [Nkusu, 2011]. Central bankers assented that pre-crisis financial distress was related to banks' credit risk, transmitted by an expansion of non-performing loans (NPLs) [2].Moreover, several studies have documented that a rise in NPLs is marked as a red flag and is usually associated with banking system frictions and crises occurrence. They revealed that pre-crisis loan problems tend to be closely related to post-crisis recessions [Ari et al., 2021, Laeven and Fabian, 2008, Samad, 2012, Reinhart and Rogoff, 2011, Calomiris and Mason, 2003, Salas and Saurina, 2002, Desmet, 2000]. Furthermore, a study by [Demyanyk and Hemert, 2011], has shown that banks experienced non-performing loan expansion for six consecutive years before the crisis. No wonder non-performing loans are often identified as "financial pollution" due to the mess they left behind on banks' balance sheets [Makri et al., 2014, Zeng, 2012, Barseghyan, 2010]. Therefore, a special task force has been set to deal with NPLs' problems and to enhance banks' ability to maintain clear and strong risk-taking strategies [3]. However, the debate related to the defaulted loans problem has heightened after the propagation of legislative reforms destined to stem the overflow of impaired assets on banks' balance sheets. In fact, following crises, new reforms are carried out to prevent new episodes of financial crises. Towards, December 2017, the Basel Committee on Banking Supervision released "2017b Basel III: Finalizing Post-crisis Reforms" to improve the resilience of the banking system and to avoid the occurrence of further financial crises.

The Basel Committee on Banking Supervision (BCBS) has long been committed to setting up regulatory frameworks that aim to strengthen the resilience and stability of the banking industry. As a part of the Basel prudential regulations, the BCBS sets some thresholds related to certain financial ratios as a part of the credit risk mitigation to help banks with non-performing loan expansion. In their latest prudential review process [4], the BCBS requires all banks category worldwide to maintain a minimum Tier 1 leverage ratio of 3 % [5] and at least 8% of their risk-weighted assets (RWA) as a total capital (CAR). A special recommendation by the IMF working paper on the Islamic Banking Regulation and Supervision (2014) [6], Islamic banks need to maintain a CAR range from 8% to 12% of RWA. This regulational disparity highlights serious regulatory gaps. Given the ongoing expansion of the banking sector, alongside the emergence of Islamic banks, it becomes evident that regulatory measures may not fully address credit risk mitigation challenges across different banking models. In this regard, it is essential to consider extending these regulations to blur the distinction between Islamic and conventional banking systems. This includes incorporating

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[2]The US Banking Crises of the 1980s and Early 1990s, the Asian crisis in the 90s, the Subprime crisis, and recently the European Sovereign Debt Crisis.

[3]Since 2015, the European Central Bank has set up a full strategy to tackle the NPL problem. The most recent report is the DIRECTIVE OF THE EUROPEAN PARLIAMENT AND THE COUNCIL in November 2021 on credit services and credit purchasers and amending directives.

[4]In November 2020 the BCBS released the RBC Risk-based capital requirements updated to take account of the revised credit risk standards that come into effect due to the December 2017 Basel III publication, including the revised implementation date announced on 27 March 2020.

[5]Basel III's leverage ratio framework and disclosure requirements following endorsement on 12 January 2014.

[6]IMF Working Paper Monetary: Islamic Banking Regulation and Supervision: Survey Results and Challenges, Inwon Song and Carel Oosthuizen, December 2014.

additional thresholds based on key financial metrics known to influence the non-performing loan level. Building on established NPLs determinants such as; the Return on Equity (ROE) and the Return on assets (ROA) that reflect the bank's profitability [Panta, 2018, Borroni and Rossi, 2019, Munteanu and Milos, 2021], the Debt-to-Total Assets ratio as a proxy of the solvency ratio [Coulon, 2020, Lessambo, 2022], the Loans-to-Total Deposits ratio as a metric for the bank's liquidity [Gatev et al., 2009, De Haan and van den End, 2013], the net interest margin and diversification ratio as a measure of the bank's efficiency [Rachman et al., 2018, Putri, 2022, Naili and Lahrichi, 2022], and the capital adequacy ratio as an institutional metric, our study will employ the threshold test to identify critical benchmarks within these internal banking metrics and NPLs relationships across conventional versus Islamic banking models.

While these financial measures provide valuable insights into banks' resilience, the banking system's dynamic nature extends beyond these internal metrics. Nkusu, 2011 demonstrates that banks' dynamics are also vulnerable to macroeconomic conditions and business cycles. [Mohaddes et al., 2017] proved that an economic growth rate above 1.2% could reduce the NPL ratio, highlighting a clear macro-financial relationship. Thus, we extend our threshold analysis to examine NPLs trends in conventional and Islamic banks across developed and developing countries. This analysis would help us capture the cross-country and cross-bank specifications and implement a comparative analysis of four dimensions. This comparative approach would allow for a deeper understanding of the relationship between NPL and bank-specific financial ratios, across different economic context.

Though extensive research related to credit risk management exists, significant gaps remain in the literature and regulatory frameworks. Few studies treated the nonlinear relationship between bank-specific variables, such as profitability or liquidity, and NPLs, considering neither the economic context nor the divergence of banking models. Furthermore, existing prudential regulations often fail to account for threshold dynamics and macro-financial interactions that drive NPLs limiting their effectiveness in risk mitigation. Our study addresses these gaps by modelling the relationship between the NPL level and bank-specific factors from a non-linear perspective. This would allow us to capture the critical points beyond which NPLS increases. Further, determining an optimal benchmark for key financial metrics offering banks actionable internal threshold-based risk assessment practices. This provides valuable insights into the bank's risk exposures and offers a significant advancement by incorporating thresholds into prudential regulations. Such enhancements help banks and policymakers to strengthen financial resilience through data-driven risk management strategies.

The remainder of this paper is organized as follows: The next section provides an overview of the literature related to prudential regulations and the impact of financial metrics on risk management within conventional and Islamic financial institutions. Section 3 presents the empirical methodology and discusses the results. Section 4 concludes the work by offering policy recommendations and providing insight for further research.

2 Literature Review

2.1 Prudential Regulation

NPL refers to a loan being 90 days overdue; however, it is usually identified in the regulations under "problem assets" [Core principle 18], "default exposures" [Basel II rules text paragraph 452], and "past due exposures" [Basel II rules text paragraph 75]. Until the announcement of the prudential treatment of 2017 as guidance on NPL measures, including stricter regulatory standards and an accounting approach on NPLs that goes beyond the traditional use of "days past due rule" or "the

standards for risk reporting" but requires banks to maintain clear identifications of overdue loan payments.

However, despite these adjustments, such reforms remain insufficient as they largely delegate banks' responsibility to develop their own procedures for monitoring defaulted loans. Banks are expected to promote internal credit risk management within the BCBS prudential regulations, including loan loss provisioning, capital allocation, forbearance process, affordability assessment, and credit risk rating process. Over-reliance on banks 'internal controls, along with inconsistent global jurisdictional definitions of NPLs, may delay the recognition of loans as impaired, undermining the bank's risk management system.

Furthermore, as a part of credit risk mitigation measurements, the BCBS has implemented thresholds related to banks' internal financial ratios developing a risk-based capital structure to absorb credit losses relative through three thresholds; Common Equity Tier 1 (CET1) at 4.5% of the total risk-weighted assets (RWA), Tier 1 capital fixed at 6 % of RWA and a Total adequacy capital of 8% (Tier1+ Tier 2). In addition to a Capital Conservation Buffer of 2.5%; raising the banks' Minimum Plus Capital Conservation Buffer to 10.5% of RWA. As an extension, the BCBS has settled a countercyclical capital buffer (CCyB) around 2.5%of common equity under the Basel III agreement in 2010, allowing jurisdictions to adjust the CCyB regarding national economic conditions.

However, recent works raise concerns about the minimum capital ratios and the effectiveness of the Risk-Weighted Assets (RWA) scale as a credit risk mitigation measurement and prevention. While Basel III raised the minimum required capital and introduced supplementary buffers to improve risk coverage during economic downturns. The BCBS committee, in their report in December 2022[7] , admit the ongoing challenges in maintaining adequate loss-absorbing reserves. The report highlights the complexity of the RWA mechanism and the multiple capital buffers that undermine the risk assessment transparency and risk sensitivity. The flaws of the countercyclical capital buffer (CCyB), while it is designed to adjust required capital along with the macroeconomic context it may trigger the procyclicality impact, resulting in credit supply shocks. Further inconsistent Basel III standards implementation across countries induces regulatory arbitrage as banks take advantage by maximizing regulatory benefits instead of enhancing resilience. Moreover, [Böhnke et al., 2023] have confirmed that supervisory authorities' discretion often influences Basel RWAs' scales. Within lenient regulatory policies, banks often tend to underestimate their real risk levels. As banks engage in regulatory arbitrage, adjusting their risk-weighted assets to reduce capital buffers instead of accurately capturing their risk exposures.

Despite these efforts, significant gaps remain, as Basel standards focus on loss provisioning instead of early risk detection. To enhance banking resilience, a shift toward preventive and data-based risk early risk detection measures that integrate an early warning system based on non-performing determinants as a part of their credit risk assessment practices. Yet, the Basel frameworks are addressed for both conventional and Islamic banks, neglecting the unique nature of the Islamic banking system, such as Sharia compliance and interest prohibition. Such shortcomings limit the effectiveness of Basel risk mitigation measurements across diverse banking models, emphasizing the need for complementary measures that account for operational divergences between conventional versus Islamic banking systems to create a more comprehensive and effective prudential framework.

