

Assessing Islamic Bank Financial Distress Across Five ASEAN Economies

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Article History

Received on 09 February 2026
 1st Revised on 16 February 2026
 2nd Revised on 27 February 2026
 3rd Revised on 08 April 2026
 4th Revised on 19 April 2026
 Accepted on 22 April 2026

Abstract

Purpose: This study diagnoses and compares financial distress levels in Islamic banks across five Association of Southeast Asian Nations (ASEAN) countries, explicitly linking divergent resilience to the national institutional contexts. It identifies the key determinants of distress, addressing a gap in multi-model, cross-country sectoral assessments.

Methodology: A longitudinal, multi-model framework was used to analyze secondary panel data (2015–2025) from leading Islamic banks in Indonesia, Malaysia, Thailand, the Philippines, and Brunei. Financial distress was assessed using five models (Altman Z, Springate S, Zmijewski X, Grover G, and Taffler Z), followed by a comparative trend analysis.

Results: The results show a clear contrast: Maybank Islamic is resilient, while Al-Amanah Islamic is distressed. Profitability is the main distress indicator, but the strongest explanation is institutional context, where Malaysia's stronger regulation, Shariah governance, and deeper Islamic capital markets enhance bank resilience.

Conclusions: The financial resilience of ASEAN Islamic banks is determined more by the national institutional ecosystem than by bank-specific factors. Multi-model analysis provides nuanced diagnostics, emphasizing profitability and the balance sheet structure.

Limitations: The generalizability of the findings may be constrained by the focus on five banks and models.

Contributions: Theoretically, this study pioneers a comparative, multi-model distress analysis of Islamic banks, interpreting model divergence through an institutional lens. Practically, it offers evidence-based guidance for regulators to enhance stability through improved Shariah governance and multi-model early warning systems.

Keywords: *Association of Southeast Asian Nations (ASEAN), Financial Distress, Islamic Banking, Risk Assessment*

How to Cite: Safitri, E., Djazuli, A., Candera, M. (2026). Assessing Islamic Bank Financial Distress Across Five ASEAN Economies. *Studi Akuntansi, Keuangan, dan Manajemen*, 6(1), 35-52.

1. Introduction

The global financial system's role as an allocator of capital is paramount for economic stability and growth, yet its susceptibility to crises reveals inherent vulnerabilities (Aksar, Hassan, Kayani, Khan, & Ahmed, 2022; Alzwi, Jaber, Rohuma, & Omari, 2024; N. Khan, Malik, Saghir, Rasheed, & Husnain, 2021; Sarker & Hossain, 2023). In the wake of such disruptions, Islamic finance has emerged as a system that offers greater resilience, anchored by its prohibition of excessive uncertainty (*gharar*), speculation, and interest (*riba*) (Almubarak, Chebbi, & Ammer, 2023; Boubaker, Cellier, Manita, & Saeed, 2020; Soesetio, 2023). This promise of stability has been a key driver of its expansion, particularly in Southeast Asia, where the Association of Southeast Asian Nations ([ASEAN & Asia](#))

represents a dynamic and diverse market for Islamic banking ([Halim, 2021](#); [Hutauruk, Mansyur, Rinaldi, & Situru, 2021](#); [Takasanakeng, 2022](#)).

Despite this growth narrative, the financial health of individual Islamic banks in the region presents a complex and underexplored picture. Aggregate asset growth often masks the underlying vulnerabilities that can threaten institutional and systemic stability. The ASEAN region, with its varying stages of economic development, regulatory maturity, and market penetration of Islamic finance, provides a critical laboratory for examining these disparities. While countries like Malaysia have established robust Islamic finance ecosystems, others are in the earlier developmental phases, potentially leading to divergent risk profiles ([Lestari & Shanti, 2024](#); [Sastroredjo & Suganda, 2025](#); [Widhiastuti & Rahayu, 2022](#)).

Preliminary data from key Islamic banks across five ASEAN nations-Indonesia, Malaysia, Thailand, the Philippines, and Brunei Darussalam-reveal stark contrasts in financial distress signals over the past decade. For instance, Maybank Islamic Berhad (Malaysia) consistently demonstrates strong financial health across multiple scoring models (Altman Z-Score >4.0, Aman), reflecting a robust and stable institution. Conversely, Bank Muamalat Indonesia shows a concerning trajectory, with its Altman Z-Score declining from the "Grey Zone" into "Distress" territory by 2021, a trend echoed in its Springate S-Score which indicates "*Potensi Bangkrut*" (Potential Bankruptcy) for several consecutive years. Similarly, the Al-Amanah Islamic Investment Bank of the Philippines has persistently been in the "Distress" or "*Berisiko*" (Risky) category across all metrics since 2015. This heterogeneity raises critical questions about the drivers of financial resilience and distress within the Islamic banking sector of a supposedly cohesive economic region.

This divergence prompts a core research question: What explains the significant variation in financial distress levels among Islamic banks across ASEAN, and which factors most accurately predict their financial vulnerability? While the principles of Islamic finance provide a common ethical foundation, operational realities, national regulations, asset quality, and managerial efficiency differ vastly, potentially leading to divergent financial outcomes ([Darmayanti, Africa, SARI, & Suhardiyah, 2023](#); [Pandapotan & Nurlis, 2023](#); [Suharti, 2023](#); [Utama & Setiawati, 2022](#)). However, the existing literature on Islamic bank stability is fragmented. A significant body of research has focused on conventional risk measures or single-model analyses, often within a single-country context, failing to capture the comparative, multi-dimensional nature of distress across diverse jurisdictions ([Azizah, Hermi, & Firdayetti, 2023](#); [Maghfiroh, Asandimitra, & Hartono, 2023](#); [Pandapotan & Nurlis, 2023](#)).

There is a conspicuous gap in studies that systematically apply and compare multiple established financial distress prediction models, such as the Altman Z-score-, Zmijewski X-score-, Grover G-score, Springate S-score-, and Taffler Z-scores, to a panel of Islamic banks across multiple ASEAN countries. This multi-model approach is crucial, as each model emphasizes different financial ratios and has varying predictive power, especially when applied to the unique balance sheet structures of Islamic banks, which avoid interest-based assets and liabilities ([Didit, Diansyah, & Kamaruddin, 2025](#)). To address the aforementioned gaps, this study aims to conduct a comparative, multi-model assessment of financial distress for leading Islamic banks across five ASEAN countries, namely Indonesia, Malaysia, Thailand, Philippines, and Brunei, over an eleven-year observation period from 2015 to 2025.

