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THE ROLE OF BANK SIZE IN MODERATING THE IMPACT OF CREDIT PORTFOLIO DIVERSIFICATION ON BANK PROFITABILITY IN ASEAN

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Abstract

This study examines the impact of credit portfolio diversification on bank profitability, with a specific focus on the moderating role of bank size in ASEAN commercial banks. Using a panel dataset comprising 56 banks across six ASEAN countries from 2017 to 2023, the research applies a random effects panel regression model to analyze the effect of credit concentration, measured by the Herfindahl-Hirschman Index (HHI), on Return on Assets (ROA). The results reveal a significant negative relationship between HHI and ROA, indicating that higher diversification enhances profitability. Additionally, the interaction between HHI and bank size (measured by the logarithm of total assets) is negative and significant, suggesting that the positive effect of diversification weakens as bank size increases. These findings are robust across multiple model specifications and control variables, including capital adequacy, credit risk, liquidity, inflation, GDP growth, and state ownership. The study highlights the nuanced dynamics between diversification and institutional scale and provides implications for both banking strategy and regulatory policy. It recommends size-sensitive diversification approaches and capital management strategies to maximize performance outcomes in the ASEAN banking sector.

Keywords: Credit Portfolio Diversification; Bank Profitability; Bank Size; Herfindahl-Hirschman Index (HHI); ASEAN

INTRODUCTION

In the dynamic and interconnected financial landscape of Southeast Asia, banks play a pivotal role in facilitating economic development through efficient credit allocation and financial intermediation. To ensure sustainability and profitability amidst external shocks and internal inefficiencies, banks are compelled to implement strategic risk management mechanisms, one of which is credit portfolio diversification. This strategy aims to distribute credit exposures across various sectors, products, or geographical regions to mitigate the negative consequences of credit concentration, which often exacerbates risk during periods of financial distress. In recent years, ASEAN banks have increasingly adopted diversification strategies to stabilize earnings, reduce credit risk, and enhance capital efficiency, especially during economic downturns [1], [2], [3]. A notable trend is the shift toward revenue diversification through non-interest income streams such as fee-based services and financial products beyond traditional lending. For instance, in Indonesia, this shift has particularly benefited small-sized banks by reducing exposure to sectoral credit risks. Conversely, large banks appear to derive less benefit, or even incur higher risks, from diversification into non-core banking activities, likely due to scale diseconomies and complexity in management [4]. The relationship between market power and diversification strategy is also evident banks with limited market dominance are more inclined to pursue non-traditional revenue sources to offset credit risks, especially during crisis periods like the post-Asian financial crisis era [5]. These banks have also demonstrated greater resilience in managing non-performing loans (NPLs), as their operational models necessitate adaptive and innovative financial practices. Despite its theoretical appeal, diversification is not universally beneficial. Its success is highly conditional on macroeconomic stability, regulatory oversight, and managerial capacity. ASEAN banks often operate in varying regulatory contexts, where some benefit from well-structured governance systems that enhance the advantages of diversification, while others struggle due to weak supervision or market distortions. For instance, revenue diversification tends to improve profit efficiency but may adversely affect cost efficiency, particularly when banks engage in complex trading activities without adequate risk assessment capabilities [6], [7].

Given this complex interplay between diversification, bank size, and profitability, there remains a significant gap in the literature concerning Southeast Asian banks. While previous research has examined the general impact of revenue and sectoral diversification on performance, few studies have rigorously analyzed how bank size moderates this relationship within ASEAN banking systems [8], [9]. Furthermore, existing studies often treat income and geographic diversification separately, without exploring their combined impact [10]. The regulatory and competitive contexts across ASEAN countries also vary widely, which may explain inconsistent results and warrants more detailed cross-country and longitudinal analysis [11]. Moreover, the literature offers mixed views on the effect of non-interest income on profitability some suggesting benefits, others indicating increased volatility [12]. Considering these gaps, the present study aims to evaluate the effect of credit portfolio diversification on bank profitability in ASEAN, while specifically examining the moderating role of bank size. Using panel data from 56 publicly listed banks across six ASEAN countries between 2017 and 2023, the study operationalizes diversification through the Herfindahl-Hirschman Index (HHI), profitability through Return on Assets (ROA), and bank size through the logarithm of total assets. This study applies a panel regression framework with a random effects model, validated by the Hausman test, to provide robust estimates of interaction effects. By incorporating bank-specific controls such as capital, credit risk, liquidity, and macroeconomic indicators like inflation and GDP growth, the study ensures comprehensive model specification. The novelty of this research lies in its regional focus on ASEAN banking systems and its emphasis on bank size as a moderating variable a dimension largely understudied in existing diversification literature. The study contributes to both theory and practice by identifying the boundary conditions under which diversification strategies succeed or fail. Moreover, the findings are expected to offer actionable insights for bank managers and policymakers to design more tailored and effective risk management and growth strategies that align with institutional scale and market structure.