Within this context, a special recommendation by The Islamic Financial Services Board (IFSB) induces Islamic banks to hold a minimum of 12% as a CAR and 8% as a Tier 1 capital ratio. As for countries where the banking system adjusts the Basel standards to the Islamic Financial Services

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[7]Evaluation of the impact and efficacity of the Basel III reforms. December 2022

Board (IFSB) prescriptions, Islamic banks have to maintain a minimum of a CAR of 12.5 % and an AT1 ratio of 10.5 %. [The Central Bank of the Kingdom of Bahrain based on the Basel III, December 2010]. Islamic banks need to be considered in light of further prudential regulations.

As an extension to the risk management guidelines, the BCBS implemented a non-risk-based minimum leverage ratio (LR) [8] of 3% of the Tier 1 capital of their total exposures [9], being used as a bulkhead against the buildup of excessive leverage (borrowing). The Bank for International Settlements (BIS) [10] recommends raising the LR to a range of 4 to 5% to prevent excessive leverage during financial booms. This aligns with the empirical findings from an ECB working paper, which support adjusting LR calibration to ensure consistency with risk-weighted capital requirements. In response, the Federal Reserve along with the Federal Deposit Insurance Corporation (FDIC), and the Office of the Comptroller of the Currency (OCC) released regulatory capital instructions [11] that imposed an LR ratio of 5%, based on the banks' size [12]

Alongside prudential regulations, the European Banking Authority (EBA) provides recommendations under the annual supervisory review and evaluation process (SREP) assessment. Since the last update of the risk-based capital requirements (RBC) in 2020, it reveals that the overall capital required should not fall below 14.9% of RWA, against 10.5% under the BCBS updated capital requirements, and it is still increasing to reach 15.5% as estimated for 2024 as shown in Figure1. An additional threshold has been settled under the IMF Global Financial Stability Report 2017 [13] related to the appropriate return on equity ratio (ROE). According to the IMF 2017 instructions, banks have to maintain an 8% minimum ROE ratio.

To further highlightr the vulnerability of NPLs to the bank's financial ratios, we could take a look at the NPL cycle during the pre-crisis and post-crisis periods of the GFC in the US banking system, along with the changes in some of the key financial metrics see Figure2. In the earlier 2007 pre-crisis period, the NPL ratio registered 1.1% with 8.75% of ROE, 0.87% of ROA, 3.13% of NIM, and 12.8% of CAR. However, during the crisis, the NPL level increased from 1.1% to 2.21%, while the ROE decreased from 8.75% pre-crisis (2007) to 1.64% post-crisis (2009). In addition, the ROA ratio shows an inverse response to the NPLs level, with a fall from 0.87% in 2007, 0.10% in 2008, 0.16% in 2009, and 0.66% in 2010, while the NPL ratio continues rising from 2.21% in 2008 to 5.30% in 2010. Even after the GFC spread, the NPL level steel increased from 2.21% in 2008 to 4.70% in 2009 and continued rising to 5.30% in 2010. This could be explained by the credit crash phenomenon that leads to a business failure, then, triggers a second round of NPL push-ups and makes banks more hesitant about lending as a snowball. This was widely validated by several empirical models in which NPLs are typically persistent, which could explain the slow response of bank-impaired loans to the economic cycle, and then they would simply accumulate to high levels [Espinoza and Prasad, 2010]. By 2018, the recovery period, the financial ratios returned to their pre-crisis levels along with a decrease of the NPL ratio to 0.89%. These findings suggest that banks could manage their non-performing loan portfolio based on a critical point of some financial ratio beyond which the NPL trend changes. This illustrates a clear timeline of the interaction between

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[8]Under the Basel III 2010 version, the BCBS introduced the leverage ratio for the first time.

[9]After the release of "the finalized Basel III framework" in 2017

[10]Ingo Fender & Ulf Lewrick, 2015. "Calibrating the leverage ratio," BIS Quarterly Review, Bank for International Settlements, December.

[11]Federal Register: "Regulatory Capital Rules: Regulatory Capital, Revisions to the Supplementary Leverage Ratio", 2014.

[12]Banks with more than $10 trillion in assets under management (AUM) or more than 700 billion in consolidated total assets are required to hold an additional 2% as a buffer, making their minimum LR ratios 5% .

[13]Global Financial Stability Report October 2017: Is Growth at Risk?

various financial ratios and the NPL level, as well as how these financial metrics at a certain point may be associated with NPL expansion.

More effective prudential regulations should combine preventive risk detection, dynamic risk monitoring practices driven by financial determinants of non-performing loans and tailored measurement that addresses the emerging risks of distinct banking models. Such adjustments would help promote more robust cross-border supervision.

2.2   Financial metrics and threshold effect

A few studies have investigated the threshold effect of some financial metrics on NPL. These studies remain limited because the statistical basis for the dynamic panel threshold test was recently developed by [Seo and Shin, 2016] and later refined [Seo et al., 2019]. Previously, researchers used the PSTR model, which was limited to the threshold effect of the dependent variable only. For instance, Pop et al., 2018, have used the PSTR model to investigate the threshold effect of the bank's liquidity (measured by DTA) on the NPL level in seven emerging European countries. Their empirical results revealed that banks have to maintain a DTA ratio below 94.89%. Otherwise, they have to use 94.89% of their deposits to fund the lending activity. In adverse, [Alnabulsi et al., 2023] have tried to capture the threshold effect of NPLs on the NIM (used as a proxy of the bank's profitability) [14]. They found that an NPL ratio above 4.2% reduces the NIM ratio and, as a result, the profitability. Within context, [Bolarinwa et al., 2021] have examined the threshold effect of the NPL profitability nexus in Nigerian banks relative to the recapitalization policy. Their empirical findings revealed a non-linear relationship between NPLs and bank profitability, as well as an NPL threshold that is approximately 3.5% to 5% higher than the ROAA (return on average assets) and ROAE (return on average equity), respectively. These studies provide valuable insights into NPLs' dynamics. Yet, they do not fully address the structural divergence between conventional and Islamic banking models nor account for the macroeconomic context, often concentrating on developed economies or emerging countries.

While, a wide range of literature has discussed factors related to NPLs' expansion that take into consideration idiosyncratic shocks related to macroeconomic vulnerabilities such as GDP growth, inflation, interest rate, real estate markets, etc., and drives relative to systematic shocks, precisely macro-financial vulnerabilities to bank-specific factors such as (ROA, management quality, bank's size, etc.[Salas and Saurina, 2002, Louzis et al., 2012, Kauko, 2012, Erdinc and Abazi, 2014]. In effect, [Salas and Saurina, 2002] focus on the relationship between bank size and non-performing loans (NPLs) in the Spanish banking system.

Their work highlights the negative relationship between larger banks and NPLs. Louzis et al., 2012studied the determinants of NPLs in the Greek banking sector, analyzing both macroeconomic factors and bank-specific characteristics. Kauko, 2012 Focuses on financial stability indicators in the European banking sector, identifying early warning signs of banking crises. Erdinc and Abazi, 2014 examine the impact of financial sector vulnerabilities and systemic risks on banks' NPLs in emerging markets.

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[14]In the MENA region especially in North Africa the bank's main activity is based on interest- bearing operations, where the bank's profit is generated by the interest income that is measured by the NIM.

3 The Empirical Strategy

3.1 Econometric Methodology

In this paper, we tried to capture the threshold effects of several financial metrics on NPLs. To this end, we employ the fixed-effect panel threshold model proposed by Seo and Shin, 2016. Under the null hypothesis of this test, the financial metrics do not have a threshold effect on the NPLs. The system of equations on panel data can be written as follows:

$$\text{NPL}_{it} = \alpha_0 + \emptyset NPL_{it-1} + \beta_1 \text{ROA}_{it} + \beta_2 \text{ROE}_{it} + \beta_3 \text{LTD}_t + \beta_4 \text{DTA}_{it} + \beta_5 \text{NIM}_{it} + \beta_6 \text{DIV}_{it} + \beta_7 \text{CAR}_{it} + \epsilon_{it}$$
$$(1)$$

where ROA_{it} is Return on Assets, ROE is is Return on Equity, LTD is Loan Deposit Ratio, LTD is Loan Deposit Ratio, DTA is Loan Deposit Ratio, NIM is Net Interest Margin, DIV is Diversification Ratio and CAR is the capital adequacy ratio.Table 1 further presents our variables.

Table 1: Data Presentation

Category	Determinant	Proxy
Profitability Ratio	Return On Assets (ROA) Return on Equity (ROE)	Net income / Total assets Net income / Shareholders Equity
Liquidity Ratio	Loan Deposit Ratio (LTD)	Total Loans / Total Deposits
Solvency Ratios	Debt to Total Assets (DTA)	Total debt / Total assets
Efficiency Ratios	Net Interest Margin CB (NIM CB) Net profit-and-loss sharing/PLS margin IB (NPM IB) Diversification (DIV)	Net interest income/total assets Earning on financing activities CB: Non-interest income / total income
Institutional Ratios	Capital adequacy ratio (CAR)	Total capital / Total risk-weighted Assets

All variables are drawn from the DataStream database. In this model, we introduce as explanatory variables only the bank-specific factors mentioned above. Equation (1), however, does not account for the possible threshold impact of financial metrics on NPLs. To take into account this form of non-linearity, we adopt a dynamic panel threshold model developed by [Seo and Shin, 2016]. This econometric model makes it possible to test for the existence of threshold effects in the relationship between financial metrics and the NPL. This technique allows us to test the hypothesis that the equation can be divided into regimes depending on threshold values of financial metrics. Following the methodology proposed by [Seo and Shin, 2016], the model (1) can be written as follows:

$$\begin{aligned}
\mathrm{NPL}_{it} = {} & \big(\phi_1\mathrm{NPL}_{i,t-1} + \theta_{11}\mathrm{ROA}_{it} + \theta_{21}\mathrm{ROE}_{it} + \theta_{31}\mathrm{LTD}_{it} \\
& + \theta_{41}\mathrm{DTA}_{it} + \theta_{51}\mathrm{NIM}_{it} + \theta_{61}\mathrm{DIV}_{it} + \theta_{71}\mathrm{CAR}_{it}\big)I\{FM_{it} \le \gamma\} \\
& + \big(\theta_{32}\mathrm{LTD}_{it} + \theta_{42}\mathrm{DTA}_{it} + \theta_{52}\mathrm{NIM}_{it} \\
& + \theta_{62}\mathrm{DIV}_{it} + \theta_{72}\mathrm{CAR}_{it}\big)I\{FM_{it} > \gamma\} + \alpha_i + \upsilon_{it}
\end{aligned} \tag{2}$$

In equation (2), one of the financial metrics (FM) is the threshold variable. According to the level of this variable, we split the data into distinct regimes, which can be called low- and high-financial metrics regimes. γ represents the threshold parameters. I(.) is a dummy variable which takes 1 if the threshold variable is below the threshold parameter specific to that equation, and 0 otherwise.