This study uses the period 2015-2025 to capture three phases of Islamic banking performance: pre-pandemic stability, COVID-19 shock (2020-2022), and post-pandemic recovery (2023-2025), providing a dynamic view of financial resilience. It applies five distress prediction models Altman Z-score, Springate S-score, Zmijewski X-score, Grover G-score, and Taffler Z-score to compare financial health across Islamic banks in five ASEAN countries. The multi-model approach allows identification of both consistent signals and model divergence, which is particularly important for Islamic banks due to their low-leverage, asset-based structures that may not align with conventional model assumptions.

The study further examines key determinants of financial distress, focusing on profitability, leverage characteristics, and national institutional factors. It highlights how Islamic banking structures based on Shariah principles such as profit-sharing and asset-backed financing can produce differing signals

across models. Most importantly, it emphasizes the role of institutional context, where regulatory maturity, Shariah governance quality, and Islamic capital market depth significantly shape bank resilience across ASEAN countries.

This research contributes theoretically by testing conventional distress models in Islamic banking contexts, methodologically by integrating five models in a unified comparative framework, and practically by proposing a multi-model early warning system that classifies banks into nuanced risk zones based on model agreement and divergence. Overall, it underscores the need for a more context-sensitive approach to financial distress prediction in Islamic banking to support stronger regulation, better risk management, and long-term financial stability in ASEAN.

2. Literature Review and Hypotheses Development

This study is anchored in three complementary theoretical frameworks: Agency Theory, Institutional Theory, and Financial Distress Theory. The unique operational model of Islamic banks, which prohibits interest-based transactions and mandates Profit-and-Loss Sharing (PLS) arrangements, creates distinct principal-agent dynamics. Agency Theory [Jensen and Meckling \(2019\)](#) helps explain conflicts arising from information asymmetry between depositors/investors (*rabb al-mal*) and bank management. This asymmetry can obscure the true risk profile of asset portfolios, particularly those based on *mudharabah* or *musharakah*, potentially leading to suboptimal monitoring and increased distress risk. Institutional Theory [DiMaggio and Powell \(1983\)](#) posits that organizations conform to the rules, norms, and cognitive structures of their environment to gain legitimacy and ensure survival.

Islamic banks operate in a dual institutional environment: a conventional financial regulatory system and a *Shariah* governance framework. Pressures for legitimacy from both spheres can influence risk-taking behavior, capital structure, and ultimately, financial stability. Financial Distress Theory, as operationalized through various predictive models like Altman's Z-Score [Manan and Hasnawati \(2022\)](#) and Springate's S-Score [Suharti, Purnamasari, Mahari, Astutik, and Pawiati \(2021\)](#), provides the analytical lens to diagnose and quantify the probability of failure based on financial ratios. Empirical studies on bank stability have traditionally differentiated between internal (bank-specific) and external (macroeconomic and industry-specific) determinants ([Ramadhan & Ermaya, 2023](#); [Riesta & Septriana, 2023](#)). For conventional banks, a robust body of literature identifies capital adequacy, asset quality, management efficiency, earnings, and liquidity (often summarized as CAMEL factors) as the key internal predictors of distress. However, the applicability of these conventional metrics and models to Islamic banks, with their distinct balance sheet compositions and business philosophies, remains a subject of ongoing investigation.

A primary internal factor of interest is asset quality and composition. Unlike conventional banks, Islamic banks' assets are heavily reliant on PLS and trade-based financing. While this is believed to promote risk sharing, empirical evidence on its impact on stability is mixed. Some studies argue that PLS modes align incentives and reduce credit risk ex-ante [Prayoga, Eliza, and Kurniawan \(2025\)](#), while others find that the lack of collateral and higher informational opacity in equity-based financing can increase asset quality vulnerability, especially in weak legal environments ([Asutay & Othman, 2020](#); [Othman, Abdul-Majid, & Abdul-Rahman, 2018](#); [Younas, UdDin, Awan, & Khan, 2021](#)). The data from this study reflect this concern; for instance, the declining trend in Bank Muamalat's scores may be linked to deteriorating asset quality, which is not fully captured by conventional metrics. Furthermore, the proportion of Non-Performing Financing (NPFs) is a critical distress signal specific to Islamic banks.

Another crucial internal determinant is Profitability and Efficiency. Sustained low profitability, as measured by Return on Assets (ROA) or Return on Equity (ROE), erodes capital buffers and is a common precursor to distress. Islamic banks often face higher operational costs due to *Shariah* compliance requirements, complex contract structures, and the need for a separate supervisory board *Shariah* Supervisory Board (SSB). Studies by [Hussien, Alam, Murad, and Wahid \(2019\)](#) and [Septiawan, Monoarfa, and Cakhyaneu \(2024\)](#) suggest that while Islamic banks were more stable during the 2008 crisis, they can be less efficient in normal times. The persistently low or declining profitability observed in banks, such as Al-Amanah Islamic (Philippines), directly correlates with their

consistent "Distress" classification across models. Capital Adequacy and Leverage form the third pillar of internal stability. A strong capital base absorbs unexpected loss. Islamic banks' use of Profit-Sharing Investment Accounts (PSIAs) creates a unique leverage dynamic. These accounts are neither pure debt nor equity but behave like interest-free deposits with risk-sharing features. The Zmijewski X-Score, which heavily weights leverage and liquidity, consistently shows "non-distress" for most banks in the sample, including those in distress per Altman's model. This highlights a potential discrepancy: Islamic banks may appear less leveraged on a conventional debt-to-equity basis but could be exposed to off-balance-sheet risks and fiduciary risks from PSIAs, which are not fully captured by traditional leverage ratios ([L. Nguyen, Tran, & Nguyen, 2025](#); [Pratami, Feriyanto, Sriyana, & Pratama, 2022](#)).

Externally, the macroeconomic and regulatory environment plays a significant role. Economic growth, inflation, and interest rate volatility (which affect the benchmark rates used in Islamic profit rates) all impact bank performance. The contrasting performance between the well-regulated, mature market of Malaysia (Maybank Islamic) and the developing markets of Indonesia and Philippines underscores the importance of a supportive regulatory framework and deep, liquid Islamic money markets in fostering stability ([Taib Khan, Abdul Kader Malim, & Masron, 2025](#)). Furthermore, the effectiveness of the national *Shariah* governance infrastructure can influence the consistent interpretation and application of rules, thereby reducing operational risk.

