



Income diversification and earnings stability in Indonesian Islamic banks: a U-shaped association

JIAFR | 231

Septian Yudha Kusuma,^{1*} Arin Pranesti,² Nurseto Adhi,¹ Rizki Dini Shandra Yunita³

¹Politeknik Negeri Semarang, Semarang, Indonesia; ²Universitas Negeri Yogyakarta, Yogyakarta, Indonesia; ³National Yunlin University of Science and Technology, Yunlin, Taiwan

Received
12 April 2026
Revised
8 October 2026
Accepted
13 October 2026

Abstract

Purpose - This study examines the linear and non-linear relationships between income diversification and earnings stability in Islamic banks in Indonesia, and the direction of this relationship.

Method - This study uses quarterly panel data for 13 Islamic banks for the period Q4 2020 to Q3 2025 (260 observations); it applies fixed effects with Driscoll-Kraay standard errors (lag 4) to address heteroscedasticity and serial autocorrelation. Timing and direction are examined using non-overlapping lagged specifications, reverse regressions, and Dumitrescu-Hurlin panel Granger tests.

Result - No significant linear relationship is found. Instead, diversification and stability show a contemporaneous U-shaped association, with the lowest stability at a diversification level of 0.239. The pattern is robust to winsorization, alternative standard-error lag lengths, and the exclusion of the COVID-19 period, but does not hold when diversification precedes the stability window. Earlier stability is weakly and positively associated with subsequent diversification, indicating feedback from stability to diversification.

Implication - Diversification should not be treated as a standalone strategy for stabilizing earnings. Because most banks lie below the turning point and stability appears to shape diversification choices, diversification decisions should reflect each bank's risk-bearing capacity.

Originality - The study provides evidence of a non-linear, bidirectional relationship between income diversification and earnings stability in Indonesian Islamic banks, showing that the direction of the relationship matters for its interpretation.

Keywords: Earning stability; Income diversification; Islamic bank; U-shaped relationship

Copyright © 2024 Journal of Islamic Accounting and Finance Research



This is an open access article under the terms and conditions of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

How to cite (APA Style):

Kusuma, S.Y., Pranesti, A., Adhi, N. & Yunita, R.D.S. (2026). Income diversification and earnings stability in Indonesian Islamic banks: a U-shaped association. *Journal of Islamic Accounting and Finance Research*, 8(2), 231-254. <https://doi.org/10.21580/jiafr.2026.8.2.31800>

* Corresponding Author. Email: septian.yudhakusuma@polines.ac.id

Introduction

Islamic banks operate in accordance with Sharia principles, so their income and risk profiles differ from those of conventional banks. Despite their strategic importance, maintaining earnings stability remains a key challenge for Islamic banks due to their unique risk-sharing and asset-backed financing structures. In this case, earnings stability is important for financial resilience, especially given banks' key roles in fundraising, capital allocation, and risk management (Haddou & Boughrara, 2025). One strategic step is income diversification. Income diversification is often associated with the creation of positive liquidity, damping market volatility, and financial shocks, thereby increasing earnings stability (Duong et al., 2025).

Certain income structures have different levels of risk and stability (Grassa, 2012). Although income diversification is seen as a strategic move, empirical evidence remains mixed. Islamic banks' income diversification strategy has been associated with strengthened performance and stability (Duong et al., 2025; Hamid, 2020). However, recent studies suggest that this relationship depends on the level of diversification. Šeho et al. (2023) report both positive effects at higher levels of diversification and negative effects at lower levels. This indicates that stability increases with diversification only beyond a certain level.

The relationship between income diversification and earnings stability is not standalone. Large Islamic banks tend to benefit from diversification strategies (Chowdhury et al., 2024), particularly when market structures and policy rules form the optimal level and form of diversification (AlKhouri & Arouri, 2019; Alsharif, 2025). At the same time, the quality of governance and sharia compliance, the monitoring process, and risk management (Boulanouar et al., 2026). Meanwhile, operational inefficiencies may increase revenue volatility and weaken earnings stability (Johari et al., 2022). In addition, previous research has focused on large samples, listed banks, and cross-country settings (Al Thnaibat et al., 2024; AlKhouri & Arouri, 2019), which limits the generalizability of findings to Islamic banks in single-country domestic contexts.

Most studies test the diversification stability relationship linearly and report mixed results; Haddou & Boughrara (2025) for example, threshold models testing; different tests are needed for more complex relationships (Duong et al., 2025). Evidence of non-linear or threshold effects is limited and inconsistent; some studies find that moderate diversification enhances stability while excessive diversification undermines it (Haddou & Boughrara, 2025; Khémiri et al., 2026), whereas others report the opposite pattern (Šeho et al., 2023). In addition, prior studies predominantly focus on cross-country samples and linear specifications, which limit understanding of how diversification

relates to earnings stability in a single-country Islamic banking context and whether non-linear dynamics exist.

Why do studies of bank income diversification reach such conflicting conclusions? Portfolio theory predicts that combining income streams with imperfectly correlated returns should reduce earnings volatility (Markowitz, 1952), thereby making banks' expansion into non-financial activities more stable. The specialization hypothesis predicts the opposite: banks that move away from core lending lose the informational and operational advantages of focus, and enter activities whose income is typically more volatile, so that diversification raises rather than lowers risk (DeYoung & Roland, 2001; Stiroh, 2004). Both predictions find empirical support. Diversification has been associated with stronger performance and stability in some Islamic banking studies (Hamid, 2020) but not in others, and recent non-linear studies report opposite patterns: moderate diversification enhances stability in some samples (Haddou & Boughrara, 2025; Khémiri et al., 2026), while it undermines stability in others (Šeho et al., 2023).

We argue that the two theories need not be mutually exclusive and that the conflict in the literature may arise from two sources. First, if the relationship is non-linear, linear specifications capture whichever segment dominates a given sample, producing positive or negative estimates depending on where banks lie. Second, most studies treat diversification as a determinant of stability, yet banks with more stable earnings may be better able to bear the risks and costs of new activities. If stability shapes diversification, the observed association may not reflect the mechanisms that either theory proposes. Islamic banks offer a useful setting to examine this puzzle, because Sharia constraints on interest-based and speculative activities limit the range of permissible non-financing income and make the costs of departing from core financing activities particularly salient.

This study addresses these gaps using quarterly panel data on 13 Indonesian Islamic commercial banks from 2020Q4 to 2025Q3. Indonesia offers a relevant setting: it has one of the world's largest Muslim-majority populations, operates a dual banking system in which several Islamic banks belong to conventional banking groups, and requires Sharia board approval for new products, which constrains the scope for fee-based income. We estimate fixed-effects models with Driscoll–Kraay standard errors, test for a U-shaped relationship by verifying that the estimated turning point lies within the data range, and examine timing and direction using non-overlapping lagged specifications, reverse regressions, and Dumitrescu–Hurlin panel Granger tests.

We find no significant linear relationship between income diversification and earnings stability. Instead, the two show a contemporaneous U-shaped association, with the lowest stability at a diversification level of 0.239. Most observations lie on the declining segment of the curve. However, the pattern does not persist when

diversification is measured before the stability window, and there is weak evidence that earlier stability is associated with subsequent diversification.