The analysis would provide insights on four dimensions, by conducting a cross-country analysis between banks in developed and developing countries, also between conventional and Islamic banks (cross-bank analysis).

3.2 Data

The model described previously is estimated for a panel dataset composed of 497 banks including, 283 Conventional banks and 49 Islamic banks from developed countries, 89 conventional banks and 76 Islamic banks from developing countries. The data was collected from 2005 to 2022 including the 2008 crisis and the COVID-19 pandemic, among seven developed countries[15] and thirteen developing ones [16]. The financial data is collected from the DataStream database, and the missing variables are extracted directly from the annual report of each bank. The analysis would provide insights on 4 dimensions, by conducting a cross-country analysis between banks in developed and developing countries, also between conventional and Islamic banks (cross-bank analysis).

4 Results

4.1 Preliminary Analysis

First, we would start with a preliminary analysis using the Arellano bond estimator to prove statistically that chosen bank-specific ratios affect the NPLs level. After that, we will proceed with the dynamic panel threshold model introduced by [Seo and Shin, 2016]. The results of the dynamic panel two-step GMM estimation are presented in tables 2 and 3 below. These results prove that the financial metrics, the ROA, the ROE, the LTD, the DTA, the NIM, the DIV and the CAR ratios, have a significant effect on NPLs exposure. Thus, we can apply the threshold test without restriction.

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[15] United State of America, Canada, Switzerland, France and the United Kingdom, Japan, China

[16] Jordan, Türkiye, and the Republic of Kuwait, Malaysia, Oman, Saudi Arabia, Singapore, Thailand, the United Arab Emirates, Bahrain, Qatar, Indonesia, and Pakistan

Two-step GMM Estimation on Developed Countries

Variable	Conventional Banks		Islamic Banks	
	Coefficient	T-statistic	Coefficient	T-statistic
NPL (-1)	0.9824***	(0.000)	0.8449***	(0.000)
ROA	0.1460***	(0.000)	0.0739***	(0.001)
ROE	-0.0301***	(0.000)	-0.0886***	(0.000)
LTD	-0.0040**	(0.032)	0.0045***	(0.002)
DTA	0.0284***	(0.000)	0.0374***	(0.000)
NIM	0.1483***	(0.000)	0.8075***	(0.000)
DIV	0.0108***	(0.000)	0.0255***	(0.000)
CAR	-0.0094*	(0.057)	-0.0853***	(0.000)
Constant	-0.3654**	(0.046)	-1.3403***	(0.000)
Observations	4811		784	
Number of Banks	283		49	
Wald χ^2 Statistic	1.8606		8.3106	
Prob ¿ χ^2	0.0000		0.0000	
Number of Instruments	82		144	

Notes: ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. P-values are reported in parentheses.

TTwo-step GMM estimation on Developing countries

Variable	Conventional Banks		Islamic Banks	
	Coefficient	T-statistic	Coefficient	T-statistic
NPL (-1)	0.3378	0.000***	0.4330	0.000***
ROA	-0.2502	0.000***	-0.1289	0.000***
ROE	-0.0362	0.000***	-0.0379	0.000***
LTD	-0.0256	0.000***	-0.0594	0.000***
DTA	-0.0307	0.000***	-0.0564	0.000***
NIM	-0.3281	0.000***	0.8085	0.000***
DIV	0.0159	0.000***	0.0302	0.000***
CAR	-0.0714	0.000***	-0.0182	0.000***
Constant	9.8633	0.000***	6.7941	0.000***
Observations	1513		1292	
Number of Banks	89		76	
Wald Chi2 Statistic	1.1706		6.1409	
Prob ¿ Chi2	0.0000		0.0000	
Number of Instruments	160		160	

Note: ***, **, * indicate the significance level of 1%, 5%, and 10%, respectively.

Based on these findings, the impact of the diversification ratio DIV, the capital adequacy ratio (CAR), and the return on equity ratio (ROE) remains the same for all banks' categories. Both the CAR ratio and the ROE ratio tend to reduce NPL exposure, consistent with existing literature [Hosna et al., 2009, Kithinji, 2010, Ogboi, 2013]. The ROE ratio is commonly used in the literature as a proxy of the banks' performance and profitability, as it reflects the return of the shareholders 'equity. Generally, high profitability is associated with low NPL levels. On the other hand, banks need to maintain a sufficient capital reserve to cover potential losses, as high Capital Adequacy Ratio (CAR) helps mitigate credit risk. Though, relevant research supports the non-linear relationship between the CAR ratio and the NPL level. They opined that a high CAR ratio could reduce NPLs up to a certain point, after which its impact may lessen or cease to be relevant. Effectively, [Claessens et al., 2010, Louzis et al., 2012, Akyildirim et al., 2020] highlight the critical balancing act between maintaining sufficient capital and managing credit risk. While high DIV ratio acts as an NPLs booster for both banking system regardless the economic conditions. According to the given results, banks should avoid relying heavily on non-interest income (non-financing income in case of Islamic banks). The relationship between the return on assets ratio ROA, the debt to total assets ratio DTA and the NPLs level highlights the economic environment (macroeconomic factors) impact on the financial dynamics. While both DTA and ROA tend to reduce defaulted loans levels for conventional and Islamic banks in developing countries. They trigger the NPLs level in developed ones across all bank category. The DTA ratio on the NPLs level might be explained by the debt discipline theory first introduced by Dewatripont and Tirole (1994), as banks with high DTA ratios adopt stricter lending practices. In addition, banks in developing economies usually tend to hold more tangible assets as collateral, avoiding defaulted loans even with high leverage. Further, research by Boudriga et al., 2010, Kauko, 2012 support our findings. Generally high ROA is related to high profitability hence low NPL level which is the case for both all banks in developing countries. However, our findings reveal an adverse response for banks in developed economies. While high ROA could be related to aggressive lending practices, that boost profits in the short-run but increasing NPLs portfolio later. According to the results above, A high loan to deposit ratio LTD reduces NPLs level within conventional banking system across developed and developing countries. While for Islamic banks the LTD ratio effect differs from IB in developed and developing ones. It has been obvious that the relationship between the financial metrics and the NPLs level is more complex, and the interaction with the macroeconomic conditions makes it more reasonable to investigate these nexuses within a sample that gathers both developing and developing countries. Moreover, these results outline the impact of different banking business model on bank-specific financial factors and the NPL-level nexus. Also, it underscores the deep impact of broader economic conditions on the vulnerability of NPLs to changes in banks' internal outcomes, even within banks that adopt the same banking principles. This suggests that the economic context plays a critical role in shaping the relationship between bank-specific outcomes and the NPL level. It highlights the need for a deeper understanding of how the interaction between internal banking metrics affects banks' exposure to NPLs.

4.2   Dynamic panel threshold model results

Next, we will apply the dynamic threshold effect model. At each time, we estimate equation (2) while taking on financial metrics as the threshold variable. The results will be presented by variable.

4.2.1 The case of ROA:

Threshold variable: ROA

	Developed Countries				Developing Countries			
	Conventional Banks		Islamic Banks		Conventional Banks		Islamic Banks	
Threshold level (P-value)	0	.88*** (0.000)	1	.68*** (0.004)	0	.768*** (0.000)	1	.091** (0.018)
	Lower		Upper		Lower		Upper	
ROA	**-0.558*****	**1.632*****	**1.014****	**-2.033*****	**-0.432*****	**0.819*****	**0.499*****	**-1.006*****
	(0.000)	**(0.000)**	**(0.042)**	**(0.001)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
NPL (-1)	0.474***	0.030***	0.788***	-0.034	0.097***	0.557***	0.606***	-0.113***
	(0.000)	(0.000)	(0.000)	(0.724)	(0.000)	(0.000)	(0.000)	(0.000)
ROE	0.047***	-0.136***	-0.030**	-0.030	-0.040***	-0.024**	-0.038***	0.109***
	(0.000)	(0.000)	(0.041)	(0.120)	(0.000)	(0.012)	(0.000)	(0.000)
LTD	-0.005***	-0.000	-0.021	0.158***	0.015***	-0.0625***	0.087***	-0.176***
	(0.000)	(0.019)	(0.185)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DTA	0.034***	-0.035***	0.047	0.388***	-0.065***	0.077***	-0.135***	0.171***
	(0.000)	(0.000)	(0.269)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
NIM	1.06***	-0.878***	0.048	0.128	-0.037	0.387***	1.220***	0.670***
	(0.000)	(0.000)	(0.666)	(0.745)	(0.538)	(0.000)	(0.000)	(0.000)
DIV	0.003***	0.032***	-0.016***	-0.043	0.019***	-0.041**	0.024**	0.051***
	(0.005)	(0.000)	(0.000)	(0.127)	(0.000)	(0.000)	(0.000)	(0.000)
CAR	0.005**	0.006*	0.027	0.024	0.036***	-0.033**	-0.371**	0.388***
	(0.022)	(0.051)	(0.603)	(0.867)	(0.000)	(0.002)	(0.000)	(0.000)

Note: ***, **, * indicate significance at 1%, 5%, and 10% levels respectively. P-values in parentheses.