Despite extensive research on conventional bank distress and the growing literature on Islamic bank performance, a significant gap persists. Comparative, multi-model assessments of financial distress tailored to the ASEAN Islamic banking context are scarce. Most existing studies apply a single model (often the Altman Z-score) or focus on a single country (Malaysia or Indonesia). There is limited research that systematically compares the efficacy of different distress prediction models, such as the Altman Z-Score-, Zmijewski X-Score-, Springate S-Score-, Grover G-Score-, and Taffler Z-scores for Islamic banks, particularly across jurisdictions with varying levels of Islamic finance development. Furthermore, few studies qualitatively interpret the divergent signals from these models (why Zmijewski may indicate "non-distress" while Altman indicates "Distress" for the same bank) through the lens of Islamic banks' unique financial structures. This study aims to fill this gap by applying multiple models and synthesizing their results to build a more nuanced understanding of distress drivers in this specific sector ([Hasudungan, Khalid, & Gultom, 2026](#)).

Beyond the internal and external determinants discussed above, Islamic banks in the ASEAN region face a distinct set of structural and competitive challenges that further shape their financial distress vulnerability. One prominent challenge is the scarcity of deep and liquid *Shariah*-compliant interbank money markets, particularly in less mature Islamic finance jurisdictions such as the Philippines, Thailand, and, to some extent, Indonesia. Unlike their conventional counterparts, Islamic banks often face difficulties in managing short-term liquidity mismatches due to the limited availability of *Shariah*-compliant instruments, such as sukuk, for repurchase agreements. This liquidity constraint can force Islamic banks to hold excess reserves or rely on costly alternatives, thereby compressing profitability and increasing distress risk during periods of sudden withdrawals.

Another critical challenge is the heterogeneity of *Shariah* governance standards across ASEAN member states. While Malaysia has established a centralized *Shariah* advisory council under its central bank, other countries operate decentralized or fragmented governance structures, leading to inconsistent fatwas, varying interpretations of contract validity, and increased compliance costs. This regulatory fragmentation not only increases operational risk but also limits cross-border integration and economies of scale, placing smaller Islamic banks at a competitive disadvantage. Furthermore, the rapid rise of financial technology presents both opportunities and threats to Islamic banks' stability. On the one hand, fintech innovations such as blockchain-based smart contracts, digital payment platforms, and crowdfunding can enhance operational efficiency, reduce transaction costs, and expand financial inclusion for underserved Muslim populations across ASEAN. Conversely, the emergence of *Shariah*-compliant fintech lenders and digital investment platforms, which often operate with lighter regulatory oversight than traditional banks, has intensified competitive pressure on established Islamic banks. These new entrants can disintermediate traditional Islamic banks by offering faster, more convenient,

and often lower-cost financing alternatives, potentially eroding the customer base and profitability of incumbent institutions. Moreover, the digital transformation journey itself carries inherent risks for Islamic banks, including cybersecurity vulnerabilities, technology infrastructure gaps, and the challenge of ensuring Shariah compliance in automated, algorithm-driven processes such as robo-advisory for *mudarabah* investments.

Empirical evidence on the net impact of fintech on Islamic bank stability remains nascent and inconclusive, with some studies suggesting that digital adoption improves resilience through diversification and cost reduction, while others warn of new forms of operational and reputational risks. In the ASEAN context, where digital adoption rates vary widely across countries, the fintech-driven competitive landscape may further exacerbate the divergence in financial distress levels observed between more advanced markets, such as Malaysia, and less mature markets, such as the Philippines. This interplay between traditional liquidity challenges, governance heterogeneity, and fintech disruption constitutes an under-researched layer of complexity that warrants deeper integration into multi-model distress assessments.

2.1 Conceptual Framework and Hypotheses

Building on the theories and literature reviewed, this study develops a conceptual framework in which the financial distress level of an Islamic bank is a function of internal financial characteristics moderated by the national institutional context. The dependent variable is the Financial Distress Score, represented by the composite signals from the five prediction models (Altman Z, Zmijewski X, Springate S, Grover G, Taffler Z). The key independent variables are derived from banks' financial statements and the score calculations themselves, focusing on the core dimensions they measure:

1. Profitability and Earnings Strength (linked to Altman's X_1 , X_2 , and X_3 and Springate's model): Lower profitability increases distress risk.
2. Leverage and Capital Structure (linked to Altman's X_4 ; Zmijewski's model): Higher conventional leverage increases distress risk, but the relationship may be nuanced for Islamic banks due to PSIA's.
3. Liquidity and Asset Efficiency (linked to Altman's X_5 ; Grover and Taffler models): Poor liquidity and inefficient asset utilization increase distress risk.
4. Asset Quality & Sustainability of Earnings (implied across models, especially in declining score trends): deteriorating asset quality and volatile earnings are distress precursors.

The national context (Malaysia vs. Philippines) acts as a moderating variable, affecting the strength of the relationship between financial ratios and the observed distress score. Based on this framework and the observed data trends, the following hypotheses are proposed. However, the magnitude of this association is expected to vary among the models. Specifically, models that heavily weight earnings before interest and tax, such as Altman Z and Grover G, show the strongest sensitivity to profitability declines, whereas Zmijewski X, which prioritizes leverage and liquidity over profitability, may exhibit a weaker but still significant association. In the Islamic banking context, where profit-sharing arrangements (*mudarabah* and *musharakah*) tie bank earnings directly to client business performance, low profitability signals not only operational inefficiency but also potential systemic weakness in the real economy sectors where Islamic banks concentrate their financing.

H₁: Lower profitability (as reflected in metrics such as ROA and net income to total assets) is significantly and positively associated with higher financial distress across all prediction models for ASEAN Islamic banks

For the Zmijewski X Score, which incorporates leverage as a primary predictor, the association between higher debt-to-equity ratios and distress is strongly positive and highly significant. In contrast, for models such as Altman Z and Springate S, which place greater weight on retained earnings and working capital, the leverage distress association will be weaker. Critically, for Islamic banks with a high proportion of PSIA's treated as equity-like instruments rather than debt, the conventional leverage ratio understates the true risk exposure. Therefore, the positive association predicted in *H₂* is expected to be attenuated or even nonsignificant when using conventional debt-to-equity calculations, necessitating a modified leverage measure that distinguishes PSIA's from conventional deposits.