This study makes three contributions. First, it offers an explanation for the conflicting evidence on diversification by showing that the specialization hypothesis and portfolio theory can each account for a different segment of a non-linear relationship: the declining segment below the turning point is consistent with the loss of specialization advantages, and the rising segment above it with portfolio diversification benefits. Second, it shows that the direction of the relationship matters for its interpretation: the U-shape reflects a contemporaneous association rather than an effect of diversification on subsequent stability, which cautions against treating diversification as an exogenous stabilizing tool. Third, it links these findings to the institutional features of Indonesian Islamic banking, including Sharia constraints on non-financial income and the dual banking structure.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature and develops the hypotheses. Section 3 explains the research methodology. Section 4 presents the empirical results and discussion. Finally, Section 5 concludes the study and provides implications, limitations, and suggestions for future research.

Literature Review

The fundamental distinction between Islamic and conventional banks lies in the strict prohibition of predetermined interest rates (*Riba*) and excessive uncertainty or speculation (*Gharar*). These principles are rooted in the Quran, as interpreted by Sharia (Islamic law) (Alsharif, 2025). Consequently, Islamic banks rely heavily on profit-and-loss-sharing arrangements and trading margins that necessitate a direct linkage to the real sector (Abedifar et al., 2013; Chowdhury et al., 2024). These distinct characteristics generate a unique risk profile: while Islamic banks are relatively insulated from derivative-induced financial market crises, they face significant challenges due to high information asymmetry in partnership-based financing (Abedifar et al., 2013).

Income diversification allows Islamic banks to reduce reliance on a single revenue stream by balancing financing income with non-financing, fee-based activities (Chowdhury et al., 2024). Its intended outcome is earnings stability, which concerns the variability of profits over time rather than their level. High profitability in a single period can be misleading if earnings are volatile, as volatility reflects a greater risk of distress (Stiroh, 2004). We therefore measure stability as the negative volatility of ROA. We prefer this measure to the Z-score for two reasons. First, diversification theories make predictions specifically about earnings volatility. Second, the Z-score incorporates the equity-to-assets ratio, which would overlap mechanically with CAR, a control variable in

our models. We acknowledge that ROA volatility does not directly capture insolvency risk and return to this issue in the limitations.

Two theories offer opposing predictions. Under modern portfolio theory (Markowitz, 1952), combining income streams with imperfectly correlated returns disperses risk and dampens earnings fluctuations, and sharing resources across services generates economies of scope (Panzar & Willig, 1981). Diversification should therefore increase stability. Under the specialization hypothesis, banks that move away from core lending lose the informational and operational advantages of focus (Thakur & Arora, 2024). Non-interest income is also more volatile than financing income and carries higher operating leverage (DeYoung & Roland, 2001; Stiroh, 2004), and new business lines increase complexity and agency costs (Jensen & Meckling, 1976; Laeven & Levine, 2007). Diversification should therefore reduce stability.

Hypotheses Development

Empirical evidence supports both views. Studies of U.S. banks find that greater reliance on non-interest income raises volatility without improving risk-adjusted returns (Stiroh, 2004), whereas Elsas et al. (2010) find that diversification increases profitability. In Islamic banking, some literature shows both positive (Abbas & Ali, 2022; Shahriar et al., 2023) and negative effects (AlKhouri & Arouri, 2019; Paltrinieri et al., 2021). Because Islamic banks face Sharia constraints on the range of permissible fee-based activities, and most hold relatively low levels of non-financing income, we expect the specialization effect to dominate on average.

H1: Income diversification is negatively associated with earnings stability in Islamic banks.

The two theories (portfolio theory and specialization hypothesis) need not be mutually exclusive; each may dominate at a different level of diversification. At low to moderate levels, banks give up part of the advantages of specialization, while non-financial income is still too small to provide meaningful portfolio benefits and is itself volatile. Stability is therefore expected to decline as diversification rises. At higher levels, non-financing income becomes large enough for imperfect correlation with financing income to smooth total earnings, and fixed costs of new activities are spread over a larger base, so that portfolio and scope effects begin to dominate. Stability is therefore expected to rise. Together, these mechanisms imply a U-shaped relationship.

Recent studies confirm that the relationship is non-linear but disagree on its shape. Šeho et al. (2023) find that the stability of GCC Islamic banks deteriorates at moderate levels of financing diversification, and that conventional banks' stability is impaired at low levels and enhanced at high levels. In contrast, Haddou & Boughrara (2025) and Khémiri et al. (2026) report an inverted U-shape, with moderate diversification

enhancing stability. Given the constraints on non-financing income in Islamic banks, we expect the specialization costs to dominate at lower levels.

H2: The association between income diversification and earnings stability in Islamic banks is non-linear and U-shaped.

Most studies treat diversification as a determinant of stability, but stability may also shape diversification (Abbas & Ali, 2022; Aliyu et al., 2025). Banks with stable earnings have greater capacity to absorb the fixed costs and uncertain returns of new activities (Abbas & Ali, 2022; Al-Habashneh et al., 2023), and are more likely to obtain regulatory and Sharia board approval for new products (Azmi et al., 2025; Hassan et al., 2019). The opposite argument is also possible: distressed banks may expand into riskier non-traditional activities in search of higher returns (DeYoung & Torna, 2013). In Islamic banks, where new products require approval from the Sharia board and fee-based activities are constrained, we expect the risk-bearing capacity argument to dominate.

H3: Earnings stability is positively associated with subsequent income diversification in Islamic banks.

Research Methods

This study uses a quantitative approach based on bank-level panel data. The population comprises all Islamic commercial banks (Bank Umum Syariah) in Indonesia. Using purposive sampling, banks were selected if they operated continuously from 2020Q1 to 2025Q3 and published quarterly financial statements throughout this period, yielding a sample of 13 banks (13 of the 14 Islamic commercial banks, i.e. nearly the entire population) and 299 bank-quarter observations. Because earnings stability is computed over a rolling four-quarter window, 2020Q1–2020Q3 serve as the initialization period, so the estimation sample covers 2020Q4–2025Q3 (260 observations). Variable measurement is presented in [Table 1](#).

$$STAB_it = \alpha + \beta_1 DIV_it + \beta_2 DIV^2_it + \beta_3 CAR_it + \beta_4 NPF_it + \beta_5 FDR_it + \beta_6 SIZE_it + \beta_7 BI7DRR_t + \mu_i + \varepsilon_it(1)$$

Before the regression is conducted, the classical assumptions in [Table 2](#) are tested. Fixed Effects (FE) regression is conducted based on the Hausman Test. Driscoll–Kraay standard errors with a lag of 4 are used to address heteroscedasticity, autocorrelation, and cross-sectional dependence, ensuring unbiased statistical inference (Driscoll & Kraay, 1998; Hoechle, 2007). DIV is mean-centred before squaring to lessen the impact of excessive multicollinearity (Aiken et al., 1991).

Since the STAB in the t-quarter is calculated on the basis of the ROA during the t–3 to t-quarters, independent variables measured at t or lagged by one to three quarters fall

within the same time window. Such a specification cannot separate the timing of diversification and stability, and may capture a mechanical correlation because non-financing income enters both DIV and ROA. Therefore, we analyze the timing and direction in three ways.