According to table 4, in Islamic banks, a high ROA (Return on Assets) seems to reduce non-performing loans (NPLs) exposure, unlike conventional banks. Since Islamic banks use assets as collateral, ensuring that investments are backed by tangible assets or productive activities. This makes Islamic finance less risky, as banks can hold excess assets without negatively impacting performance. This approach reduces speculative operations and risky collateral use while providing extra funds to cover potential losses. According to our findings, there is a slight difference between Islamic banks: those in developing countries need to maintain an ROA of at least 1.09% to reduce NPL exposure, while banks in developed countries require a higher ROA of 1.68%. This difference is attributed to the economic diversification.

Additionally, Islamic banks tend to have a higher ROA than conventional banks due to their unique instruments, such as risk-sharing and interest-free activities, which encourage prudent financial practices and improve asset quality, lowering NPL risk as confirmed by [Iqbal, 2012]. Our findings align with Islamic finance principles, as Islamic banks rely on secured assets, typically linked to productive activities, to reduce risk. Even if financing fails, these assets serve as collateral and extra funds in case of losses. This is based on Islamic finance principles, which forbid certain financial operations and require real assets to back transactions.

While conventional banks also use assets as their primary revenue source, mostly interest-bearing assets (loans), we can conclude that their income is largely based on risky financing. This increases the likelihood of taking additional risks and investing in risky assets for higher profits. Consequently, a high ROA is usually associated with increased NPLs, as our empirical results confirm. García-Marco and Robles-Fernández, 2008 suggest that poorly performing banks are more likely to adopt

cautious credit policies to prevent further losses.

In fact, we found that for conventional banks, a high ROA negatively impacts the bank, making it less exposed to credit risk by reducing NPLs. Our results show that conventional banks in developing countries need an ROA below 0.76% to reduce NPLs, while in developed ones, banks could generate a higher ROA up to 0.8%.

4.2.2 The case of ROE:

Table 5: Threshold variable: ROE

	Developed Countries				Developing Countries			
	Conventional Banks		Islamic Banks		Conventional Banks		Islamic Banks	
Threshold level (P-value)	8.69*** (0.000)		16.468*** (0.000)		7.660*** (0.000)		15.43*** (0.000)	
	Lower regime		Upper regime		Lower regime		Upper regime	
NPL (-1)	**0.443*** (0.000)**	**0.020*** (0.000)**	**0.898*** (0.000)**	**-0.141*** (0.004)**	**0.271*** (0.000)**	**0.336*** (0.000)**	**0.501*** (0.000)**	**0.329*** (0.000)**
ROE	0.100*** (0.000)	0.110*** (0.000)	-0.049*** (0.000)	0.084** (0.013)	-0.015*** (0.000)	-0.121*** (0.000)	-0.033*** (0.000)	0.024*** (0.000)
ROA	-1.244*** (0.000)	1.83*** (0.000)	-0.343 (0.106)	-0.674*** (0.010)	-0.396*** (0.000)	0.359*** (0.000)	0.322*** (0.000)	1.248*** (0.000)
LTD	-0.005** (0.017)	-0.007** (0.017)	0.004 (0.336)	0.055*** (0.000)	0.013*** (0.000)	0.027*** (0.000)	-0.006 (0.071)	-0.071*** (0.000)
DTA	0.063*** (0.000)	-0.073*** (0.000)	-0.026 (0.172)	-0.129*** (0.000)	-0.095*** (0.000)	0.096*** (0.000)	-0.153*** (0.000)	0.443*** (0.000)
NIM	1.182*** (0.000)	-1.051*** (0.000)	0.820*** (0.000)	-0.287* (0.052)	0.148*** (0.001)	0.441*** (0.000)	-0.299*** (0.003)	1.477*** (0.000)
DIV	-0.004*** (0.000)	0.028*** (0.000)	0.031*** (0.000)	-0.017 (0.111)	0.024*** (0.000)	-0.056*** (0.000)	-0.013* (0.085)	0.071*** (0.000)
CAR	-0.054*** (0.000)	0.138*** (0.000)	-0.188*** (0.003)	0.062 (0.504)	-0.021*** (0.003)	0.133*** (0.000)	-0.043*** (0.047)	-0.073*** (0.001)

Note: ***, **, * indicate significance at 1%, 5%, and 10% levels respectively. P-values in parentheses.

Based on the given results reported in Table 5, the ROE ratio shows adverse responses to the NPL level in conventional and Islamic banks. In the case of conventional banks, a minimum ROE threshold of 7% to 8% is necessary to ensure that they maintain sufficient profitability and capital reserves. While Islamic banks should aim for a maximum ROE threshold of 15% to 16% exceeding this limit could lead to excessive risk-taking and higher NPL levels. These thresholds align with the broader industry benchmark, notably the International Monetary Fund's[17] benchmark of a 10% ROE as a healthy ratio. However, it is important to note that conventional banks in developing countries, even with relatively low ROE, can still mitigate the expansion of NPLs. This can be attributed to their ability to maintain adequate capital reserves and implement effective risk management practices, even when profitability is not excessively high. In fact, the traditional banking model emphasizes flexibility in capital management, as conventional banks can leverage higher ROE levels as additional backup capital to absorb losses. Further, a literature survey related

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[17]Financial Systems Dept. (2017). Global Financial Stability Report, October 2017: Is Growth at Risk?. International Monetary Fund.

low profitability with the bad management hypothesis, which suggests that low profitability reflects poor management lending practices leading to a high level of NPLs [Ghosh, 2015, Louzis et al., 2012]. Low-profitability banks are more likely to increase their risk exposure and adopt a liberal credit policy to recover previous losses and maintain prudent current profitability, which may lead to NPL exposure. Though the Islamic banking model operates according to risk-sharing and assets-backed principles, where Islamic banks (IBs) must balance profitability with risk-mitigating objectives of Sharia-compliant finance to maintain investor confidence and ensure long-term sustainability. For instance, to attract investors, IBs may pursue high returns on investment accounts, which is predictable given the fierce competition in the broader banking industry. Studies by Sarwar, 2018, Slimene and Obeid, 2022 further support this idea, showing that IBs to avoid withdrawing funds may prioritize high ROE to maximize shareholder returns. Consequently, they might resort to risky ventures tied to risk-sharing contracts (Mudarabah) or investments prone to failure (Musharakah), potentially leading to higher NPL levels. Mukhibad et al., 2023, even confirmed that such equity-based financing (EBF) mechanisms are associated with higher NPL levels.

To strike such a balance, IBs often adopt a cautious approach and maintain moderate ROE levels to remain competitive while adhering to Sharia principles and mitigating NPL exposure. This is evident in the PwC report [18], which notes that Islamic banks generate an average ROE of around 7%, significantly lower than many conventional banks.

Our results also suggest that profitability, even at modest levels, plays a significant role in improving loan portfolio quality in developing countries. Recent findings in the World Bank report (2024) [19] indicates that generally, conventional banks in these economies are well-capitalized and maintain strong risk-management practices, which contribute to better loan quality, even with a modest profitability level. Strict capital requirements under (Basel III), which limit leverage and encourage banks to adopt more conservative lending and investment practices. While this reduces losses and enhances financial stability, it also limits returns, leading to lower profitability (ROE).

Furthermore, developing economies are often bank-based financial systems, where banks play a central role in the economy. The presence of relationship banking, where banks build long-term relationships with borrowers, enables better credit risk assessment and monitoring. Which reduces the pressure on banks to pursue high ROE, to ensure profitability or attract investors. As a result, banks in these economies can focus on maintaining asset quality without resorting to aggressive lending practices.

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[18]The PwC Islamic advisory since the 1980s concentrated in the Middle East, Malaysia and the UK.

[19]World Bank. 2024. Finance and Prosperity 2024. Finance and Prosperity.

4.2.3 The case of NIM:

Table 6: Threshold variable: NIM

	Developed Countries				Developing Countries			
	Conventional Banks		Islamic Banks		Conventional Banks		Islamic Banks	
Threshold level (P-value)	3.28*** (0.000)		1.91*** (0.000)		2.631*** (0.000)		4.28*** (0.000)	
	Lower regime		Upper regime		Lower regime		Upper regime	
NPL (-1)	**0.538*** (0.000)**	**-0.016** (0.029)**	**0.205 (0.519)**	**0.571* (0.082)**	**-0.761*** (0.000)**	**0.594*** (0.000)**	**-0.866*** (0.000)**	
NIM	0.222** (0.044)	-0.0247** (0.021)	-1.620** (0.013)	2.320*** (0.001)	0.369** (0.021)	-0.276* (0.097)	-1.854*** (0.000)	4.391*** (0.000)
ROA	-0.916*** (0.000)	1.770*** (0.000)	-1.680 (0.179)	0.563 (0.633)	-0.318*** (0.000)	0.285*** (0.000)	0.146*** (0.002)	3.140*** (0.000)
ROE	0.029*** (0.000)	-0.147*** (0.000)	0.138** (0.011)	-0.196*** (0.004)	0.014*** (0.000)	-0.056*** (0.000)	-0.024*** (0.000)	-0.664*** (0.000)
LTD	0.007*** (0.000)	-0.051*** (0.000)	0.0007 (0.925)	-0.030*** (0.000)	0.022*** (0.001)	-0.065*** (0.000)	0.024*** (0.000)	-0.134*** (0.000)
DTA	-0.001 (0.406)	0.039*** (0.000)	-0.036 (0.178)	0.045 (0.271)	0.011 (0.227)	-0.028** (0.022)	-0.037*** (0.000)	-0.232*** (0.000)
DIV	0.007** (0.012)	0.046*** (0.000)	-0.118*** (0.000)	0.148*** (0.000)	0.015 (0.114)	-0.018* (0.090)	0.027*** (0.000)	0.141*** (0.000)
CAR	0.004*** (0.002)	-0.017*** (0.000)	-0.120 (0.424)	0.565*** (0.001)	-0.105*** (0.000)	0.084*** (0.000)	-0.263*** (0.000)	0.060 (0.278)

Note: ***, **, * indicate significance at 1%, 5%, and 10% levels respectively. P-values in parentheses.