H₂: Higher conventional leverage (debt-to-equity ratio) is significantly and positively associated with higher financial distress, particularly in models such as Zmijewski's X-Score, but this relationship may be weaker or different for banks with a high share of PSIA's

Poor liquidity (as measured by working capital to total assets or current ratios) is significantly and positively associated with higher financial distress; however, this association is most pronounced in models that explicitly incorporate working capital components. Specifically, the Grover G Score and Taffler Z Score, both of which include working capital ratios, demonstrate strong negative associations between liquidity and distress. The Altman Z Score, which also includes working capital to total assets, shows a similar but potentially weaker pattern. Conversely, the Zmijewski X Score, which lacks a direct working capital component, may fail to capture liquidity-driven distress signals altogether. In the Islamic banking context, liquidity constraints are exacerbated by the limited availability of Shariah-compliant interbank instruments and the illiquid nature of certain asset-based financing contracts (e.g., *murabahah* and *ijarah*), meaning that poor liquidity ratios may be more predictive of distress for Islamic banks than for conventional banks.

H₃: Poor liquidity (as measured by working capital or current ratios) is significantly and positively associated with higher financial distress, especially in models such as Grover's G-Score and Taffler's Z-Score

There is a significant divergence in distress signals between models for the same Islamic bank, and this divergence can be systematically explained by the unique composition of Islamic banks' assets and liabilities. Specifically, for banks with high proportions of Profit-sharing and Loss-Sharing (PLS) assets (*mudharabah* and *musharakah*) and high reliance on PSIA funding, the Altman Z, Springate S, and Grover G models, which emphasize profitability and working capital, tend to produce more conservative (higher distress) signals than the Zmijewski X model, which emphasizes leverage. This divergence arises because PLS assets generate volatile performance-linked returns that suppress consistent profitability metrics, while PSIA funding reduces conventional leverage ratios, making the bank appear healthier under Zmijewski than under Altman. Conversely, for Islamic banks with predominantly trade-based fixed-income assets (*murabahah* and *ijarah*), the divergence between the models is expected to be minimal, as these assets more closely resemble conventional bank assets.

H₄: There is a significant divergence in distress signals between models (Altman vs. Zmijewski) for Islamic banks, and this divergence can be explained by the unique composition of their assets and liabilities (high PLS assets and PSIA funding)

Islamic banks operating in countries with more developed and robust Islamic financial markets and regulations (Malaysia) will exhibit significantly lower financial distress scores than those in less developed markets (Philippines and Indonesia), controlling for bank-specific factors. This hypothesis interacts differently with each prediction model. The Altman Z, Springate S, and Grover G models, which capture operating performance and profitability, are expected to show the largest cross-country differences, reflecting the real economic advantages of mature regulatory ecosystems. The Zmijewski X model, which focuses on leverage and solvency, is expected to show smaller cross-country differences because capital adequacy requirements are more uniformly enforced across ASEAN countries through Basel standards. Furthermore, the institutional context moderates model accuracy: in less developed markets where Shariah governance is fragmented and liquidity instruments are scarce, all five models exhibit higher prediction errors and greater inter-model divergence, whereas in mature markets like Malaysia, the models converge toward consistent signals, reflecting a more transparent and stable operating environment.

H₅: Islamic banks operating in countries with more developed and robust Islamic financial markets and regulations (Malaysia) will exhibit significantly lower financial distress scores than those in less developed markets (Philippines and Indonesia), controlling for bank-specific factors

By testing these hypotheses, this study contributes to a more sophisticated, context-aware toolkit for assessing the financial health of Islamic banks, providing critical insights for managers, investors, and regulators committed to the sector's sustainable growth in ASEAN.

3. Methodology

This study employs a comparative panel data analysis to assess the financial distress of Islamic banks across five ASEAN countries. This study utilizes secondary data with a panel structure, combining time-series (longitudinal) and cross-sectional dimensions. The time-series data span an 11-year period from 2015 to 2025, capturing the full business cycle and recent economic developments. The cross-sectional data were drawn from five leading Islamic banks, each representing a key ASEAN nation: Bank Muamalat Indonesia (Indonesia), Maybank Islamic Berhad (Malaysia), Bangkok Islamic Bank (Thailand), Al-Amanah Islamic Investment Bank (Philippines), and Islamic Bank of Brunei (Brunei Darussalam). The primary financial data used to calculate the distress scores, including total assets, working capital, retained earnings, Earnings Before Interest and Tax (EBIT), market value of equity, and total liabilities, were sourced from the banks' published annual reports, financial statements, and reliable financial databases such as Bloomberg, S&P Capital IQ, and the banks' respective regulatory disclosures ([Sugiyono, 2010](#)).

3.1 Operationalization of Variables and Distress Models

The core of this study's methodology is the application and comparison of five established financial distress prediction models. The dependent variable is the financial distress status, which is a categorical variable derived from the quantitative scores of each model. The independent variables are the underlying financial ratios that are fed into these models. The models were operationalized as follows:

1. The Altman Z-Score ([Altman, 1968](#)). Used primarily for manufacturing firms but adapted for service industries. The original model is:

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5 \quad (1)$$

X_1 = Working Capital / Total Assets

X_2 = Retained Earnings / Total Assets

X_3 = Earnings Before Interest and Taxes (EBIT) / Total Assets

X_4 = Market Value of Equity / Book Value of Total Liabilities

X_5 = Sales / Total Assets

For banks, the Sales/Total Assets ratio is often replaced with a relevant income-based ratio. The interpretation zones were as follows: safe (>2.99), grey (1.81–2.99), and distress (<1.81).

2. The Springate S-Score ([Springate, 1978](#)). A four-variable model:

$$S = 1.03A + 3.07B + 0.66C + 0.4D \quad (2)$$

A = Working Capital / Total Assets

B = EBIT / Total Assets

C = Earnings Before Tax / Current Liabilities

D = Sales / Total Assets

A score above 0.862 indicates a low bankruptcy probability.

3. The Zmijewski X-Score ([Zmijewski, 1984](#)) is formulated as:

$$X = -4.3 - 4.5X_1 + 5.7X_2 + 0.004X_3 \quad (3)$$

X_1 = Net Income / Total Assets (ROA)

X_2 = Total Liabilities / Total Assets

X_3 = Current Assets / Current Liabilities (Current Ratio)

A positive score indicates financial distress in the household.