Table 1*Variable Measurement*

Variable	Measurement	Source
<i>Dependent Variable</i>		
Earnings Stability (STAB)	$-\sigma(\text{ROA})$ 4 quarter rolling (de Haan & Poghosyan, 2012)	Bank Report
<i>Independent Variable</i>		
Income Diversification (DIV)	$1 - (\text{Financing Income} - \text{Non-Financing Income} / \text{Operating Income}) $ (Laeven & Levine, 2007)	Bank Report
Income Diversification ² (DIV ²)	square DIV (mean-centered)	
<i>Control Variable</i>		
Capital Adequacy Ratio (CAR)	(Tier 1 + 2 Capital / Risk-Weighted Assets (Bank Indonesia)	Bank Report
Non-Performing Financing (NPF)	Non-Performing Financing / Total Financing (Bank Indonesia)	Bank Report
Financing to Deposit Ratio (FDR)	Total Financing / Third Party Funds (Bank Indonesia)	Bank Report
Bank Size (SIZE)	LN (Total Assets) (AlKhouri & Arouri, 2019)	Bank Report
BI-7 Day Reverse Repo Rate (BI7DRR)	Average of 3 months in a quarter	Bank Indonesia

Source: Author's own work

Table 2*Classic Assumption Test*

Test	Method	Reference
Multicollinearity	VIF	Hair et al. (2019)
Heteroscedasticity	Modified Wald Test	Greene (2020)
Autocorrelation	Baltagi-Wu LBI	Baltagi & Wu (1999)
Cross-sectional dependence	Pesaran CD Test	Pesaran (2021)
FE vs RE	Hausman Test	Hausman (1978)

Source: Author's own work

First, we estimate predictive specifications in which all regressor variables are delayed by four quarters, so that those variables are measured before the start of the four-quarter window used to calculate the STAB.

JIAFR | 238

$$\text{STAB}_{it} = \alpha + \beta_1 \text{DIV}_{i,t-4} + \beta_2 \text{DIV}^2_{i,t-4} + \beta_3 \text{CAR}_{i,t-4} + \beta_4 \text{NPF}_{i,t-4} + \beta_5 \text{FDR}_{i,t-4} + \beta_6 \text{SIZE}_{i,t-4} + \beta_7 \text{BI7DRR}_{i,t-4} + \mu_i + \varepsilon_{it} \quad (2)$$

We also re-estimate Equation (2) including the lagged dependent variable, $\text{STAB}_{i,t-4}$, whose window (t-7 to t-4) does not overlap with that of the dependent variable.

Secondly, we estimate the reverse relationship:

$$\text{DIV}_{it} = \alpha + \delta_1 \text{STAB}_{i,t-4} + \delta_2 \text{DIV}_{i,t-4} + \delta_3 \text{CAR}_{i,t-4} + \delta_4 \text{NPF}_{i,t-4} + \delta_5 \text{FDR}_{i,t-4} + \delta_6 \text{SIZE}_{i,t-4} + \delta_7 \text{BI7DRR}_{i,t-4} + \mu_i + \varepsilon_{it} \quad (3)$$

Including lagged DIV ensures that δ_1 does not simply reflect persistence in diversification. Both equations are estimated using fixed effects with Driscoll–Kraay standard errors.

Third, as a complement, we apply the panel Granger non-causality test (Dumitrescu & Hurlin, 2012) in both directions, accounting for heterogeneity across banks. The lag length is selected based on Akaike Information Criterion (AIC) with a maximum of four lags, and we report the $\tilde{Z}$ statistic, which is appropriate for panels with a fixed time dimension.

We did not use a dynamic panel GMM estimator because, with 13 cross-sectional units, the number of instruments would exceed the number of groups, thereby weakening the Hansen test and rendering the estimation unreliable (Roodman, 2009).

Several robustness checks are conducted: (i) winsorization of all continuous variables at the 1st and 99th percentiles to ensure that the main results are not driven by extreme values (Leone et al., 2019); (ii) alternative Driscoll–Kraay lag lengths (3 and 5) to assess the sensitivity of inference to the serial-correlation bandwidth; and (iii) exclusion of 2020–2021 (post-COVID-19 subsample, 2022–2025) to rule out pandemic effects. Timing and direction are examined using the specifications described above. Statistical analyses are performed using Stata 18.

Results and Discussion

Table 3 presents the descriptive statistics. The mean (standard deviation) of STAB is -0.0086 (0.0100); by construction, more negative values indicate higher earnings volatility. The number of STAB observations (260) differs from that of the other variables (299) because the four-quarter rolling window requires 2020Q1–2020Q3 as an

initialization period. The mean (standard deviation) of DIV is 0.1927 (0.1666), and 76.9% of bank-quarter observations lie below the turning point (see [Figure 1](#)).

CAR has a mean of 0.4924 (0.8550) and a maximum of 5.8868, indicating extreme outliers, which are addressed through winsorization in the robustness checks. NPF has a low mean of 0.0125 (0.0144), indicating that the asset quality of Indonesian Islamic banks is generally maintained. FDR, bank size, and BI7DRR have means of 0.8170, 30.3827, and 0.0483, respectively.

As shown in [Table 4](#), there is no serious multicollinearity among the independent variables. The high correlation between DIV and DIV^2 (0.946) is typical of polynomial terms and is mitigated by mean-centring. STAB is negatively correlated with CAR (-0.400), indicating that better-capitalized banks tend to exhibit lower earnings stability. The positive correlation between STAB and NPF (0.164) provides an early signal of a counterintuitive finding that is examined in the regression results. STAB is positively correlated with DIV (0.247) and DIV^2 (0.194), providing an early indication of a non-linear relationship. FDR is negatively correlated with CAR (-0.517); therefore, a multicollinearity test is performed (see [Table 5](#), Panel A).

Table 3

Descriptive Statistics

Variable	N	Mean	Std. Dev.	Min	P25	Median	P75	Max
STAB	260	-0.0086	0.0100	-0.0462	-0.0076	-0.0054	-0.0027	-0.0001
CAR	299	0.4924	0.8550	0.0716	0.2104	0.2392	0.3670	5.8868
NPF	299	0.0125	0.0144	0.0000	0.0010	0.0063	0.0211	0.0498
FDR	299	0.8170	0.2619	0.0000	0.7445	0.8516	0.9358	1.9673
SIZE	299	30.3827	1.2207	27.2868	29.7880	30.3644	30.9716	33.6631
DIV	299	0.1927	0.1666	0.0001	0.1006	0.1408	0.2282	0.9317
DIV^2	299	0.0648	0.1221	0.0000	0.0101	0.0198	0.0521	0.8681
BI7DRR	299	0.0483	0.0105	0.0350	0.0358	0.0500	0.0575	0.0625

Source: Author's own work

Table 4

Correlation Matrix

	STAB	CAR	NPF	FDR	SIZE	DIV	DIV^2	BI7DRR
STAB	1.000							
CAR	-0.400*	1.000						
NPF	0.164*	-0.268*	1.000					
FDR	0.048	-0.517*	0.273*	1.000				
SIZE	0.227*	-0.499*	-0.119*	0.071	1.000			
DIV	0.247*	-0.079	0.206*	-0.245*	0.192*	1.000		
DIV^2	0.194*	-0.031	0.119*	-0.318*	0.152*	0.946*	1.000	
BI7DRR	0.081	-0.099	-0.123*	0.097	0.137*	-0.078	-0.071	1.000

Note: * $p < 0.05$. $n = 260$ for STAB; $n = 299$ for the other variables.