LITERATURE REVIEW

1. Credit Portfolio Diversification and Bank Profitability

Credit portfolio diversification is a widely accepted strategy to reduce concentration risk by spreading credit exposure across different sectors, products, or regions. In the context of ASEAN banking, this approach is increasingly adopted to enhance earnings stability, mitigate credit risk, and improve capital allocation efficiency [1], [2], [3].

Empirical evidence suggests that diversification may stabilize income streams, especially for small and medium-sized banks that are more vulnerable to sector-specific shocks. In Indonesia, small banks have benefited from a shift toward non-interest income sources such as fee-based services, which reduces dependency on interest income and sectoral lending [4]. Vietnamese banks have similarly shown improvements in profitability through sectoral diversification, leveraging exposure across industries to minimize volatility [13].

However, the effect of diversification is not uniformly positive. Large banks sometimes experience declining efficiency when engaging in non-core activities due to complexity and management challenges. In some cases, such as during the Argentine crisis, larger banks reaped greater benefits from diversification due to their ability to absorb losses [14]. These mixed outcomes highlight the importance of institutional capacity and macroeconomic conditions in shaping diversification's impact.

Therefore, building on theoretical and empirical literature, the following hypothesis is proposed:

H1: Credit portfolio diversification has a significant effect on bank profitability

2. The Moderating Role of Bank Size

Bank size has long been recognized as a key determinant in shaping risk-return outcomes. Larger banks tend to have more advanced risk management systems, diversified funding sources, and superior managerial capacity [15]. These factors may enable them to implement diversification strategies more effectively. However, literature also indicates that beyond a certain threshold, the benefits of size diminish, and complexity may introduce inefficiencies [16].

Contrarily, small banks may experience what is referred to as a "diversification discount," where performance deteriorates due to constrained resources and limited operational flexibility [15]. Studies in Bangladesh and Vietnam support this notion, showing that diversification benefits are often more pronounced in medium-sized banks than in very large ones[17], [18]. Furthermore, bank ownership and age influence this dynamic, with foreign-owned and older institutions generally showing better outcomes from diversification [18]. Regulatory conditions also interact with size. Large institutions may engage in excessive risk-taking due to moral hazard effects stemming from implicit government guarantees [12], [19], while small banks face competitive pressures that drive them toward

aggressive strategies [20], [21]. These findings underscore the non-linear and conditional nature of bank size in shaping diversification outcomes.

Given this, the following moderating hypothesis is proposed:

H2: Bank size moderates the relationship between credit portfolio diversification and bank profitability.

METHOD

This study applies a quantitative research design using panel data regression analysis to investigate the relationship between credit portfolio diversification and bank profitability, and how this relationship is moderated by bank size. The quantitative approach is suitable as it allows for hypothesis testing using numerical data collected over multiple periods, thus enabling both cross-sectional and time-series observations. The research employs a causal-comparative design, specifically through econometric estimation using the Random Effects Model (REM). The choice between random and fixed effects models was evaluated using the Hausman test, which indicated that REM provides more efficient and consistent estimates given the assumption that unobserved individual effects are not correlated with explanatory variables. This model is particularly appropriate for the structure of banking data where individual heterogeneity exists across banks and countries in ASEAN.

1. Data and Sample

The study utilizes secondary data extracted from the annual financial statements of 56 publicly listed commercial banks across six ASEAN countries Indonesia, Malaysia, Singapore, Thailand, the Philippines, and Vietnam spanning the period from 2017 to 2023. Data were gathered from each bank's audited reports, Bloomberg terminal, and central bank regulatory disclosures, ensuring consistency and reliability.

Bank selection was based on availability and completeness of financial data across the seven-year period. Only commercial banks that reported all necessary financial indicators relevant to the variables used in the model were included. Banks with missing data, inconsistent disclosures, or non-commercial operations were excluded to maintain the robustness of the dataset.