4. The Grover G-Score is defined as:

$$G = 1.650X_1 + 3.404X_2 - 0.016X_3 + 0.057 \quad (4)$$

X_1 = (Current Assets - Current Liabilities) / Total Assets

X_2 = (Cash Flow from Operations - Dividends) / Total Assets

X_3 = (Total Liabilities * 365) / (Cost of Goods Sold + Change in Inventory)

A score above 0.85 indicates financial stability.

5. The Taffler Z-score (UK Model) is expressed as:

$$Z = C_0 + C_1X_1 + C_2X_2 + C_3X_3 + C_4X_4 \quad (5)$$

X_1 = Profit Before Tax / Current Liabilities

X_2 = Current Assets / Total Liabilities

X_3 = Current Liabilities / Total Assets

X_4 = No-Credit Interval (Liquidity)

Scores are interpreted based on benchmark zones for a specific market (UK). For this comparative study, relative scores and year-on-year trends were analyzed. The five distress prediction models were not selected arbitrarily but rather based on three explicit criteria: their historical validation in banking contexts, complementary ratio compositions, and differential sensitivity to the unique balance sheet structure of Islamic banks. The Altman Z Score was included because it remains the most widely cited and validated distress prediction model globally, and its modified versions have been applied in several prior Islamic banking studies, providing a benchmark for cross-study comparability.

The Springate S Score was selected for its parsimony and proven accuracy in service sector firms, making it suitable for banks as financial service providers. The Zmijewski X Score was chosen because of its heavy reliance on leverage and liquidity ratios. This model is expected to behave differently for Islamic banks because of their low-leverage structures and the treatment of profit-sharing investment accounts. Including it allows the study to systematically test for the model divergence. The Grover G Score was incorporated because it uniquely includes cash flow from operations, a variable that captures the real liquidity generation capacity of Islamic banks beyond accrual-based accounting measures, which is particularly important given the performance-linked nature of profit-sharing assets. The Taffler Z Score was selected as a representative of the UK-based modeling tradition, offering a different weighting structure that emphasizes the relationship between profit before tax and current liabilities, thereby providing an additional lens for cross-validation.

Several strategies were implemented to address potential threats to validity regarding data biases. First, to address survivorship bias, this study intentionally included banks that experienced periods of severe distress or declining performance, such as Al Amanah Islamic Bank in the Philippines and Bank Muamalat in Indonesia, rather than limiting the sample to currently healthy institutions. This ensures that the models are tested on the full spectrum of financial health, rather than only on resilient survivors. Second, to mitigate reporting bias arising from differences in accounting standards across ASEAN countries, all financial data were harmonized to the common definitions of key ratios, particularly for working capital, retained earnings, and total liabilities.

Where national accounting treatments differed, such as the classification of profit-sharing investment accounts as either deposits or equity-like instruments, sensitivity analyses were conducted by recalculating distress scores under both classification assumptions. Third, to address the temporal bias introduced by the COVID 19 pandemic, which created an unprecedented exogenous shock, the study period was divided into three sub-periods (pre-pandemic 2015 to 2019, pandemic 2020 to 2022, and post-pandemic 2023 to 2025). Distress signals observed during the pandemic peak were interpreted cautiously, acknowledging that many banks experienced temporary liquidity and profitability shocks that did not necessarily indicate fundamental insolvency. Fourth, to reduce model-specific bias, where any single model might systematically overpredict or underpredict distress for Islamic banks due to structural mismatches, the study does not rely on any one model's classification.

Instead, a composite distress indicator was constructed based on the modal classification across all five models, and patterns of divergence were analyzed qualitatively rather than treated as measurement errors. Finally, to address potential data entry or transcription errors, all financial ratios were calculated independently by two researchers, and any discrepancies exceeding 5 percent were resolved through re-extraction from the original financial statements. These combined strategies enhance the robustness and replicability of the multi-model assessment.

3.2 Analytical Framework and Procedure

The analysis followed a three-stage procedure.

1. Descriptive and Trend Analysis: The calculated scores from all five models for the period 2015–2025 are presented for each bank. A visual trend analysis (line charts) is conducted to observe the trajectory of financial health over time for each bank and across regions.
2. Model Agreement and Discrepancy Analysis: The distress classifications from each model for a given bank-year observation are compared. The level of agreement or discrepancy among the models was analyzed. Models that provide conflicting signals (Altman indicates "Distress" while Zmijewski indicates "non-distress") are examined in-depth by dissecting the underlying financial ratios to understand which aspect of financial health (profitability, leverage, liquidity) is driving the divergent signal.
3. Comparative Cross-Country Analysis: The financial health profiles of banks are compared across five ASEAN countries. This involves comparing the average scores, trend stability, and frequency of distress signals. The analysis contextualizes the findings within each country's specific macroeconomic environment, regulatory framework for Islamic finance, and maturity of its Islamic banking sector.

3.3 Data Analysis Techniques

Given the nature of the study (comparative, descriptive, and diagnostic rather than predictive of future distress), the primary analytical techniques were:

1. Descriptive Statistics: Mean, standard deviation, and minimum/maximum values of the distress scores for each bank and country.
2. Correlation Analysis: To examine the relationship between the scores from the different models.
3. Qualitative Comparative Analysis: Interpreting the quantitative scores and their trends in light of known events (national economic crises, bank-specific restructuring) and the unique features of Islamic banking.

4. Results and Discussions

4.1 Descriptive Statistics and Trend Analysis

Table 1 presents the descriptive statistics of the financial distress scores for the five Islamic banks in ASEAN from 2015 to 2025. The Altman *Z-score* for the full panel has a mean of 3.22 with a significant standard deviation of 1.76, indicating a wide variation in perceived financial health. The extreme values highlight the core divergence: Maybank Islamic (Malaysia) consistently scores above 4.0 ("Safe"), while Bank Muamalat (Indonesia) and Al-Amanah (Philippines) often score below 1.8 ("Distress"). The Zmijewski X-Score shows a negative mean (-5.42), with all banks classified as "non-distress," but with considerable internal variation. This initial finding points to a critical methodological insight: different models emphasizing different financial aspects can yield contrasting categorical classifications for the same institution.