Source: Author's own work

Table 5
Classic Assumption Test

Panel A: Multicollinearity Test (VIF)

Variable	VIF	1/VIF
DIV_c	3.39	0.295
DIV2_c	3.29	0.304
CAR	2.06	0.487
FDR	1.74	0.576
SIZE	1.60	0.626
NPF	1.35	0.740
BI7DRR	1.05	0.950
Mean VIF	2.07	

Panel B: Panel Assumption Test Summary

Test	Null Hypothesis	Statistics	p-value	Decision
Modified Wald test	Homoskedasticity (constant variance)	$\chi^2(13) = 290.79$	0.000	Reject $H_0 \rightarrow$ Heteroscedasticity
Baltagi-Wu LBI test	No AR(1) autocorrelation	LBI = 0.816	-	Reject $H_0 \rightarrow$ Autocorrelation exists
Pesaran CD test	No cross-sectional dependence	CD = 0.114	0.909	Fail to reject $H_0 \rightarrow$ No CSD
Hausman test	Random effects model is consistent (no systematic differences)	$\chi^2(6) = 20.68$	0.002	Reject $H_0 \rightarrow$ Fixed Effects selected

Source: Author's own work

Table 5, Panel A shows a mean VIF of 2.07. DIV_c and DIV²_c, the mean-centred terms, show the highest values (3.39 and 3.29), but all values are below 5, indicating no multicollinearity problem. In Panel B, the Modified Wald test yields $\chi^2 = 290.79$ ($p = 0.000$), indicating heteroscedasticity. The Baltagi-Wu LBI statistic is 0.816 (far from 2), indicating autocorrelation. Both problems are addressed with Driscoll-Kraay standard errors (lag 4). The Pesaran CD test ($p = 0.909$) indicates no cross-sectional dependence; nevertheless, Driscoll-Kraay standard errors are retained as a conservative procedure. Finally, the Hausman test ($\chi^2 = 20.68$, $p = 0.002$) supports the fixed-effects model.

In the main regression (Table 6), the F-statistic of 88.07 ($p = 0.000$) indicates that the model is jointly significant. After controlling for bank fixed effects, the explanatory variables account for approximately 19.6% of the within-bank variation in earnings stability; the remainder is attributable to factors not included in the model.

The coefficient on DIV_c ($\beta = -0.002$) is insignificant; therefore, H1 is not supported. Because DIV is mean-centred, this coefficient captures the slope of the curve at the sample mean (0.193), which lies close to the turning point (0.239). A near-zero and insignificant linear coefficient is therefore expected under a U-shaped relationship and does not imply the absence of an association. The coefficient on DIV²_c is positive and significant ($\beta = 0.025$, $p = 0.011$), indicating a non-linear, U-shaped association between

income diversification and earnings stability; therefore, H2 is supported for the contemporaneous specification. The turning point, $DIV^* = -\beta_1/(2\beta_2) + \text{mean DIV} = 0.239$, lies within the data range [0.0001–0.9317], confirming the U-shape empirically.

The control variables show mixed results. In the full sample, NPF is positively and significantly associated with earnings stability ($\beta = 0.233$, $p = 0.001$), which contrasts with most prior studies reporting a negative association. CAR, FDR, SIZE, and BI7DRR are not significantly associated with earnings stability; these results are discussed further in the Discussion section.

Table 6
Regression and Robustness Checks

Variables	(1) Main	(2) Winsor	(3) Lag 3	(4) Lag 5	(5) Post-COVID-19
CAR	-0.0003 (0.0013)	-0.0004 (0.0014)	-0.0003 (0.0013)	-0.0003 (0.0012)	-0.0018 (0.0011)
NPF	0.2332*** (0.0582)	0.2296*** (0.0560)	0.2332*** (0.0644)	0.2332*** (0.0509)	0.1830* (0.0866)
FDR	0.0076 (0.0062)	0.0070 (0.0065)	0.0076 (0.0061)	0.0076 (0.0062)	-0.0083** (0.0037)
SIZE	0.0035 (0.0021)	0.0032 (0.0019)	0.0035* (0.0020)	0.0035 (0.0021)	0.0034 (0.0025)
DIV_c	-0.0023 (0.0028)	-0.0048 (0.0030)	-0.0023 (0.0027)	-0.0023 (0.0027)	-0.0123 (0.0071)
DIV ² _c	0.0253** (0.0090)	0.0324*** (0.0103)	0.0253*** (0.0088)	0.0253** (0.0089)	0.0309*** (0.0101)
BI7DRR	0.0398 (0.0599)	0.0350 (0.0604)	0.0398 (0.0628)	0.0398 (0.0569)	0.1401*** (0.0403)
_cons	-0.1272* (0.0646)	-0.1157* (0.0587)	-0.1272* (0.0633)	-0.1272* (0.0639)	-0.1154 (0.0791)
R ² Within	0.1959	0.1833	0.1959	0.1959	0.1656
F-stat	F(7,19) =88.07	F(7,19) =101.96	F(7,19) =52.46	F(7,19) =135.75	F(7,14) =58.51
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000
n Bank	13	13	13	13	13
Obs	260	260	260	260	195

Note: Driscoll-Kraay standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. DIV_c and DIV²_c are the mean-centered DIVs (mean DIV = 0.1927). Column (2): the variable is winsorized at 1%–99%. Column (5): sample is limited to 2022–2025 ($n=195$). F-statistic and p-value based on Driscoll-Kraay fixed effects estimation. Degrees of freedom: $F(k, n-1)$ where k = number of regressors and n = number of groups.

Source: Author's own work

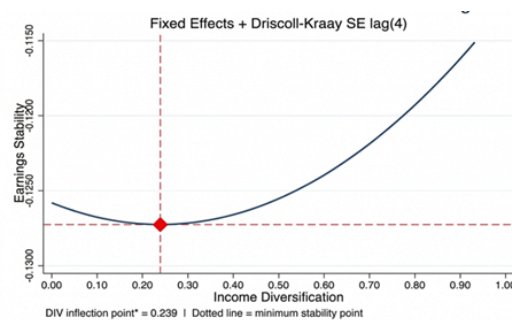
Table 6 also reports the robustness checks. In the winsorized model (Column 2), the coefficients on NPF and DIV^2_c remain significant. With Driscoll–Kraay lags of 3 (Column 3) and 5 (Column 4), the coefficients and their significance are unchanged, indicating that inference is not sensitive to the lag choice. In the post-COVID-19 subsample (Column 5), NPF remains significant at $p < 0.10$, while the coefficient on DIV^2_c becomes larger (0.0309). FDR becomes significantly negative and BI7DRR significantly positive, suggesting that macro-financial conditions are more visibly associated with stability outside the crisis period.

Table 7 presents the results of the timing and direction tests. Column (1) reports the baseline estimates, in which the positive and significant coefficient on DIV^2 (0.0253, $p < 0.05$) indicates a contemporaneous U-shaped association between diversification and stability. When all explanatory variables are measured four quarters earlier, before the start of the stability window (Column 2), this pattern disappears: the coefficient on DIV^2 becomes negative and statistically insignificant (-0.0134 , $p = 0.197$). The result is unchanged when lagged stability is added as a control (Column 3; $DIV^2 = -0.0132$, $p = 0.119$). H2 is therefore supported for the contemporaneous association but not in the predictive specification. The negative and significant coefficient on $STAB_t-4$ (-0.4800 , $p < 0.01$) indicates mean reversion in stability, but should be interpreted with caution because fixed-effects models with a lagged dependent variable are subject to Nickell bias in short panels. Overall, diversification measured before the stability window does not predict subsequent stability.

Columns (4) and (5) examine the direction from stability to diversification. Lagged stability is positively associated with subsequent diversification (1.5930, $p = 0.065$) after controlling for lagged diversification. The coefficient is of similar magnitude when lagged diversification is excluded (1.5379, $p = 0.084$). Although significant only at the 10% level, these results suggest that banks with more stable earnings tend to expand their non-financing income activities in the following period, providing weak support for H3.