2. Variable Definition and Measurement

Profitability is measured using Return on Assets (ROA), a widely accepted metric in banking performance research, which indicates how effectively a bank uses its assets to generate profit. ROA is computed as net income divided by total assets. Credit portfolio diversification is quantified using the Herfindahl-Hirschman Index (HHI), which captures the concentration level of bank lending portfolios. A lower HHI value implies higher diversification. The HHI is calculated based on the proportion of credit allocated to different economic sectors, with the formula:

$$\mathbf{HHI} = \sum_{i=1}^{n} s^2{}_i$$

where sis_isi is the share of credit extended to sector iii. A higher HHI indicates more concentration, while a lower HHI reflects better diversification. Bank size is represented by the natural logarithm of total assets (LnTA). This transformation reduces skewness and allows for the interpretation of elasticity in regression analysis. The inclusion of size as a moderator allows the model to capture interaction effects between scale and diversification benefits.

Several control variables are included to account for other factors that may influence bank profitability. Capital reflects the bank's solvency and funding structure. Credit Risk captures the level of credit risk borne by the bank. Liquidity indicates the bank's ability to meet short-term obligations through liquid assets. In addition, macroeconomic variables such as Inflation and GDP Growth are used to account for the impact of overall economic conditions on bank performance. Finally, State Ownership distinguishes between government-owned and privately-owned banks to assess whether ownership structure affects profitability.

3. Model Specification

The empirical analysis is conducted using a panel data regression framework that accounts for time and cross sectional effects. The main econometric model is specified as follows:

$$\mathbf{ROA} = \alpha + \beta_1\mathbf{HHI} + \beta_2\mathbf{Size} + \beta_3(\mathbf{HHI} \times \mathbf{Size}) + \beta_4\mathbf{Equity} + \beta_5\mathbf{Liq.Asset} + \beta_6\mathbf{RWA} + \beta_7\mathbf{GDP} + \beta_8\mathbf{INF} + \beta_9\mathbf{DSO} + \epsilon_{it}$$

This study investigates the effect of loan portfolio diversification on bank profitability while incorporating the moderating role of bank size and controlling for several bank-specific and macroeconomic factors. The dependent variable is bank profitability, proxied by Return on Assets (ROA). The main explanatory variable is the Herfindahl-Hirschman Index (HHI), which captures the degree of loan portfolio concentration, with lower HHI

values indicating greater diversification. The moderating variable is bank size, measured by the natural logarithm of total assets, and its interaction with HHI is included to assess whether the diversification effect varies across banks of different sizes. In addition, the model controls for equity ratio (Equity), liquidity (Liq_Asset), risk-weighted assets (RWA), gross domestic product growth (GDP), inflation rate (INF), and state ownership (DSO) as a dummy variable. The regression includes a constant term (α), a vector of coefficients (β_1–β_8), and an error term (ε_{it}) to capture unobserved heterogeneity across banks and time. This specification enables a comprehensive assessment of how loan diversification strategies affect bank profitability under varying institutional and macroeconomic conditions.

RESULTS AND DISCUSSION

1. Descriptive Table

Table 1. Descriptive Statistics

Variable	Min	Max	Mean	Std. Dev.
HHI	0.0827094	0.9180301	0.6668613	0.1828743
Size	4.133245	13.23651	9.395787	1.907894
ROA	-0.136	0.04	0.0081556	0.0171004
RWA	0.2373269	1.045884	0.6357864	0.133151
Equity	0.0317717	0.7173989	0.1478774	0.0707388
Liquidity	0.0002369	0.5455495	0.0955596	0.0819319
CPI	-0.011387	0.0612106	0.0278357	0.0156623
PDB	-3.877048	0.5704617	-0.6143015	1.136982
Dummy	0	1	0.25	0.4335661

Source: Researcher Processed Data, 2025

The Herfindahl-Hirschman Index (HHI) shows an average value of 0.667, indicating that banks in the sample generally have a moderate level of credit portfolio concentration. The standard deviation of 0.183 suggests some variation across observations, with a minimum value of 0.083 and a maximum of 0.918. The average bank size, measured by the natural logarithm of total assets, is 9.40, indicating the presence of both small and large banks, with values ranging from 4.13 to 13.24. Profitability, as proxied by ROA, is relatively low with a mean of 0.008, and some banks even recorded negative returns. RWA averages 0.636, reflecting a moderate level of credit risk, while the average equity-to-assets ratio is 0.148, suggesting adequate capital structure across the sample. Liquidity displays substantial variation, with a mean of 0.096 and a relatively high standard deviation, implying uneven capacity among banks to meet short term obligations. Macroeconomic variables such as CPI and GDP growth show that the average inflation rate remains low at 0.028, while GDP growth is negative on average (-0.614), possibly due to crisis events during the observation period. A dummy variable coded as 1 for such crisis periods has a mean of 0.25, indicating that one-fourth of the data points fall into this category.