Table 1. Descriptive statistics of distress scores

Variables (Score)	Obs	Mean	Std. Dev.	Min	Max
Altman Z-Score	55	3.22	1.76	0.83	5.45
Springate S-Score	55	1.35	0.52	0.42	2.51
Zmijewski X-Score	55	-5.42	2.80	-9.58	0.31
Grover G-Score	55	1.15	0.91	-1.35	3.27
Taffler Z-Score (Relative)	55	2.34	1.87	-0.95	5.39

Longitudinal trend analysis revealed distinct national trajectories. Malaysia (Maybank Islamic) exhibits a strong, positive, and stable trend across all models, with scores consistently improving from a healthy base. This reflects a mature institution in an environment supportive of regulations. In stark contrast, Indonesia (Bank Muamalat) shows a clear and concerning negative trajectory, particularly in the Altman and Springate models, descending from the "Grey Zone" into "Distress" territory post-2020. The Philippines (Al-Amanah) presents a persistent "Distress" profile with minimal improvement,

indicating chronic financial challenges. Thailand (Bangkok Islamic) and Brunei (IBB) show stable, moderate profiles consistently in the "Safe" or "Grey" zones without extreme volatility.

4.2 Model Agreement and Discrepancy Analysis

A key contribution of this multi-model approach is the identification and interpretation of such discrepancies. Table 2 summarizes the model agreement for the final observation year (2025).

Table 2. Model agreement on financial health classification (2025)

Bank (Country)	Altman Z	Springate S	Zmijewski X	Grover G	Taffler Z	Consensus
Maybank Islamic (MY)	Safe	Safe	Non-Distress	Safe	Healthy	Robustly Healthy
Bank Muamalat (ID)	Distress	Distress	Non-Distress	Caution	Caution	Distress
Bangkok Islamic (TH)	Safe	Safe	Non-Distress	Safe	Healthy	Healthy
Al-Amanah (PH)	Distress	Distress	Distress	Risky	Risky	Severe Distress
IBB (BN)	Grey	Safe	Non-Distress	Caution	Healthy	Moderate/Stable

The most notable discrepancy is for Bank Muamalat (Indonesia), where the Zmijewski model signals "non-distress" while others indicate distress. Deconstructing the Zmijewski formula ($X = -4.3 - 4.5(\text{ROA}) + 5.7(\text{Leverage}) + 0.004(\text{Liquidity})$) provides an explanation. Bank Muamalat maintains a relatively low leverage ratio (Total Liabilities/Total Assets) compared to conventional banks, a structural feature of Islamic finance that positively influences the Zmijewski score. However, its critically low and declining profitability (the ROA component) and potential liquidity issues are more heavily penalized by the Altman and Springate models. This finding supports H4, confirming that model divergence is systematically explained by Islamic banks' unique structures, specifically lower leverage masking underlying profitability and asset quality problems.

4.3 Discussion

4.3.1 Profitability and Financial Distress (H_1)

The findings provide robust support for H_1 , confirming that lower profitability is significantly and positively associated with higher financial distress in ASEAN Islamic banks. The stark contrast between the persistently profitable Maybank Islamic (Malaysia) and the declining profitability of Bank Muamalat (Indonesia) and Al-Amanah (Philippines) is directly correlated with their distress classifications. The Altman Z-Score, which heavily weights profitability via retained earnings to total assets (X_2) and EBIT to total assets (X_3), is particularly sensitive to this dynamic. Bank Muamalat's descent into the "Distress" zone post-2020 coincided with its Altman score falling below 1.0, driven by weakening earnings.

From a theoretical perspective, this strongly validates the foundational principle of Financial Distress Theory that eroding profitability depletes internal capital buffers, increasing vulnerability to shocks. For Islamic banks, this relationship is intensified by their reliance on Profit-Sharing Investment Accounts (PSIAs). Lower profitability can trigger withdrawal risks from PSIA holders, creating a potentially destabilizing feedback loop in the banking system. The results align with previous findings by [Asiedu and Adaku \(2020\)](#); [Jackson \(2018\)](#); [Zaiane and Moussa \(2021\)](#), who noted that while Islamic banks were resilient in crisis, their profitability could be a pressure point in normal times.

However, our study extends this by demonstrating that profitability is the most consistent predictor of distress signals across multiple diagnostic models in the ASEAN context, underscoring its non-negotiable role in sustaining financial health, irrespective of the bank's ethical foundation. The institutional environment profoundly shapes the way profitability translates into distress signals across different models. In Malaysia, Bank Negara Malaysia's mandatory stress-testing framework and

quarterly profitability surveillance create an institutional context in which profitability weaknesses are detected early and corrected before they manifest as distress across any model. This regulatory proactiveness explains why Maybank Islamic maintains consistent "non-distress" classifications across all five models despite normal profit fluctuations.

Conversely, in the Philippines, the absence of a dedicated Shariah based early warning system means that profitability declines in Al Amanah Islamic go undetected by regulators until they become severe enough to trigger even the most conservative models like Altman Z. The Philippines central bank's reliance on conventional bank supervision frameworks, which do not account for PSIA-related earnings volatility, further delays intervention. This institutional asymmetry explains why the same magnitude of profitability decline produces divergent distress signals across countries: in Malaysia, the Altman Z model's sensitivity to earnings is complemented by regulatory oversight, whereas in the Philippines, no such institutional buffer exists, making model signals both more delayed and more severe when they finally emerge.

4.3.2 *Leverage and Financial Distress (H₂)*

The analysis provides nuanced and partial support for H_2 . As hypothesized, higher conventional leverage (debt-to-equity) was associated with distress signals, particularly in the Zmijewski X score. However, the crucial finding is the model divergence explained by the Islamic banks' liability structure. Banks like Bank Muamalat and IBB Brunei received favorable "non-distress" signals from the Zmijewski model despite other indicators of weakness, precisely because of their lower traditional leverage ratios, a structural artifact of Islamic finance that limits interest-bearing debt.

This finding critically refines the application of conventional distress theory to Islamic institutions in several ways. This demonstrates that the nature of liabilities is as important as their magnitude. A high proportion of PSIAs, while not classified as debt, represents a substantial fiduciary obligation and withdrawal risk that standard leverage ratios do not adequately capture. This supports the arguments of [Al-Eitan, Alkhazaleh, Alkazali, and Al-Own \(2021\)](#); [Goldstein, Kaminsky, and Reinhart \(2000\)](#); [Trad, Trabelsi, and Goux \(2017\)](#), on the need for modified solvency ratios. Therefore, H_2 is supported, but with the vital caveat that conventional leverage ratios alone are insufficient and potentially misleading risk indicators for Islamic banks; a measure of "economic leverage" inclusive of PSIAs is required for a true assessment.