Figure 1

Non-linear Relation: Income Diversification and Earnings Stability



Source: Author's own work

Table 7*Timing and Direction of the Diversification–Stability Relationship*

Variables	(1) Eq. (1)	(2) Eq. (2)	(3) Eq. (2) + STAB	(4) Eq. (3)	(5) Eq. (3) excl. DIV_c
Dependent variable	STAB_t	STAB_t	STAB_t	DIV_c_t	DIV_c_t
Regressor timing	t	t-4	t-4	t-4	t-4
DIV_c	-0.0023 (0.0028)	0.0021 (0.007)	0.001 (0.0071)		
DIV ² _c	0.0253** (0.009)	-0.0134 (0.01)	-0.0132 (0.008)		
STAB_t-4			-0.480*** (0.0553)	1.5930* (0.8013)	1.5379* (0.8317)
DIV_c_t-4				-0.0615 (0.0475)	
CAR	-0.0003 (0.0013)	-0.0042*** (0.001)	-0.006*** (0.0014)	-0.1097*** (0.0221)	-0.1057*** (0.0244)
NPF	0.2332*** (0.0582)	-0.0140 (0.0481)	-0.0137 (0.0403)	2.9291** (1.2541)	3.0544** (1.2601)
FDR	0.0076 (0.0062)	0.0011 (0.0056)	-0.0016 (0.003)	-0.0611** (0.025)	-0.0555* (0.0273)
SIZE	0.0035 (0.0021)	0.0015** (0.0007)	0.0024* (0.0012)	0.0212 (0.0208)	0.0228 (0.0231)
BI7DRR	0.0398 (0.0599)	0.0738* (0.0398)	0.0763** (0.0274)	-2.1420*** (0.4264)	-2.0190*** (0.4179)
Constant	-0.1272* (0.0646)	-0.0569*** (0.0184)	-0.0856** (0.036)	-0.2457 (0.6138)	-0.3207 (0.6889)
Bank FE	Yes	Yes	Yes	Yes	Yes
Observations	260	247	208	208	208
Within R ²	0.1959	0.1604	0.4241	0.3457	0.342

Notes: Fixed-effects estimates with Driscoll–Kraay standard errors (maximum lag 4) in parentheses. In Columns (2)–(5), all regressors are measured four quarters before the dependent variable, so that they precede the four-quarter window (t-3 to t) used to compute STAB. *** p < 0.01, ** p < 0.05, * p < 0.10.

Source: Author's own work

Table 8 presents the results of the Dumitrescu–Hurlin panel Granger tests. The null hypothesis of Granger non-causality is rejected in both directions (DIV → STAB: $\tilde{Z} = 8.81$; STAB → DIV: $\tilde{Z} = 6.17$; both $p < 0.01$). These results should be interpreted in light of the lag structure. The AIC selects four lags for the DIV → STAB test, three of which fall within the window used to construct STAB, so this result may reflect the mechanical overlap discussed above rather than genuine predictive content. In contrast, the STAB → DIV test uses a single lag, for which the stability window ends before the quarter in which diversification is measured, and is therefore free of such overlap.

Table 8*Dumitrescu–Hurlin panel Granger non-causality tests*

Null hypothesis	Lags (AIC)	$\bar{W}$	$\bar{Z}$	$\tilde{Z}$	Lags overlap STAB window?
DIV does not Granger-cause STAB	4	22.36	23.4045***	8.8107***	Yes (lags 1–3)
STAB does not Granger-cause DIV	1	4.2328	8.2420***	6.1653***	No

Notes: Tests follow Dumitrescu and Hsurlin (2012), implemented with xtgcause (Lopez & Weber, 2017). Lag length selected by AIC, with a maximum of four. $\tilde{Z}$ is reported as the preferred statistic for panels with a fixed time dimension. H1: Granger causality holds for at least one bank. *** $p < 0.01$.

Source: Author's own work

Overall, the evidence suggests that the U-shaped pattern in Table 6 reflects a contemporaneous association rather than a predictive effect of diversification on future stability. The clearest evidence, from Column (4) of Table 7 and the STAB → DIV test in Table 8, points to an association running from stability to diversification. The relationship is therefore more accurately described as bidirectional rather than as a one-way effect of diversification on stability.

This study finds that the relationship between income diversification and earnings stability in Indonesian Islamic banks is not linear; the linear term is insignificant, so H1 is not supported. Instead, the results support a contemporaneous U-shaped association (H2), in which stability is lowest at a moderate level of diversification ($DIV^* = 0.239$) and higher at both lower and higher levels. This pattern suggests that the association between diversification and stability may depend on how far a bank has moved away from its core financing activities. However, the U-shape does not persist when diversification is measured before the stability window, while earlier stability is positively associated with subsequent diversification (H3). The findings therefore challenge the conventional view that diversification enhances bank stability, and indicate that diversification and stability are jointly determined rather than linked by a one-way effect.

The declining segment: low to moderate diversification

The results do not support a linear relationship between income diversification and earnings stability (H1), but they support a contemporaneous U-shaped association (H2). Below the turning point ($DIV^* = 0.239$), higher diversification is associated with lower stability. This segment covers most of the sample: the mean DIV is 0.193 and 76.9% of bank-quarter observations lie below the turning point (23.1% lie above it). Although 11 of the 13 banks exceed the threshold in at least one quarter, only one bank (Bank

Muamalat Indonesia) does so in most quarters, and the share of observations above the threshold declined from 46.2% in 2020 to 17.9% in 2025. The threshold is therefore attainable but has not been sustained by most banks.

A plausible explanation is that when Islamic banks shift their portfolios from focused financing strategies to early stage or moderate-level diversification, they may lose informational advantages without yet benefiting from risk spreading (Šeho et al., 2023). In addition, entering new economic sectors or non-financing sources of income at a moderate level increases operational complexity, supervisory costs, and agency costs, which are compounded by high fixed costs and Shariah compliance constraints (Paltrinieri et al., 2021; Šeho et al., 2024).

In the Indonesian context, Khattak et al. (2021) reported that diversification did not significantly affect the stability of either conventional or Islamic banks. Empirical evidence from previous research confirms the risks associated with this low-to-moderate level of diversification for Islamic banks. Šeho et al. (2023) studied banks in the GCC region and showed that the stability of Islamic banks (measured by the Z-score) declined significantly, particularly at moderate levels of financing sectoral diversification (AHHI index between 0.33 and 0.55). In line with that, Paltrinieri et al. (2021) and Abuzayed et al. (2018) found that the shift to non-financing activities at the initial to moderate level increases profitability, volatility, and credit risk (NPF), which drastically erodes the accounting stability of Islamic banks compared to conventional banks.

The rising segment: high diversification

Above the turning point, higher diversification is associated with higher stability. This is consistent with portfolio theory (Markowitz, 1952), under which the benefits of diversification emerge only when income streams are sufficiently large and imperfectly correlated, and with economies of scope (Panzar & Willig, 1981). In the context of Islamic banking, the expansion of the portfolio from reliance on traditional financing (such as Murabahah) to Shariah-compliant non-financing income (such as fee-based income, service commissions, transaction-based services, and Sukuk investments) creates alternative income streams that do not correlate perfectly with primary financing risks (Haddou & Boughrara, 2025). Theoretically, this combination may stabilize operating cash flows, reduce earnings volatility, help manage Displaced Commercial Risk (DCR) for profit-sharing account holders, and strengthen banks' capital cushions against macroeconomic shocks without violating sharia principles (Haddou & Boughrara, 2025).