According to Table 6, the NIM also underscores the difference between conventional and Islamic banking systems, showing adverse responses to NPL despite the economic environment. Based on our threshold test results, conventional banks are required to maintain an NIM ratio between 3.28% to 4.28% to increase NPL exposure. However, in the case of Islamic banks, a low NIM ratio is required to hinder the NPLs' level. To begin with, the NIM ratio for conventional banks is a proxy of the bank's efficiency; even in some cases, it is considered a profitability ratio because it reflects the net income generated by interest-based assets (commonly loans), being the main activity of conventional banks. The first to consider the NIM as a performance proxy was Ho and Saunders (1981), using the dealership model. The NIM further reflects the bank's efficiency in managing its assets to generate income [Pandia, 2012]. Therefore, maintaining a balance between profitability and asset quality has been challenging, as we noted before. A literature survey [Purba and Triaryati, 2018, Falikhatun et al., 2024] confirms that a high NIM indicates that banks effectively generate income from their lending activities, suggesting that banks have a high loan portfolio quality. In such cases, the bank may allocate additional funds to cover potential losses, thereby reducing NPL exposure. Though IB financing services are interest-free, they use the NIM ratio as the difference between a bank's revenue from financing activities and its costs[20] . The revenues stand for revenues generated via investing and lending activities, while the cost of financing may include the profits distributed to depositors or investment account holders. We hence consider the IB margin as the

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[20]the revenues stand for revenues generated via investing and lending activities while the cost of financing may include the profits distributed to depositors or investment account holders.

ratio of net-financing income to average earning assets, which has been widely used in the literature [see,Yanikkayaa et al., 2018].

According to our findings, the IB margin seems to have an adverse response to NPL exposure. We found that IB should maintain a relatively low NIM, below 1.91% for Islamic Bank in developed countries and 2.63% for developing countries, to reduce the NPL. Let us explain these results further. Islamic financial instruments are divided into two main categories; profit-loss sharing (PLS)-based and Non-PLS-based financing. However, it has been theoretically proven that PLS-based financing strengthens the Islamic bank's ability to manage their risk mitigation, namely non-performing financing [Usmani, 2002, Siddiqi, 2006]. However, research shows that in practice Islamic banks have failed to adopt PLS-based financing and being trapped by the traditional banking [Williamson, 2000]. A study by Abdul-Rahman et al., 2014, confirms that 90% of the Islamic financial operations in Malaysia are Non-PLS base contracts.

However, the most non-PLS-based financing is the Murabaha contracts, which have been widely associated with a high likelihood of NPL exposure, since IBs have to bear all losses in case of defaulted financing, [see, Haron and Hock, 2007, Boumediene, 2011, Ahmed and Habib, 2011. Therefore, we can tell that the high IBs' margin acts as a trigger for NPF exposure. However, with the ongoing competition, they tend to increase their financing income using an aggressive lending strategy, hence increasing the likelihood of high NPL levels.

4.2.4 The case of LTD:

Table 7: Threshold variable: LTD

	Developed Countries				Developing Countries		
	Conventional Banks		Islamic Banks		Conventional Banks		Islamic Banks
Threshold level (P-value)	95.09*** (0.000)		68.89*** (0.000)		81.18*** (0.000)		111.74*** (0.000)
	Lower regime		Upper regime		Lower regime		Upper regime
NPL (-1)	**0.510*** **	**0.004*** **	**0.260*** **	**0.561*** **	**-0.362*** **	**-0.202*** **	**0.094*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
LTD	0.033***	0.047**	-0.166***	0.173***	-0.120***	0.131***	-0.114***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ROA	0.657***	-0.530***	-0.547*	-0.852***	-1.131***	0.792***	-0.036
	(0.000)	(0.000)	(0.066)	(0.007)	(0.000)	(0.000)	(0.000)
ROE	0.069***	-0.037***	-0.121**	0.103	0.015***	-0.069***	-0.013***
	(0.000)	(0.000)	(0.050)	(0.123)	(0.000)	(0.000)	(0.000)
DTA	0.083***	-0.144***	0.015	-0.006	-0.325***	0.264***	0.054***
	(0.000)	(0.000)	(0.897)	(0.961)	(0.000)	(0.000)	(0.000)
NIM	0.740***	-0.869***	2.787***	-1.930***	0.096	-0.132*	1.314***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.151)	(0.095)	(0.000)
DIV	0.025***	-0.042***	0.175***	-0.129**	0.080***	-0.145***	-0.015**
	(0.001)	(0.000)	(0.000)	(0.022)	(0.000)	(0.000)	(0.000)
CAR	-0.103***	0.177***	0.111	-0.378***	-0.071***	0.125***	-0.135***
	(0.000)	(0.000)	(0.361)	(0.001)	(0.000)	(0.000)	(0.000)

Note: ***, **, * indicate significance at 1%, 5%, and 10% levels respectively. P-values in parentheses.

As reported in Table 7, unlike the NIM ratio, the loan-to-deposit ratio effect on NPLs remains consistent across countries and banks. We can tell that the bank's liquidity level and credit risk

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exposure nexus have been proven across the global banking system. Even with the unique nature of the Islamic banking system, Islamic banks are also vulnerable to similar risk trends related to liquidity and lending. A combination of prudence and regulatory requirements suggests that the LTD should be around 80% to 90% for traditional banks, which is in line with our findings.

In fact, we found that banks in developed countries represent the highest LTD threshold. While conventional banks could allocate up to 95.09% of total deposits to lending, Islamic banks may use 68.89% of total deposits to fund their lending activity. As for banks in developing countries, we found that Islamic banks have the highest LTD threshold with 111.74% while their counterparties could set up a maximum of 81.18% of total deposits to fund loans. Overall, when the LTD surpasses the threshold, the banks will experience a shortage of liquidity. In such a situation, the bank would struggle to cover future losses, exposing it to a high NPL level. Louzis et al., 2012 have explained this with the "bad management" and "lose control" hypotheses that low-liquid banks have poor creditworthiness policies.

Further, a study by Pop et al., 2018, on the relationship between NPLs and LTD using the threshold method in seven emerging European countries, revealed that a moderate LTD ratio is around 95%. A bank with an LTD ratio that surpasses 95% is highly sensitive to several factors that could lead to an NPL expansion. Furthermore, according to the IMF definition, the loan-to-deposit ratio serves as a selective credit instrument that defines the liquidity buffers that should be included in the bank's credit strategy.

As for Islamic banks, they have significant custody banking services, requiring them to keep most of their deposits liquid. Although they can only use unrestricted deposits as an investment account, they do not have the right to use or dispose of these funds. Although conventional banks are usually risk-averse and focus highly on traditional banking services, their business model supports high LTD levels. This is obvious given the high LTD threshold, which allows conventional banks to allocate more than 80% of total deposits to fund lending activity. However, overreliance on deposits could lead to liquidity shortages that may be needed in case of deposit withdrawals or to cover potential losses. By enduring high LTD, banks might be exposed to financial stress due to excessive lending. Hence, all banks are required to maintain a prudent LTD ratio and attempt to strike a balance between lending and liquidity. Based on our empirical results, conventional banks could consider using an additional metric that might help maintain such a balance. The threshold test results across conventional banks in both developed and developing countries show that when the LTD surpasses the threshold, leading to a significant rise in non-performing loan and the NIM tends to reduce the NPL level. These results indicate that conventional banks should prioritize increasing their NIM to mitigate the adverse effects of NPLs, which also provides an additional buffer against future losses. However, maintaining sustainable lending activity and sufficient net interest profit requires banks to rely on debts as a substitute source of funds. Our threshold analysis further confirms that when the LTD ratio exceeds the threshold, the DTA ratio tends to reduce defaulted loan exposure.

These findings suggest conventional banks should strategically prioritize increasing their net interest margin (NIM) to counterbalance non-performing loan (NPL) risks. Beyond boosting net interest income, a higher NIM provides a critical buffer against future loan losses. However, maintaining sustainable lending operations and adequate interest profitability requires banks to utilize debt financing as an alternative funding source. Our threshold analysis further substantiates that when the loan-to-deposit (LTD) ratio surpasses its critical threshold, the debt-to-asset (DTA) ratio demonstrates an inverse relationship with defaulted loan exposure.

Overall, conventional banks in developed countries should lend a maximum of 95.09% of their

deposits to fund lending and maintain at least a 3.28% NIM. For CBs in developing countries, they should use a maximum of 81.18% of their deposits and sustain at least a 2.63% NIM. These findings highlight the importance of maintaining a balanced LTD ratio to mitigate the risk of NPLs for banks across different economic contexts.