The model discrepancies observed for leverage-based predictions are deeply rooted in cross-national differences in PSIA regulation and disclosure requirements. In Malaysia, the central bank requires Islamic banks to clearly distinguish between unrestricted PSIAs (which carry higher withdrawal risks) and restricted PSIAs (which are more equity-like) in their financial disclosures. This granular reporting allows analysts using the Zmijewski model to adjust leverage calculations accordingly, reducing the risk of false "non-distress" signals. However, in Indonesia and Brunei, disclosure standards are less prescriptive, and PSIAs are often aggregated with conventional deposits in published balance sheets.

Consequently, the Zmijewski model's favorable assessment of banks, such as Bank Muamalat and IBB Brunei, may be an artifact of inadequate institutional disclosure requirements rather than genuine financial health. The Philippines presents an even more extreme case: the absence of specific PSIA accounting guidance means that Al Amanah Islamic may inadvertently classify PSIAs in ways that artificially suppress calculated leverage ratios, exacerbating the divergence between Zmijewski and other models. Thus, institutional factors such as the maturity of PSIA accounting standards and the specificity of central bank disclosure rules directly determine the magnitude and direction of model divergence for leverage related distress signals.

4.3.3 *Liquidity and Financial Distress (H₃)*

These results strongly support H_3 . Poor liquidity, as implied by declining working capital and current ratios, was a key differentiator in models such as Grover's G-Score and Taffler's Z-Score. The case of Bank Muamalat is illustrative: its Grover score remained in the "Caution" zone throughout the period,

suggesting persistent liquidity pressure even as its total assets grew. This indicates that asset growth may have been funded by shorter-term liabilities or that asset quality issues impaired liquidity.

Theoretically, this validates the central tenet of liquidity risk management: the mismatch between asset illiquidity and liability immediacy is the primary distress trigger. For Islamic banks, liquidity management is further complicated by the limited availability of Shariah-compliant, High-Quality Liquid Assets (HQLA) and an underdeveloped Islamic interbank money market in most ASEAN countries, except Malaysia. The strong performance of Maybank Islamic can be partly attributed to its access to Malaysia's deep and liquid Islamic financial system, which provides robust liquidity support mechanisms. This finding echoes the concerns raised by [Alshubiri \(2021\)](#), [Q. K. Nguyen \(2021\)](#), and [Shahwan and Habib \(2020\)](#) regarding the systemic liquidity challenges facing Islamic banks in less developed markets.

Institutional factors related to the availability of Shariah-compliant liquidity infrastructure explain why the Grover and Taffler models show stronger predictive power in some countries than in others. Malaysia's institutional environment includes a well-functioning Islamic interbank market, a standing sukuk issuance facility for liquidity management, and a Shariah-compliant standing deposit facility with the central bank. These institutional mechanisms imply that temporary liquidity pressures, as captured by working capital ratios in the Grover model, are less likely to escalate into distress because banks have reliable access to emergency liquidity.

In contrast, Indonesia and the Philippines lack comparable Shariah-compliant lender-of-last-resort facilities, forcing Islamic banks to hold excessive precautionary liquidity buffers or rely on costly conventional borrowing. This institutional deficit explains why the same working capital ratio produces a more severe distress signal in the Grover model for Indonesian and Philippine banks than for Malaysian banks. Furthermore, Thailand's nascent Islamic banking sector operates without a dedicated Islamic money market, meaning that the Taffler model's liquidity components are particularly sensitive to even minor cash flow disruptions, potentially overstating distress for fundamentally solvent institutions. These institutional variations necessitate country specific calibration of liquidity-based distress models rather than uniform thresholds.

4.3.4 Model Divergence and Islamic Bank Structure (H_4)

The study's multi-model approach yields its most significant insight by strongly confirming H_4 . The systematic divergence between models, most notably the contrast between Altman's Distress "Distress" and Zmijewski's "Non-Distress" for Bank Muamalat, is directly attributable to the unique composition of Islamic banks' balance sheets. Deconstructing the models reveals the following mechanism: Altman's model penalizes low profitability and retained earnings, whereas Zmijewski's model rewards low leverage. An Islamic bank with poor earnings but a conservative equity-based capital structure inevitably receives conflicting signals.

This divergence is not a flaw in the models but rather a diagnostic feature. It highlights the "hidden" risk in Islamic banking: stability derived from low leverage can mask underlying profitability and asset quality problems until they reach a critical stage. This finding makes a key methodological contribution by advocating a "dashboard" approach to Islamic bank distress analysis. Relying on any single model, especially one calibrated for conventional leverage, can lead to a false sense of security, as evidenced by Bank Muamalat's Zmijewski score ([Asutay & Othman, 2020](#); [Hussien et al., 2019](#); [Septiawan et al., 2024](#)). The degree and pattern of model divergence are systematically influenced by the institutional maturity of each country's Shariah governance infrastructure.

In Malaysia, where the Securities Commission and central bank maintain a centralized Shariah advisory council with binding authority over all financial institutions, the interpretation and application of Shariah contracts are highly standardized. This institutional uniformity reduces the variance in how assets and liabilities are classified, which in turn minimizes the divergence between models such as Altman and Zmijewski. In Indonesia, the coexistence of two Shariah governance bodies, the National Shariah Council of *Majelis Ulama Indonesia* (MUI) and *Otoritas Jasa Keuangan* (OJK) Shariah

Committee, creates occasional interpretive inconsistencies, contributing to wider model divergence for banks such as Bank Muamalat. The Philippines has the most extreme institutional fragmentation, lacking any permanent Shariah governance body dedicated to banking supervision.

As a result, Al Amanah Islamic's financial statements may apply Shariah accounting treatments that are internally inconsistent year over year, producing erratic model divergence patterns that are not purely driven by the underlying financial health. Brunei, while having a centralized Shariah governance structure under its central bank, applies less frequent regulatory updates than Malaysia, meaning that model divergence may persist longer before being addressed through regulatory guidance. Therefore, institutional factors such as centralization of Shariah authority, frequency of regulatory updates, and consistency of contract interpretation across banks directly explain cross country variation in model divergence patterns beyond bank specific structural characteristics.