Haddou & Boughrara (2025) using a causal inference approach shows that income diversification significantly increases the solvency stability (Z-score) of Islamic banks to reach an optimal peak at a moderate-high level of around 59%, while minimizing non-performing financing ratios (NPF) and liquidity risks. In line with that, other research

(Abbas & Ali, 2022; Shabir et al., 2024; Shahriar et al., 2023) finds that the income diversification variable is positively and statistically significant in the Z-score of Islamic banks, which proves that the expansion of service-based income and non-financial investment significantly strengthens financial resilience and reduces the probability of bankruptcy of Islamic banks. This segment, however, rests on a smaller share of observations and should be interpreted accordingly. With only 13 banks and a single bank above the turning point in most quarters, the rising segment is identified from a limited number of bank-quarters, which reduces statistical power and limits the generalizability of this result.

Timing and direction of the relationship

The interpretations above describe a contemporaneous association rather than a causal process. When diversification is measured before the stability window, the U-shaped pattern disappears, whereas earlier stability is positively associated with subsequent diversification (H3). This suggests that diversification and stability are jointly determined. Banks with more stable earnings may have greater capacity to bear the risks and fixed costs of entering fee-based activities (Al-Habashneh et al., 2023), so that part of the observed association may reflect stable banks diversifying rather than diversification producing stability (Haddou & Boughrara, 2025). This finding addresses a question that the diversification-stability literature, which typically models diversification as a determinant of stability, has largely left open.

Position of Islamic banks relative to the turning point

The turning point (0.239) lies above the sample average for diversification (0.193), placing most observations in the declining segment of the curve. For most Indonesian Islamic banks, therefore, higher diversification coincides with lower rather than higher earnings stability. This pattern is consistent with Šeho et al. (2023), who find that the stability of GCC Islamic banks declines at moderate levels of financing diversification, although their measure captures financing composition rather than income, and the pattern may reflect features of Islamic banking such as Sharia compliance requirements and a narrower range of permissible products. Given the evidence on timing, however, this pattern should not be read as implying that banks can raise stability by increasing diversification beyond the turning point.

These patterns also reflect the institutional setting of Indonesian Islamic banking. Several Islamic commercial banks belong to conventional banking groups within the dual banking system, and fee-generating services such as payments, cash management, and treasury products may be provided through the conventional parent rather than the Sharia subsidiary. In addition, every new product requires approval from the Sharia Supervisory Board and conformity with DSN-MUI fatwas, which lengthens product

development and restricts non-financing income to Sharia-compliant fee-based services. These features help explain why most Indonesian Islamic banks remain below the level of diversification at which portfolio benefits emerge, and why the diversification–stability relationship in this setting differs from that documented for conventional banks.

Control variables

The positive association between non-performing financing (NPF) and stability appears counterintuitive. This result is inline with Sriyakul et al. (2019). A likely explanation lies in the construction of the stability measure. Because STAB is based on the absolute standard deviation of ROA, banks with lower and flatter earnings, which often coincide with higher NPF, mechanically exhibit lower dispersion. The result may therefore reflect lower earnings levels rather than genuinely more stable operations. Restructuring-oriented practices in Indonesian Islamic banks, reinforced by OJK's COVID-19 relaxation (POJK No. 11/POJK.03/2020 and its extensions to March 2024), which allowed restructured financing to remain classified as performing, spread losses over time rather than triggering sudden income shocks, allowing banks with weaker asset quality to report lower but less volatile earnings. Sharia restructuring takes the form of rescheduling, reconditioning, and restructuring, which extend repayment schedules or convert contracts rather than recognize losses immediately. Moreover, under profit-sharing contracts (*mudharabah* and *musyarakah*), part of the financing losses is passed on to investment account holders through lower profit distributions, further dampening fluctuations in the bank's reported earnings. Consistent with this interpretation, the NPF coefficient is insignificant when regressors are measured before the stability window (Table 7).

CAR is a cumulative historical indicator that reflects past capital decisions; therefore, it does not instantly respond to or influence real-time systemic vulnerabilities during economic crises or expansions, consistent with the findings of Rusydiana et al. (2026). Meanwhile, the average FDR of Islamic banks in Indonesia remains within the safe threshold. As long as banks can maintain values within regulatory limits, financing expansion proceeds safely without causing significant liquidity risk (Rusydiana et al., 2026).

Previous research has also found no significant effects of size and stability (Ashraf et al., 2016; de Haan & Poghosyan, 2012). Bank size has two opposing effects on stability. On the one hand, large banks benefit from portfolio diversification, economies of scale, and easier access to liquidity facilities (Ashraf et al., 2016). On the other hand, large banks tend to take on risk more aggressively, face greater management complexity, and exhibit higher earnings volatility (Ashraf et al., 2016; Khalifeh et al., 2025). These two opposing effects cancel each other out, making the net impact of bank size on stability insignificant

(Ashraf et al., 2016). Meanwhile, previous findings also support an insignificant relationship between interest rates and stability (Harkati et al., 2020; Mubarok et al., 2026; Rusydiana et al., 2026). An increase in interest rates can boost a bank's net interest margin (positive effect), but at the same time, it increases borrowers' repayment burdens, which may lead to a rise in nonperforming loans (negative effect); thus, these two effects cancel each other out in the aggregate statistical model (Rusydiana et al., 2026).

Conclusion

This study examines the linear and non-linear relationships between income diversification and earnings stability in Indonesian Islamic banks, as well as the direction of this relationship. Using quarterly data from 13 Islamic banks between 2020Q4 and 2025Q3 (260 observations) and fixed-effects estimation with Driscoll-Kraay standard errors, we find no significant linear relationship (H1 not supported). Instead, the results show a contemporaneous U-shaped association (H2 supported; $DIV^2 = 0.025$, $p = 0.011$), with the lowest stability at $DIV^* = 0.239$. This result is robust to winsorization, alternative standard-error lag lengths, and the exclusion of the COVID-19 period. However, the U-shape does not hold when diversification is measured before the stability window, whereas earlier stability is positively associated with subsequent diversification (H3 weakly supported). The relationship is therefore better understood as bidirectional than as a one-way effect of diversification on stability.

The average level of diversification (0.193) lies below the turning point, placing most observations on the declining segment of the curve. NPF is positively associated with stability, likely reflecting restructuring practices and the tendency of banks with lower earnings to exhibit lower ROA dispersion, rather than genuinely more stable operations. FDR and BI7DRR are significant only after excluding 2020–2021.

Theoretically, the findings suggest that (1) the diversification-stability relationship in Islamic banks is non-linear; (2) specialization and agency arguments are more consistent with the declining segment, and portfolio theory and economies of scope with the rising segment; (3) diversification and stability are jointly determined, so studies treating diversification solely as a determinant of stability may misattribute part of the association; and (4) Sharia constraints on permissible fee-based activities and the requirement for Sharia board approval of new products may explain why most Indonesian Islamic banks remain below the level at which portfolio benefits emerge.