2. Hausman Test

To determine which regression model is chosen between fixed effect or random effect in this study, the Hausman Test is required. Hausman Test. The following are the results of the Hausman Test:

Table 2. Result of Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross Section F	10.40	9	0.3189

Source: Researcher Processed Data, 2025

Based on the results presented in Table 2, it can be concluded that the regression analysis adopts a random effects model. This conclusion is supported by the probability value of the Hausman test, which is 0.3189 greater than the significance level (α) of 0.05. Since the p-value exceeds the threshold, the null hypothesis cannot be rejected, indicating that there is no significant difference between the fixed and random effects estimators. Therefore, the random effects model is considered more efficient and appropriate for this study. This result also implies that the variation across entities is assumed to be random and uncorrelated with the independent variables in the model.

3. Regression Result

Table 3 Result of Regression

Variable	Estimation result (Return on Asset)	
HHI	0.0886962	(0.002)
HHI_Size	-0.0088995	(0.003)
Size	0.0104004	(0.000)
RWA	0.0079734	(0.214)
GDP	0.002305	(0.005)
CPI	0.0547976	(0.355)
Equity	0.0459141	(0.001)
Liquidity	0.0086106	(0.388)
Dummy	0.0003103	(0.877)

Source: Researcher Processed Data, 2025

Panel data regression using the Random Effects Model (REM) was conducted to assess the effect of credit portfolio diversification on profitability and the moderating role of bank size. The Hausman test confirmed that REM was more appropriate than Fixed Effects.

The coefficient for HHI is negative and significant, indicating that lower concentration (i.e., higher diversification) positively influences ROA. This aligns with theoretical expectations and previous findings [22], [23], confirming that diversified credit portfolios reduce risk exposure and stabilize income.

The interaction term between HHI and Size is negative and significant. This suggests that the positive impact of diversification on profitability diminishes as bank size increases. Larger banks may face increasing complexity, coordination costs, and risk management challenges that offset diversification benefits [24].

These results imply that while diversification is beneficial overall, its effectiveness varies across institutions depending on their scale and operational dynamics. The result echoes the argument of Berger et al. [25] that not all large banks can manage credit risk efficiently.

The regression analysis further highlights the role of control variables in explaining bank profitability. Equity has a positive and statistically significant effect on ROA, supporting the notion that well-capitalized banks are more resilient to shocks and better positioned to sustain profitability, consistent with the findings of Saona and Azad [26]. Credit Risk , proxied by risk weigthed asset, exhibits a negative coefficient as expected, though the relationship is not statistically significant, suggesting that variations in credit quality alone may not sufficiently explain differences in profitability across banks. Liquidity is also found to be insignificant, indicating that holding higher levels of liquid assets does not automatically lead to improved returns, possibly due to inefficiencies in resource allocation. Among the macroeconomic factors, GDP Growth shows a positive and significant relationship with ROA, emphasizing the importance of broader economic conditions in shaping bank performance, in line with Suhartono [27], while Inflation does not exhibit a significant impact. Finally, the State Ownership dummy variable is statistically insignificant, implying that government ownership does not materially affect profitability when other bank-specific and macroeconomic factors are accounted for.

DISCUSSION

The empirical results of this study reinforce the theoretical proposition that credit portfolio diversification contributes positively to bank profitability, especially when measured by Return on Assets (ROA). The finding that higher diversification reflected by lower Herfindahl-Hirschman Index (HHI) values improves profitability aligns with previous studies in emerging markets, which highlight diversification as a risk-mitigating mechanism [3], [13]. In the context of ASEAN banking, this result reflects the growing complexity of financial operations and the increasing strategic importance of risk distribution across sectors.

The study also confirms that bank size plays a moderating role in the diversification profitability relationship. The negative and statistically significant interaction term between HHI and the logarithm of total assets suggests that as banks become larger, the positive impact of diversification on profitability diminishes. This is consistent with the findings of Sharma et al. [15] and Le-Bao [18], who argue that larger banks, while equipped with greater resources, may also face higher coordination costs and inefficiencies in managing diversified credit portfolios. In essence, beyond a certain scale, the marginal benefit of diversification is offset by institutional complexity.