4.2.5 The case of DTA

Table 8: Threshold variable: DTA

	Developed Countries				Developing Countries		
	Conventional Banks		Islamic Banks		Conventional Banks		Islamic Banks
Threshold level (P-value)	6.06*** (0.000)		12.79*** (0.000)		11.465*** (0.000)		11.63*** (0.000)
	Lower regime		Upper regime		Lower regime		Upper regime
NPL (-1)	**0.516***** **(0.000)**	**0.008***** **(0.000)**	**0.674***** **(0.000)**	**0.257***** **(0.000)**	**0.668***** **(0.000)**	**0.532***** **(0.000)**	**0.664***** **(0.000)**
DTA	0.293*** (0.000)	-0.276*** (0.000)	0.138** (0.025)	-0.226*** (0.001)	0.321*** (0.000)	-0.347*** (0.000)	0.393*** (0.000)
ROA	-0.879*** (0.000)	-0.582*** (0.000)	-0.798*** (0.002)	-0.021 (0.872)	0.212*** (0.004)	-0.570*** (0.000)	-0.474*** (0.000)
ROE	-0.089*** (0.000)	-0.001 (0.395)	-0.062*** (0.000)	0.046*** (0.005)	-0.008 (0.381)	-0.022** (0.032)	-0.009*** (0.001)
LTD	-0.021*** (0.000)	0.015*** (0.000)	-0.003 (0.314)	0.025*** (0.000)	-0.088*** (0.000)	0.088*** (0.000)	0.003 (0.180)
NIM	0.231*** (0.000)	0.095*** (0.000)	0.908*** (0.000)	-0.541*** (0.000)	-0.426*** (0.000)	0.143 (0.195)	1.520*** (0.000)
DIV	0.032*** (0.115)	-0.012*** (0.000)	0.035** (0.030)	-0.026 (0.175)	0.084*** (0.000)	-0.160*** (0.000)	0.050*** (0.000)
CAR	0.0007 (0.731)	-0.001 (0.710)	-0.337*** (0.000)	0.376*** (0.001)	-0.109*** (0.000)	0.176*** (0.000)	0.085*** (0.000)

Notes: ***, **, * indicate significance at 1%, 5%, and 10% levels respectively. P-values in parentheses.

The threshold test results reported in Table 8, show that the debt-to-total assets ratio (DTA) impact on non-performing loans in the two regimes remains the same for all banks across different economic environments. When the DTA is below the threshold level, the NPL exposure increases. In contrast, by surpassing the critical point, the DTA tends to reduce NPL exposure. Despite the similar impact of the DTA ratio on NPLs, the results show that the turning point varies significantly across banks and countries. These findings can be explained by the debt discipline theory, first introduced by Dewatripont and Tirole, 1994, suggesting that bank's managers in a bank that prioritize debt financing, are more cautious about the bank's assets' quality and creditworthiness assessments. As they allocate debts as an additional source of funds to finance the lending activity, they need to enhance their creditworthiness assessments to avoid the risk of default. In such cases, high-leverage banks, apply a credit enhancement strategy, where borrowers are backed through insurance, a third-party guarantee or additional collateral. Hence, credit enhancement would reduce future losses related to debt financing.

Moreover, the disciplinary debt effect may help banks amend their risk-taking behaviour by implementing market discipline. According to this theory, the banks become risk-averse to avoid losing market confidence. Nguyen, 2013 has used the Z-score as a proxy of credit risk to examine

the effect of debt discipline on bank risk-taking. He confirmed that debt helps banks mitigate risk, even during crises. Furthermore, the author suggested that banks promote debt financing to enhance the market discipline commitment. Besides, he has proved statistically that debt financing is influenced by several external interplays such as central banks' regulations, economic development and the financial system strength [see, La Porta et al., 1997]. These findings explain the disparity in DTA thresholds across banks, as demonstrated in our empirical results. In fact, we found that the DTA threshold value of CBs in developed countries is lower at 6.06% compared to 11.46% for those in developing countries. However, this difference is not significant when it comes to Islamic banks. The results show that the IBs in developing countries should maintain a higher DTA threshold at 12.79% compared to 11.63% for IBs in developed countries.

Banks in developed countries tend to hold higher DTA, due to the gap between deposits and excessive demand on financing (loans). To solve this issue, banks rely more on external funding (debt) to provide liquidity and maintain sustainable lending, so they rely more on debts. Meanwhile, developed countries tend to have large deposits since banks operate in more mature banking systems and developed financial systems. Consequently, they don't need to rely on debt to meet demand. Also, the debt allocation is proportional to deposits, as shown in the summary table. CBs in developed countries hold the highest LTD ratio compared to those in developing countries, so consequently they use less debt-financing since they finance a large proportion of their loans (being the largest bank's assets) through deposits. As proved by our threshold test. According to FED Vice President Michael S. Barr, a related proposal would be released for all large banks' long-term debt requirements as they could be easily converted to equity and thus used to absorb losses.

Overall, it is true that a high leverage ratio makes banks more vulnerable to risks, though, a low leverage may reduce the banks' profitability. In summary, banks need to implement a risk-adjusted leverage strategy to maintain a healthier balance between debt and asset quality. Islamic banks, use Sukuk issuance as a conventional bond substitute which is an alternative to conventional debt instruments. Sukuk offers competitive yields compared to conventional bonds for debtors and provides short-term liquidity for IBs. Furthermore, Sukuk's asset-based nature makes them less risky. Indeed, according to the Fitch Ratings, Sukuk has a low default rate of only 0.27% in 2021, which makes them a relatively secure funding source that could be used for financing activity and also, reduces the non-performing financing. Hence, the use of Sukuk allows Islamic banks to maintain a balanced DTA ratio while minimizing NPF exposure. Islamic financing is likely based on equity financing rather than debt financing. However, debt-based contracts, such as Murabaha (cost-plus financing) and Ijara (leasing), provide profit to Islamic banks without charging interest; besides, they are tied to tangible assets, which can help Islamic banks mitigate credit risk. In the worst case, if the customer defaulted, the bank's funds could be recovered by selling the collateral (assets).

4.2.6 The case of Bank capital

Table 9: Threshold variable: CAR

	Developed Countries				Developing Countries			
	Conventional Banks		Islamic Banks		Conventional Banks		Islamic Banks	
Threshold level (P-value)	15.19*** (0.000)		18.14*** (0.000)		14.34*** (0.000)		17.07*** (0.000)	
	Lower regime		Upper regime		Lower regime		Upper regime	
NPL (-1)	0.443*** (0.000)	0.008*** (0.000)	0.487*** (0.000)	0.205*** (0.002)	0.642*** (0.000)	-0.480*** (0.000)	0.127*** (0.001)	0.617*** (0.000)
CAR	0.108*** (0.000)	-0.127*** (0.000)	0.117* (0.057)	-0.822*** (0.005)	-0.652*** (0.000)	0.653*** (0.000)	-0.549*** (0.003)	0.446*** (0.017)
ROA	0.498*** (0.000)	-1.674*** (0.000)	0.305** (0.039)	-0.304*** (0.008)	-0.094*** (0.000)	0.063 (0.103)	-0.091 (0.156)	0.328*** (0.008)
ROE	-0.122*** (0.000)	0.248*** (0.000)	-0.017** (0.039)	-0.130 (0.282)	-0.010*** (0.000)	-0.064*** (0.000)	-0.007*** (0.000)	-0.047 (0.147)
LTD	0.039*** (0.000)	-0.068*** (0.000)	-0.006*** (0.007)	0.011** (0.044)	-0.057*** (0.000)	0.060*** (0.000)	-0.068*** (0.000)	0.037 (0.000)
DTA	-0.059*** (0.603)	0.179*** (0.000)	0.035*** (0.001)	-0.109*** (0.008)	-0.008 (0.529)	-0.025* (0.066)	0.116*** (0.000)	-0.033 (0.238)
NIM	-0.455*** (0.000)	0.915*** (0.000)	1.077*** (0.000)	0.993*** (0.000)	0.407*** (0.000)	-0.666*** (0.000)	0.309* (0.057)	1.766*** (0.000)
DIV	0.037*** (0.000)	-0.040*** (0.000)	0.033*** (0.000)	0.025** (0.019)	0.322*** (0.000)	-0.342*** (0.000)	0.007 (0.274)	0.044 (0.000)

Notes: ***, **, * indicate significance at 1%, 5%, and 10% levels respectively. P-values in parentheses.

According to table 9, the capital adequacy ratio (CAR) response highlights the impact of the macroeconomics interplays in banking dynamics, risk mitigation nexus. Our findings reveal that in developed countries, both conventional and Islamic banks must maintain high capital buffers to effectively reduce NPL levels. The CAR benchmarks are approximately 15.19% for conventional banks which confirms the EBA prediction and about 18.14% for Islamic banks. In developing countries, the CAR thresholds are closely aligned, while CBs have to maintain a maximum CAR of around 14.34% and IBs adhering to a benchmark of approximately 17.07%., It is important to note that being subject to a specific CAR benchmark does not require banks in these economies to maintain a low CAR. In fact, their CAR thresholds are typically higher than the Basel minimum capital requirements, enabling them to operate with a comparatively high CAR. However, to effectively manage credit risk, they must ensure that their CAR remains below thresholds. Developing countries prioritize economic growth and financial inclusion, pushing banks to expand credit and actively support productive sectors. In fact, high CAR indicates that a portion of the bank's funds remains "idle" (not being used for lending) as highlighted by Alnajjar and Othman (2021). Hence, banks could allocate more funds to lending and economic activities, which stimulates growth and potentially reduces NPLs levels. Easier access to credit stimulates business activity, job creation, and income generation, which in turn improves borrowers' ability to repay loans. However, this approach implies a trade-off between risk-taking and financial stability, as lower CARs may make banks more vulnerable to financial shocks. A working paper by Demirgüç-Kunt and Detragiache, 2011 supports this by arguing that excessively high CAR in developing countries can constrain lending and hinder economic growth, particularly in economies where credit access is critical for