Practically, the findings caution against treating diversification as a standalone strategy for stabilizing earnings. The estimated turning point (0.239) lies above the sample mean (0.193), and the share of bank-quarter observations above it declined from 46.2% in 2020 to 17.9% in 2025, so most banks currently operate on the declining

segment, where higher non-financing income coincides with lower stability. Moreover, because the U-shape holds contemporaneously but not when diversification precedes the stability window, the turning point should not be read as a target that guarantees higher stability. For bank managers, diversification decisions should be based on each bank's risk-bearing capacity rather than on a target level of non-financial income. For regulators, diversification should not be uniformly encouraged, and supervisors should recognize that a bank's stability may shape its diversification choices as much as the reverse.

This study has several limitations. First, although the sample covers 13 of the 14 Islamic commercial banks in Indonesia, the small cross-section limits statistical power, precludes dynamic panel GMM estimation, and restricts generalization beyond Indonesia. Second, the direction of causality cannot be established, and part of the contemporaneous association may be mechanical, as non-interest income enters both DIV and ROA. Third, the stability measure is based on the unscaled standard deviation of ROA, which may partly reflect earnings levels and does not directly capture insolvency risk. Fourth, the two-segment income measure does not distinguish among types of non-interest income. Future research could (1) extend the sample to conventional banks and/or other countries; (2) use alternative stability measures such as the Z-score; (3) distinguish among fee, trading, and foreign exchange income; and (4) exploit exogenous regulatory shocks to identify the direction of causality.

Authors' Declaration

The authors made substantial contributions to the conception and design of the study. The authors took responsibility for data analysis, interpretation and discussion of results. The authors read and approved the final manuscript.

Acknowledgements

Not applicable.

Funding

This research received no external funding.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used Claude (Anthropic) for brainstorming and grammar improvement, and GeminiNotebook for identifying relevant citations from source materials. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

ORCID

Author 1  <https://orcid.org/0000-0003-3797-5402>

Author 2  <https://orcid.org/0000-0002-6507-3986>

Author 3  <https://orcid.org/0009-0007-9623-8898>

Author 4  <https://orcid.org/0000-0003-0394-5942>

References

- Abbas, F., & Ali, S. (2022). Dynamics of diversification and banks' risk-taking and stability: Empirical analysis of commercial banks. *Managerial and Decision Economics*, 43(4), 1000–1014. <https://doi.org/10.1002/mde.3434>
- Abedifar, P., Molyneux, P., & Tarazi, A. (2013). Risk in Islamic Banking. *Review of Finance*, 17(6), 2035–2096. <https://doi.org/10.1093/rof/rfs041>
- Abuzayed, B., Al-Fayoumi, N., & Molyneux, P. (2018). Diversification and bank stability in the GCC. *Journal of International Financial Markets, Institutions and Money*, 57, 17–43. <https://doi.org/10.1016/j.intfin.2018.04.005>
- Aiken, L. S., West, S. G., & Reno, R. R. (1991). *Multiple regression: testing and interpreting interactions*. Sage Publications.
- Al Thnaibat, M., Al-Hajaya, K., & Alshhadat, M. Q. (2024). Do the characteristics of the Sharia Supervisory Board affect the Islamic banks' performance? Evidence from Arab countries. *Journal of Financial Reporting and Accounting*. <https://doi.org/10.1108/JFRA-05-2024-0271>
- Al-Habashneh, A. K., Khatatbeh, I. N., & Alzubi, K. M. (2023). The impact of income diversification on the stability of listed Jordanian commercial banks during the COVID-19 pandemic. *Banks and Bank Systems*, 18(3), 35–48. [https://doi.org/10.21511/bbs.18\(3\).2023.04](https://doi.org/10.21511/bbs.18(3).2023.04)
- Aliyu, S., Mohammad, A. R., & Abd. Wahab, N. (2025). Bank diversification, stability and oil price in MENA region. *Journal of Islamic Accounting and Business Research*, 16(6), 1074–1099. <https://doi.org/10.1108/JIABR-09-2022-0234>
- AlKhouri, R., & Aroui, H. (2019). The effect of diversification on risk and return in banking sector. *International Journal of Managerial Finance*, 15(1), 100–128. <https://doi.org/10.1108/IJMF-01-2018-0024>
- Alsharif, M. (2025). Navigating global crises: assessing the resilience of the largest dual banking sector using parametric and non-parametric approaches. *Humanities and Social Sciences Communications*, 12(1), 1744. <https://doi.org/10.1057/s41599-025-06040-y>
- Ashraf, D., Rizwan, M. S., & L'Huillier, B. (2016). A net stable funding ratio for Islamic banks and its impact on financial stability: An international investigation. *Journal of Financial Stability*, 25, 47–57. <https://doi.org/10.1016/j.jfs.2016.06.010>
- Azmi, W., Hassan, M. K., Razak, L. A., & Ali, M. (2025). What's in a name? Uncovering a link between intermediation margins of Islamic banks and the reputation of Shariah Supervisory Boards. *Pacific-Basin Finance Journal*, 90, 102641. <https://doi.org/10.1016/j.pacfin.2024.102641>

- Baltagi, B. H., & Wu, P. X. (1999). Unequally Spaced Panel Data Regressions with AR(1) Disturbances. *Econometric Theory*, 15(6), 814–823. <https://doi.org/10.1017/S0266466699156020>
- Boulanouar, Z., Grassa, R., Naouar, A., & El Ammari, A. (2026). Does Sharia governance deter bank risk-taking? Evidence from profit-sharing accounts and board financial expertise. *Journal of Financial Reporting and Accounting*, 1–31. <https://doi.org/10.1108/JFRA-05-2025-0419>
- Chowdhury, T., Karim, R. Al, Awanis, A., & Rownak, A. (2024). Does the Size of a Bank Moderate the Relationship Between Income, Asset Diversification, and Bank Stability? *International Journal of Financial Studies*, 12(4), 125. <https://doi.org/10.3390/ijfs12040125>
- de Haan, J., & Poghosyan, T. (2012). Size and earnings volatility of US bank holding companies. *Journal of Banking & Finance*, 36(11), 3008–3016. <https://doi.org/10.1016/j.jbankfin.2012.07.008>
- DeYoung, R., & Roland, K. P. (2001). Product Mix and Earnings Volatility at Commercial Banks: Evidence from a Degree of Total Leverage Model. *Journal of Financial Intermediation*, 10(1), 54–84. <https://doi.org/10.1006/jfin.2000.0305>
- DeYoung, R., & Torna, G. (2013). Nontraditional banking activities and bank failures during the financial crisis. *Journal of Financial Intermediation*, 22(3), 397–421. <https://doi.org/10.1016/j.jfi.2013.01.001>
- Driscoll, J. C., & Kraay, A. C. (1998). Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data. *The Review of Economics and Statistics*, 80(4), 549–560. <https://doi.org/10.1162/003465398557825>
- Dumitrescu, E.-I., & Hurlin, C. (2012). Testing for Granger non-causality in heterogeneous panels. *Economic Modelling*, 29(4), 1450–1460. <https://doi.org/10.1016/j.econmod.2012.02.014>
- Duong, Q. N., Tran, N. T. K., & Dang, T. P. T. (2025). Income diversification and liquidity risk in ASEAN-5 banks: A Bayesian perspective. *PLOS ONE*, 20(3), e0316949. <https://doi.org/10.1371/journal.pone.0316949>
- Elsas, R., Hackethal, A., & Holzhäuser, M. (2010). The anatomy of bank diversification. *Journal of Banking & Finance*, 34(6), 1274–1287. <https://doi.org/10.1016/j.jbankfin.2009.11.024>
- Grassa, R. (2012). Islamic banks' income structure and risk: evidence from GCC countries. *Accounting Research Journal*, 25(3), 227–241. <https://doi.org/10.1108/10309611211290185>
- Greene, W. H. (2020). *Econometric analysis* (8th ed.). Pearson.
- Haddou, S., & Boughrara, A. (2025). How diversification shapes full-fledged Islamic bank Stability? A causal inference approach. *International Review of Economics & Finance*, 102, 104367. <https://doi.org/10.1016/j.iref.2025.104367>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Cengage.
- Hamid, F. S. (2020). The effect of diversification on bank performance in dual banking system. *International Journal of Monetary Economics and Finance*, 13(5), 446. <https://doi.org/10.1504/IJMEF.2020.110555>