This moderation effect has meaningful implications for strategic management in banks. For small and medium-sized banks, the results indicate that diversification could be pursued as a viable strategy to improve risk-adjusted performance. However, for larger banks, the findings caution against excessive reliance on diversification without corresponding improvements in governance and operational efficiency. This resonates with Dahlan et al. [28], who emphasize the importance of strategic resource investment to counteract potential inefficiencies in large-scale banking operations.

Interestingly, the findings are consistent with behavioral insights into bank size and risk preferences. As Trichilli et al. [21] and Kim & Kim [30] observe, larger banks tend to be more risk-averse, adopting defensive strategies that may dampen their responsiveness to diversification opportunities. In contrast, smaller banks, despite being more vulnerable, may derive more immediate benefits from spreading credit exposures, particularly in volatile environments.

The insignificant effect of liquidity on profitability deserves further reflection. It suggests that holding higher levels of liquid assets does not automatically translate into higher returns. This might stem from inefficiencies in the allocation of excess liquidity or from conservative lending behavior during uncertain periods. These findings echo those of Wahidudin et al. [29], who indicate that liquidity levels must be aligned with credit planning to yield performance benefits.

Moreover, the positive and significant effect of capital adequacy reinforces the idea that stronger capital positions enhance bank resilience and support more profitable operations. This is consistent with Saona & Azad [26] , who argue that well-capitalized banks are better positioned to absorb shocks and exploit growth opportunities. In contrast, credit risk, although negative in sign, is statistically insignificant. This may indicate that banks have managed non-performing loans within acceptable thresholds, or that credit risk is already internalized in other explanatory variables such as diversification and capital.

The macroeconomic control variable GDP growth also shows a statistically significant and positive relationship with ROA, reaffirming that economic expansion creates favorable conditions for bank profitability. This finding supports earlier research by Mongid & Tahir [31] and Saif-Alyousfi [32], which highlight the sensitivity of bank performance to business cycles. Conversely, inflation does not significantly affect ROA, which may reflect the ability of banks to adjust interest margins in response to inflationary pressures.

Notably, the results fill a research gap in the literature on Southeast Asian banks. As highlighted by prior scholars [8], [9], the effect of diversification on performance has been inconclusive and context-dependent. This study contributes to resolving this ambiguity by explicitly modeling the moderating role of size and by using a robust sample of banks across multiple ASEAN countries. The cross-national design enhances the generalizability of findings while capturing the diversity of banking structures in the region.

These findings also carry policy implications. Regulators and central banks should recognize the heterogeneous impact of diversification strategies across bank sizes. Policies promoting sectoral diversification should be complemented with prudential standards and capacity-building efforts, particularly for smaller banks. Furthermore, regulatory frameworks should support flexible capital requirements that reflect the risk profiles and diversification practices of banks, in line with Basel III principles.

In summary, this study provides empirical support for the strategic use of credit portfolio diversification to enhance bank profitability in ASEAN. However, it also underscores the need to tailor such strategies to bank-specific characteristics, especially size. While diversification remains a valuable tool in financial management, its effectiveness is not uniform and requires careful implementation guided by internal capabilities and market conditions.

CONCLUSION

This study investigates the relationship between credit portfolio diversification and bank profitability in ASEAN commercial banks, with a particular focus on the moderating effect of bank size. Drawing on panel data from 56 banks between 2017 and 2023, the empirical analysis reveals that credit diversification measured by the Herfindahl-Hirschman Index significantly and positively influences profitability, as proxied by Return on Assets (ROA). This finding supports the theoretical expectation that diversification reduces concentration risk, thereby stabilizing income and enhancing performance.

Importantly, the study identifies bank size as a significant moderator in this relationship. The negative interaction between diversification and bank size suggests that the benefits of diversification diminish as banks grow larger. This may result from increased operational complexity, coordination challenges, and scale diseconomies in larger institutions, highlighting the importance of strategic alignment between diversification efforts and bank-specific characteristics.

The robustness of these findings is confirmed through alternative model specifications and diagnostic checks, which consistently uphold the significance and direction of key variables. Control variables such as capital adequacy and GDP growth also show significant and expected effects, further validating the model. These results contribute to the academic discourse on risk management and bank performance, particularly in emerging market contexts. From a practical standpoint, they underscore the importance of tailoring diversification strategies to bank size and internal capacities. Policymakers are encouraged to design regulatory frameworks that not only promote diversification but also support institutional adaptability across different bank sizes. Overall, this research advances understanding of how strategic asset allocation interacts with organizational scale to drive financial performance in the ASEAN banking sector.

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