development. Similarly, Ghosh, 2015 found that in developing economies, a moderate CAR is more effective in balancing financial stability and credit growth, as overly stringent capital requirements can stifle economic activity, leading to higher NPLs due to reduced economic output. In such environments, banks do not necessarily need to hold excessive reserves (high CAR) they can use instead diversification instruments to generate additional buffers. For instance, our results show that conventional and Islamic banks in developing countries often diversify their investments to mitigate risks and reduce NPL's level. This diversification strategy helps banks manage risks without relying heavily on high capital reserves. Abedifar et al., 2016 highlight that diversification can reduce bank earnings volatility and improve stability, even with low capital buffers. Additionally, the bank-based financial systems prevalent in developing countries along with relationship banking, play a crucial role in mitigating NPL risks. Relationship banking fosters closer ties between banks and borrowers, enabling better monitoring of credit risk and reducing the likelihood of loan defaults. An IMF working paper by Chen and Wu, 2014 and a research paper by Boot, 2000 emphasize that relationship banking, which is common in such systems, limits information asymmetry and improves loan monitoring, thereby reducing NPLs. Petersen and Rajan, 1994 further opined that close borrower-lender relationships enhance the banks' credit assessment practices and provide more flexible financing terms, which can reduce default loan rates. This is reflected in the relatively low Return on Equity (ROE) observed in these countries, indicating that conventional banks focus on maintaining stable loan portfolios rather than pursuing aggressive lending practices. This aligns with the idea that banks in these countries due to the economic volatility, they often prioritize risk management over aggressive lending. Developed economies prioritize long-term financial stability over short-term economic growth, which is relevant in their financial regulatory policies, especially given the highly interconnected nature of developed economies where the failure of one institution can trigger a domino effect. These policies emphasize maintaining high capital buffers given the high-risk exposure. Banks in developed countries often engage in complex financial instruments, such as derivatives and structured products, which are usually associated with high-risk levels. Further, their operations are more globalized, exposing them to cross-border risks and volatile international markets. Further, this is consistent with the earlier idea that a high CAR mitigates the negative effects of diversification on the capital buffer. The 2008 Global Financial Crisis (GFC) highlighted the critical vulnerabilities of undercapitalized banks in such environments. During the crisis, well-capitalized and highly liquid banks maintained solvency and continued lending even during the economic downturn [Gauvin et al., 2014, Altunbas et al., 2012, Gambacorta et al., 2012, Cornett et al., 2011]. In response, regulators introduced stricter capital requirements. For instance, U.S. banks have increased their average Capital Adequacy Ratio (CAR) from 12.88% post-GFC to 16.27% by 2016. In relation, our results reveal that banks in developing countries have limited capacity to diversify their investments and reduce exposure to non-performing loans (NPLs). On average, conventional banks can allocate only 11% of their investments to non-interest operations, while Islamic banks can allocate up to 20%. Which limits their ability to build adequate reserves against potential losses, pushing them to maintain higher CAR.

Furthermore, the CAR threshold highlights a key distinction between conventional and Islamic business models. For banks in developing and developed countries, the CAR threshold ranges from 14.34% to 15.19%, aligning with the Supervisory Review and Evaluation Process (SREP) 2023 released by the European Banking Authority (EBA). These findings align with the existing literature advocating for higher minimum capital requirements following the release of the initial

Basel III[21] and the updated (revised) Basel III version[22]. As demonstrated by Miles et al., 2013, the optimal CAR should approximate double the minimum BCBS thresholds. These findings were further confirmed by, **?**, as a part of an IMF staff discussion note, that banks should maintain "loss-absorbing capital buffers" within the 15% to 23% [see,Begenau and Landvoigt, 2022, Firestone et al., 2017].

Following the GFC, a US bank data survey on CAR trends has shown that the minimum capital level has climbed directly from 12.88% to 14.78, then raised again to 16.27 in 2016. Given the CAR trends since the Global Financial Crisis, and the recent banking turmoil in March 2023 following the failures of Silicon Valley Bank (SVB), Signature Bank and, subsequently, the First Republic Bank. US regulators issued the Basel III "Endgame" Proposal[23] in July 2023, mainly addressed to the largest US banks with over $100 *billion* in total assets starting transition by July 1st, 2025, with full compliance by July 1st, 2028, both in the United States and globally. The proposal intends to increase the CAR to better align with underlying risks and enhance risk measurements. Within this reform, the regulators would implement "the expanded risk-based approach (ERB)" to improve the current standardized credit risk-weighted assets (under the standard approach "SA") to cover almost all exposure types. Further,Den Heuvel, 2022 confirms that despite the high cost of capital requirements, banks need to hold a relatively high CAR to mitigate credit risk

Also, it has been challenging for Islamic banks to implement a suitable risk-weighting assets measurement while operating with distinct business models, leading to different risk profiles, which induces regulators to assign higher RWA to certain Islamic financing operations. One of the reasons is the PLS mechanism which exposes IBs to both profit and loss and requires a heavy capital cushion to mitigate potential losses. In addition, IBs use asset-backed models, which tie financing to tangible assets. Due to the market volatility, the collateral or the assets' worth may decrease. In case of borrower default, the bank might be in the face of a great loss that not only affects the asset value but would be extended to the IBs' liabilities, which puts the IBs in a critical position. To better align the asset risk weighting requirements, IBs need to allocate a higher capital reserve. Further, IBs allocate additional funds, such as the profit equalization reserves (PER) and the investment risk reserves (IRR) to enhance the returns on investment accounts and help mitigate risk on assets financed by those accounts. Also, the absence of interest income makes it challenging for IBs to manage liquidity and improve profitability, and it could be tightened in case of losses. To address these challenges, IBs need to hold a higher capital ratio, which has been illustrated by our results. We found that Islamic banks are required to hold higher CAR up to 18,12% to 17.07% for banks in developed and developing countries, respectively. These results confirm that IBs are often highly capitalized compared to their counterparts. This difference between conventional and Islamic banks is in line with the existing literature that Islamic banks hold higher capital [Mollah et al., 2017]. Stubing, 2011 has confirmed that the GC countries have strong capital adequacy ratios, with an average within 15%-20%, as in the UAE.

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[21]A global regulatory framework for more resilient banks and banking systems (revised version June 2011)

[22]Finalizing post-crisis reforms (December 2017)

[23]Board of Governors of the Federal Reserve System, Federal Deposit Insurance Corporation (FDIC), and Office of the Comptroller of the Currency (OCC), news release, July 27, 2023; OCC, Board of Governors of the Federal Reserve System, and FDIC, 88 Fed. Reg. 64,028–64,343 (September 18, 2023).

4.2.7 The Case of Diversification

Table 10: Threshold variable: DIV

	Developed Countries				Developing Countries			
	Conventional Banks		Islamic Banks		Conventional Banks		Islamic Banks	
Threshold level (P-value)	11.09*** (0.000)		20.26*** (0.000)		25.08*** (0.000)		17.41*** (0.000)	
	Lower regime		Upper regime		Lower regime		Upper regime	
NPL (-1)	**0.758***** **(0.000)**	**-0.261***** **(0.000)**	**0.439***** **(0.000)**	**0.513***** **(0.000)**	**0.326***** **(0.000)**	**-0.246***** **(0.000)**	**0.427***** **(0.000)**	**0.402***** **(0.000)**
DIV	-0.048*** (0.000)	0.081*** (0.000)	-0.329*** (0.000)	0.350*** (0.000)	0.094*** (0.000)	-0.075*** (0.000)	0.014*** (0.000)	-0.053*** (0.000)
ROA	-1.146*** (0.000)	1.98*** (0.000)	0.110 (0.780)	-0.814** (0.020)	-0.323*** (0.000)	1.097*** (0.000)	-0.846*** (0.000)	0.916*** (0.000)
ROE	0.031*** (0.000)	-0.130*** (0.000)	0.052*** (0.008)	-0.062*** (0.000)	-0.016*** (0.000)	-0.129*** (0.000)	-0.020*** (0.000)	0.018*** (0.000)
LTD	0.008*** (0.000)	-0.012*** (0.000)	-0.003 (0.648)	0.007 (0.419)	0.004 (0.126)	-0.062*** (0.000)	0.017*** (0.001)	-0.157*** (0.000)
DTA	-0.022*** (0.000)	0.044*** (0.000)	0.010 (0.860)	0.012 (0.842)	0.007 (0.337)	0.022 (0.174)	-0.192*** (0.000)	0.384*** (0.000)
NIM	-0.388*** (0.000)	0.809*** (0.000)	1.715*** (0.000)	-1.202*** (0.000)	0.338*** (0.000)	0.731*** (0.000)	-0.046 (0.795)	1.025*** (0.000)
CAR	-0.005** (0.019)	0.030*** (0.000)	-0.346*** (0.000)	0.369*** (0.000)	0.011** (0.050)	-0.431*** (0.000)	0.148*** (0.000)	-0.076** (0.047)

Notes: ***, **, * indicate significance at 1%, 5%, and 10% levels respectively. P-values in parentheses.

Our results reported in Table 10, have revealed a remarkable presence of the economic context in modelling the relationship between the DIV ratio and NPLs levels. In developed countries the response of the DIV ratio to the NPLs exposure is consistent across both conventional and Islamic banks. Our findings have shown that in such environments high DIV ratio increases the NPLs exposure. While in developing countries all banks whether conventional or Islamic, need to highly diversify their investment portfolio, to mitigate credit risk.

Gafrej and Boujelbene, 2021 support our findings. Analyzing the "diversification-risk-performance" across different banks in GC countries, they have proved similarity in diversification behavior and investment concentration between Islamic and conventional banks. In line with, a study by Abuzayed et al., 2018, within the GCC banking system provides evidence of a non-linear relationship between non-interest (non-financing) income and banks' stability indicating that banks in such economies are able to reduce risk at higher levels of diversification. According to the portfolio theory [Markowitz, 1959, Chen, 2016], banks have to diversify their credit portfolio to maintain a lower NPL level as mentioned in the portfolio theory.

Further, a study by Wang, 2017 on conventional banks in China shows that while high non-interest income reduces the bank's capital buffer, it may also weaken the counter-cyclicity of the CAR, making banks in these regions more vulnerable to shocks and less responsive to economic cycles, increasing long-term systemic risks. This has been confirmed by our findings, that banks in developed countries must prioritize high CAR levels to effectively mitigate credit risk rather than relying excessively on diversification as a risk-management strategy.