- Harkati, R., Alhabshi, S. M., & Kassim, S. (2020). Does capital adequacy ratio influence risk-taking behaviour of conventional and Islamic banks differently? Empirical evidence from dual banking system of Malaysia. *Journal of Islamic Accounting and Business Research*, 11(10), 1989–2015. <https://doi.org/10.1108/JIABR-11-2019-0212>
- Hassan, M. K., Khan, A., & Paltrinieri, A. (2019). Liquidity risk, credit risk and stability in Islamic and conventional banks. *Research in International Business and Finance*, 48, 17–31. <https://doi.org/10.1016/j.ribaf.2018.10.006>
- Hausman, J. A. (1978). Specification Tests in Econometrics. *Econometrica*, 46(6), 1251. <https://doi.org/10.2307/1913827>
- Hoechle, D. (2007). Robust Standard Errors for Panel Regressions with Cross-Sectional Dependence. *The Stata Journal: Promoting Communications on Statistics and Stata*, 7(3), 281–312. <https://doi.org/10.1177/1536867X0700700301>
- Jensen, M. C., & Meckling, W. H. (1976). Theory Of The Firm: Managerial Behavior, Agency Cost And Ownership Structure. *Journal of Financial Economics*, 3(4), 305–360.
- Johari, S. M., Wong, W.-K., & Ayu, A. R. F. (2022). Driven Determinants to Indonesia Sharia Commercial Banks' Performance The Important Role of Diversification Strategy. *Advances in Decision Sciences*, 26(2), 64–96. <https://doi.org/10.47654/v26y2022i2p64-96>
- Khalifeh, I., Benhmad, F., El Moussawi, C., & Tarazi, A. (2025). Net stable funding ratio: Implication for Bank stability in Europe. *Global Finance Journal*, 67, 101144. <https://doi.org/10.1016/j.gfj.2025.101144>
- Khattak, M. A., Ali, M., Hamid, B. A., & Islam, M. U. (2021). Competition, Diversification, and Stability in the Indonesian Banking System. *Buletin Ekonomi Moneter Dan Perbankan*, 24, 59–88. <https://doi.org/10.21098/bemp.v24i0.1481>
- Khémiri, W., Ullah, S., & Chafai, A. (2026). Can bank efficiency alter the concavity of Islamic CSR disclosure and liquidity creation nexus in GCC economies? *Sustainable Futures*, 11, 101681. <https://doi.org/10.1016/j.sfr.2026.101681>
- Laeven, L., & Levine, R. (2007). Is there a diversification discount in financial conglomerates? *Journal of Financial Economics*, 85(2), 331–367. <https://doi.org/10.1016/j.jfineco.2005.06.001>
- Leone, A. J., Minutti-Meza, M., & Wasley, C. E. (2019). Influential Observations and Inference in Accounting Research. *The Accounting Review*, 94(6), 337–364. <https://doi.org/10.2308/accr-52396>
- Lopez, L., & Weber, S. (2017). Testing for Granger Causality in Panel Data. *The Stata Journal: Promoting Communications on Statistics and Stata*, 17(4), 972–984. <https://doi.org/10.1177/1536867X1801700412>
- Markowitz, H. (1952). Portfolio Selection. *The Journal of Finance*, 7(1), 77. <https://doi.org/10.2307/2975974>
- Mubarok, F., Wibowo, M., Pradana, H. D., & Yaacob, Z. (2026). The Influence of Macroeconomic Shocks, Operational Efficiency, and Financing Risk: An Empirical Study of NPF in Indonesian Islamic Banks. *Falah: Jurnal Ekonomi Syariah*, 11(1), 22–42. <https://doi.org/10.22219/jes.v11i1.43291>

- Paltrinieri, A., Dreassi, A., Rossi, S., & Khan, A. (2021). Risk-adjusted profitability and stability of Islamic and conventional banks: Does revenue diversification matter? *Global Finance Journal*, 50, 100517. <https://doi.org/10.1016/j.gfj.2020.100517>
- Panzar, J. C., & Willig, R. (1981). Economies of Scope. *American Economic Review*, 71(2), 268–272. <https://EconPapers.repec.org/RePEc:aea:aecrev:v:71:y:1981:i:2:p:268-72>
- Pesaran, M. H. (2021). General diagnostic tests for cross-sectional dependence in panels. *Empirical Economics*, 60(1), 13–50. <https://doi.org/10.1007/s00181-020-01875-7>
- Roodman, D. (2009). How to do Xtabond2: An Introduction to Difference and System GMM in Stata. *The Stata Journal: Promoting Communications on Statistics and Stata*, 9(1), 86–136. <https://doi.org/10.1177/1536867X0900900106>
- Rusydiana, A. S., Nurfalah, I., & Riani, R. (2026). The Markov switching model on early warning in banking vulnerability: comparison between Indonesia and Malaysia. *Journal of Islamic Accounting and Business Research*, 1–26. <https://doi.org/10.1108/JIABR-09-2024-0362>
- Šeho, M., Bacha, O. I., & Smolo, E. (2024). Bank financing diversification, market structure, and stability in a dual-banking system. *Pacific-Basin Finance Journal*, 86, 102461. <https://doi.org/10.1016/j.pacfin.2024.102461>
- Šeho, M., Shaiban, M. S. M., & Ghafoor, A. (2023). Loan and financing diversification and bank stability in dual-banking systems. *Finance Research Letters*, 51, 103395. <https://doi.org/10.1016/j.frl.2022.103395>
- Shabir, M., Jiang, P., Shahab, Y., Wang, W., Işık, Ö., & Mehroush, I. (2024). Diversification and bank stability: Role of political instability and climate risk. *International Review of Economics & Finance*, 89, 63–92. <https://doi.org/10.1016/j.iref.2023.10009>
- Shahriar, A., Mehzabin, S., & Azad, M. A. K. (2023). Diversification and bank stability in the MENA region. *Social Sciences & Humanities Open*, 8(1), 100520. <https://doi.org/10.1016/j.ssaho.2023.100520>
- Sriyakul, T., Jermisittiparsert, K., Joemsittiprasert, W., & Pamornmast, C. (2019). Comparative Analysis of Stability and Bank Earnings: A Study of Indonesian Islamic and Conventional Banking Firms. *International Journal of Innovation, Creativity and Change*, 10(1), 335–351.
- Stiroh, K. J. (2004). Diversification in Banking: Is Noninterest Income the Answer? *Journal of Money, Credit, and Banking*, 36(5), 853–882. <https://doi.org/10.1353/mcb.2004.0076>
- Thakur, N., & Arora, S. (2024). Determinants of income diversification: empirical evidence from Indian banks. *International Journal of Law and Management*, 66(2), 195–215. <https://doi.org/10.1108/IJLMA-05-2023-0113>