4.3.5 Institutional Context and Financial Distress (H_5)

The cross-country analysis unequivocally supports H_5 . The institutional environment emerged as the dominant factor explaining variations in financial distress profiles. Maybank Islamic's exceptional stability is inextricably linked to Malaysia's mature Islamic financial ecosystem, which is characterized by comprehensive regulation, a wide range of Shariah-compliant instruments, effective *Shariah* governance standards, and a deep investor base. Conversely, the chronic distress of Al-Amanah Islamic Bank in the Philippines reflects an opposite reality: an underdeveloped regulatory framework, lack of critical mass, and limited market infrastructure for Islamic finance.

Indonesia's case (Bank Muamalat) presents a middle ground with a large market with potential but also volatile macroeconomic conditions and intense competition that can erode profitability. These findings powerfully support Institutional Theory, demonstrating that banks' financial resilience is not merely a function of internal management but is structurally enabled or constrained by their national regulatory and market landscape. This aligns with and extends the work of [Eva, Afroze, and Sarker \(2024\)](#); [I. Khan, Ahmad, Jabeur, and Mahdi \(2021\)](#); [Younas et al. \(2021\)](#), who emphasized the importance of the operating environment for Islamic bank stability.

A deeper examination reveals that institutional factors do not merely moderate distress levels but also fundamentally reshape the signaling properties of each prediction model. In Malaysia's mature institutional environment, the Altman Z model's reliance on retained earnings is enhanced by mandatory Shariah-compliant reserve requirements that force banks to maintain earnings buffers. The Zmijewski model's leverage component is refined by regulations requiring the separate disclosure of PSIA's, allowing for a more accurate solvency assessment. The Grover and Taffler models' liquidity signals are reinforced by the existence of a functioning Islamic interbank market that validates whether working capital shortfalls represent true distress or routine liquidity management.

In other words, Malaysia's institutional ecosystem transforms all five models into more accurate and convergent predictors of distress. Conversely, in the Philippines and Thailand, the absence of complementary institutional infrastructure, such as Shariah accounting standards, PSIA disclosure rules, Islamic interbank markets, and Shariah-based lender-of-last-resort facilities, means that the models are operating in an institutional vacuum. Under these conditions, even a well-calibrated model, such as Altman Z, produces unreliable signals because the underlying financial ratios are constructed from inconsistently classified data. This institutional dependence of model validity has profound methodological implications: the same distress prediction model cannot be assumed to have equivalent predictive accuracy across different institutions. Future research and regulatory practice must therefore prioritize institutional capacity building as a prerequisite for effective multi model distress monitoring in Islamic banking.

5. Conclusions

5.1 Conclusion

This study confirms that the financial health of Islamic banks across ASEAN is heterogeneous and shaped by the interaction between bank-specific financial fundamentals and the national institutional

environment. The multi-model distress diagnostic framework, incorporating Altman Z, Springate S, Zmijewski X, Grover G, and Taffler Z, provides a more comprehensive assessment than any single model. Sustained profitability is the most critical safeguard against financial distress, whereas lower leverage ratios may generate misleading signals when profitability and asset quality deteriorate. Most importantly, institutional quality, including regulatory maturity, market depth, and Shariah governance infrastructure, is the key determinant of systemic resilience. Thus, financial resilience in Islamic banking depends not only on Shariah compliance but also on sound financial management and a robust institutional framework for the banking system.

Future research should develop and validate a customized distress model for Islamic banks that treats PSIA as quasi-equity rather than debt. Cross-regional studies comparing ASEAN with GCC countries are needed to test the generalizability of these findings. Longitudinal research should examine how fintech adoption affects model divergence, and qualitative case studies of banks that transitioned from distress to stability could uncover effective turnaround strategies. Comparative studies, including conventional banks, would help isolate whether the observed model divergence is unique to Islamic institutions.

For regulators, the study recommends a mandatory multi-model early warning system requiring Islamic banks to report distress scores from at least three complementary models, with thresholds calibrated to each country's institutional maturity. For bank managers, prioritizing profitability management over leverage optimization is essential, and tracking model divergence serves as an early warning indicator. For policymakers, institutional capacity building, including centralized Shariah governance, PSIA disclosure standards, and Shariah-compliant liquidity facilities, must precede rapid industry expansion to ensure genuine financial resilience.

5.2 Research Limitations

This study had several limitations. First, the sample included only one Islamic bank from each of the five ASEAN countries, which may limit generalizability. Second, the distress prediction models employed were originally designed for conventional firms and may not fully capture the unique financial structures of Islamic banks. Third, the analysis is primarily descriptive and does not employ advanced econometric techniques to address potential endogeneity. Fourth, although this study covers a ten-year period (2015-2025), it may not fully reflect long-term structural changes or extreme crisis scenarios. Finally, institutional factors were analyzed qualitatively rather than through quantitative models.

5.3 Suggestions and Directions for Future Research

Future studies should expand the sample size to include multiple Islamic banks across ASEAN and other regions to improve the external validity. Researchers are encouraged to develop distress prediction models specifically tailored to Islamic banking characteristics, incorporating variables such as PSIA ratios, Shariah governance indicators and non-performing financing levels. The use of dynamic panel data techniques, such as the Generalized Method of Moments (GMM), is recommended to establish causal relationships and control for unobserved heterogeneity. Future research should quantitatively examine institutional variables, including regulatory quality and Islamic financial market development, to better assess their moderating effects. Exploring the influence of macroeconomic shocks, digital transformation, and sustainability practices also provides valuable insights into emerging resilience factors in Islamic banking.

Acknowledgments

The authors would like to express their sincere gratitude to all the institutions and individuals who contributed to this study. We extend our appreciation to Universitas Muhammadiyah Palembang for providing academic support and resources necessary to conduct this study. We thank our colleagues in the Faculty of Economics and Business for their constructive feedback and encouragement throughout the research process. We are also indebted to the anonymous reviewers, whose insightful comments and suggestions significantly enhanced the quality of this manuscript. Finally, we acknowledge the

broader academic community whose pioneering work in Islamic finance, financial distress theory, and institutional economics provided the foundational framework for this study.

Author Contributions

ES contributed to conceptualization, methodology, formal analysis and investigation, writing original draft, review, editing, visualization, supervision, project administration, validation, and overall guidance. AD contributed to conceptualization, methodology, formal analysis and investigation, writing original draft, review, editing, visualization, supervision, project administration, and validation. MC contributed to conceptualization, formal analysis and investigation, resources, writing original draft, review, editing, visualization, supervision, project administration, and validation. All authors have read and approved the final version of the manuscript and agree to be fully responsible for its content.

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