Meanwhile, banks in developed countries face challenges in balancing diversification to mitigate

credit risk while maintaining financial stability. According to Stiroh, 2004, this is attributed to the volatility and cyclicality of the non-interest income (NONII) compared to traditional interest income. Over-diversification into NONII would increase overall bank risk and threaten revenue stability, making it crucial for banks to avoid over-use of such activities. Consistent with the literature, our results have shown that moderate diversification within a benchmark is crucial to strike such a balance. Over-reliance on NONII, as highlighted by [Wang, 2017], can reduce the capital buffer and also weaken the counter-cyclicity of the CAR, making banks in these regions more vulnerable to shocks and less responsive to economic cycles, increasing long-term systemic risks. This has been confirmed by our findings, that banks in developed countries must prioritize high CAR levels to effectively mitigate credit risk rather than relying excessively on diversification as a risk-management strategy.

As [Stiroh and Rumble, 2006] pointed out, the rising correlation between non-interest income and interest income in the U.S. banking industry makes the diversification benefits less pronounced. While the theory suggests that NONII could improve the risk-return tradeoff, their empirical results show that this potential benefit has not been fully realized in such a banking system. They also note that greater reliance on NONII, mainly trading revenue, is associated with higher risk and lower risk-adjusted profits.

As well, Islamic banks are restricted to a DIV threshold of 20.26% to maintain a relatively low NPL level. Otherwise, a DIV ratio above this benchmark could trigger the NPL exposure. While in developing countries, a high DIV ratio (above 17.41%) tends to reduce NPL exposure within the Islamic banking sector. Several studies have examined the DIV and risk mitigation nexus. [Prastiwi and Anik, 2020] found out that a high DIV ratio reduces the credit risk within Indonesian Islamic banks. Further, a global data study by [Karkowska, 2019] illustrates the consistency of this trend. Also, [Nguyen, 2019, Li and Zhang, 2013] have confirmed the negative correlation between credit risk (NPLs) and liquidity risk (LTA). Further, diversification is crucial for IBs due to their reliance on profit-and-loss sharing (PLS) contracts. [Beck et al., 2013] found that Islamic banks with diversified portfolios tend to have lower NPLs and higher stability.

Meanwhile, Islamic banks in developed countries suffer from intensive competition with their counterparties, with a lack of suitable Shariah-compliant investments due to limited options where conventional interest-based instruments dominate. [Mkadmi, 2020] opined that IBs don't offer sufficient returns, which makes their clients withdraw their funds in favour of conventional banks. Moreover, the absence or the immaturity of the Islamic Interbank Money Market limits their investment options even more. While a study by [Saiti et al., 2016] opined that the IIMM is highly developed in developing countries, with the leading of Malaysia compared to developing ones. The availability of several IIMM instruments that provide a temporary cash surplus or short-term investments could help Islamic banks cover their risk exposure, plus they have easy access to many ethical investment opportunities [Krueger, 2019]. Although the demography aspect of developing countries with significant Muslim populations has a growing demand for shariah-compliant services. Generally, emerging markets show more enthusiasm for Islamic financial products due to cultural and religious aspects [Ahmad and Ahmad, 2004]. Meanwhile, developed countries have started promoting Islamic finance as part of their financial services industry [24]. Recently, along with the integration of Fintech into Islamic finance, experts expect the efficiency of IBs' to improve. On October 5th, 2018, Reuters indicated that "Fintech would help Islamic financial system to attract more customers, increase efficiency, reduce costs and offer a wider range of products, helping the sector

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[24]The IMF working paper: ENSURING FINANCIAL STABILITY IN COUNTRIES WITH ISLAMIC BANKING, January 5, 2017.

become more competitive against conventional finance without compromising on profit margins".
[Baber, 2020]

Conclusion

This paper reveals significant insights into the nonlinear relationships between various financial ratios and non-performing loans (NPLs) in conventional and Islamic banks across developed and developing economies. The threshold analysis shows that the impact of ROA, ROE and NIM ratios on the NPL level is bank-based. While both face challenges mitigating NPL expansion, conventional banks prioritize capital flexibility and higher returns as a buffer against losses, while Islamic must balance dual objectives of offering competitive returns while adhering to Shariah-compliant and risk-sharing principles. The contrasting impact of ROA, ROE, and NIM on the NPL level within conventional and Islamic banks outlines the fundamental differences between the traditional and Islamic financing models

Conversely, the threshold impact of the DIV and CAR ratios seems to be economic-based emphasizing the impact of the macroeconomics interplays in the bank's dynamics, and risk mitigation nexus. Meanwhile, in developed countries, excessive diversification increases NPLs due to the non-interest income volatility, aligning with the revenue instability hypothesis, banks within developing economies benefit from higher diversification, in mitigating credit risk through Shariah-compliant investment opportunities. Capital adequacy requirements vary substantially across economic contexts; developed markets mandate higher reserves to address complex risks (derivatives, global exposures...) while developing economies maintain more moderate CAR levels to offset growth-oriented lending with banking stability. The research outlines fundamental structural differences between banking business models. Islamic banks require higher capital reserves due to asset-backed financing restrictions and profit-and-loss sharing mechanisms, whereas conventional banks rely on interest-based operations. In contrast, both banking systems show similar trends for the loan-to-deposit ratio (LTD), debt-to-total assets (DTA) and NPL relationship. The consistent impact across banks within different macroeconomic conditions highlights the importance of maintaining a liquidity buffer. Exceeding these threshold strains liquidity, increasing default risk, which supports the bad management and loss control hypotheses plus the debt-discipline theory as banks that are more debt financing adopt a stricter credit policy.

Our results show that the risk management issue within the traditional and Islamic banking systems requires system-specific business models given the macroeconomic context. A dual structure, adjusting Shariah compliance for Islamic banks and stricter oversight of interest-based risks for their counterparts. Tailored regulations are crucial to ensure financial system resilience and sustainable credit risk management across all economic contexts.
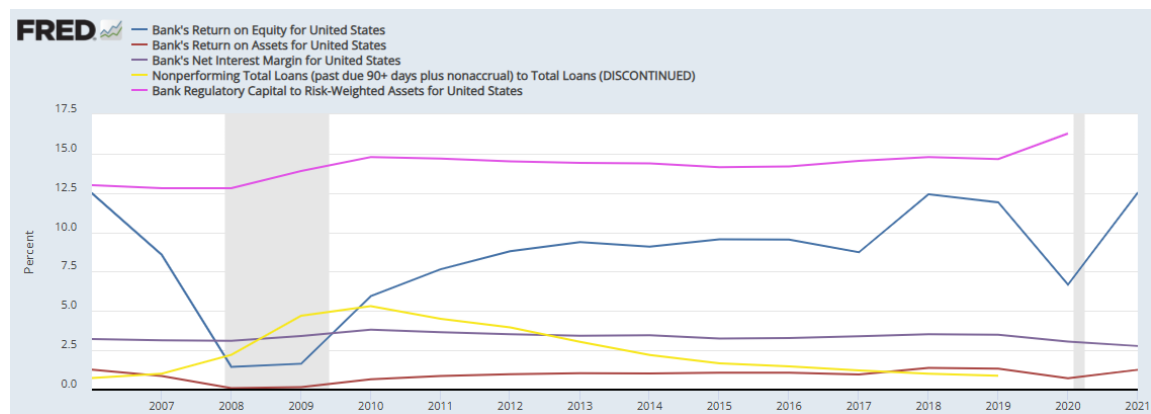
Appendix

Figure 1: Evolution overall capital requirements and Pillar 2 guidance (P2G)—the total capital stack to RWA)
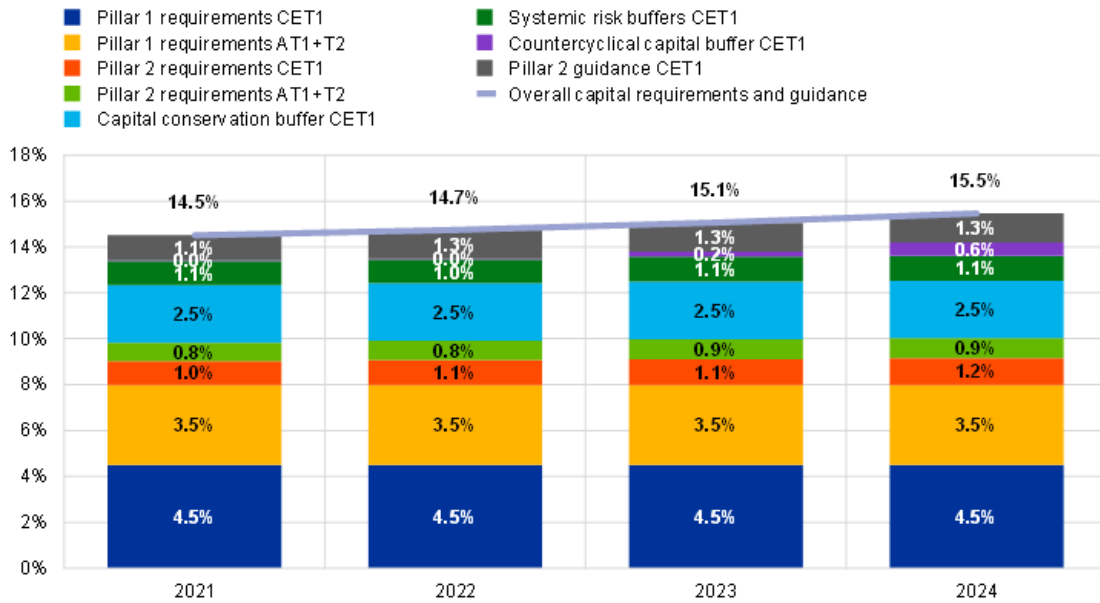
Source: Aggregated results of SREP 2023.

Figure 2: NPLs cycle in the USA banking during the pre-crisis and post-crisis periods along with movements of some of the key financial metrics.

Source: Federal Reserve Economic Data.

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