Non- interest income and bank performance in Malaysia: The role of bank size for sustainable growth

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ABSTRACT

This research examines the effect of non-interest income on banks' performance in Malaysia, focusing on how diversification affects banks of different sizes. The study utilized a balanced panel data set of 14 commercial banks from 2008 to 2023 and employed panel Autoregressive Distributed Lag (ARDL) methodology, using Pooled Mean Group (PMG) to identify how income diversification influences bank performance across various bank sizes in Malaysia. The findings reveal that large banks benefit from non-interest income in both the short and long term, whereas small banks still depend on traditional banking in the long term. The reliance of small banks significantly affects the overall performance of the banking sector in Malaysia. It is recommended that regulators create a supportive framework for smaller banks to diversify into non-interest income activities, especially incorporating fintech, which has driven innovation in the financial industry. The study also highlights the regulator's role in promoting non-interest-based revenue by encouraging industry players to adopt fintech innovations. This will help improve the stability and performance of Malaysia's overall banking sector, equipping banks to face future challenges.

Contribution/ Originality: No existing local research in Malaysia has empirically explored the link between non-interest income and bank performance while also considering the moderating effect of bank size. This study fills that crucial gap, offering a novel and significant contribution to the literature.

1. INTRODUCTION

The banking sector is essential for the economic growth of any country, acting as the main channel for financial intermediation. Banks generate revenue primarily from lending activities and capital mobilization. Increasing competition from domestic and international financial institutions, coupled with technological advancements and evolving customer demands, has compelled banks to seek revenue sources beyond traditional banking (Karimli & Bulut, 2024). By expanding into areas such as insurance, wealth management, foreign exchange, and other services, banks can generate non-interest revenue such as fees, commissions, and trading profits, providing stable financials and helping them manage economic uncertainties (Ho, Nguyen, Luu, Le, & Ngo, 2023). This diversification into non-interest income has become a vital strategy for the sustainability of the banking industry. The Bank Negara Malaysia (BNM) Financial Stability Report for the second half of 2023 revealed an 8.8% decline in net interest revenue for Malaysian banks, which has been offset by a 7.9% increase in non-interest revenue, driven mainly by trading and investment income. Figure 1 provides a visual representation of the non-interest income trend.
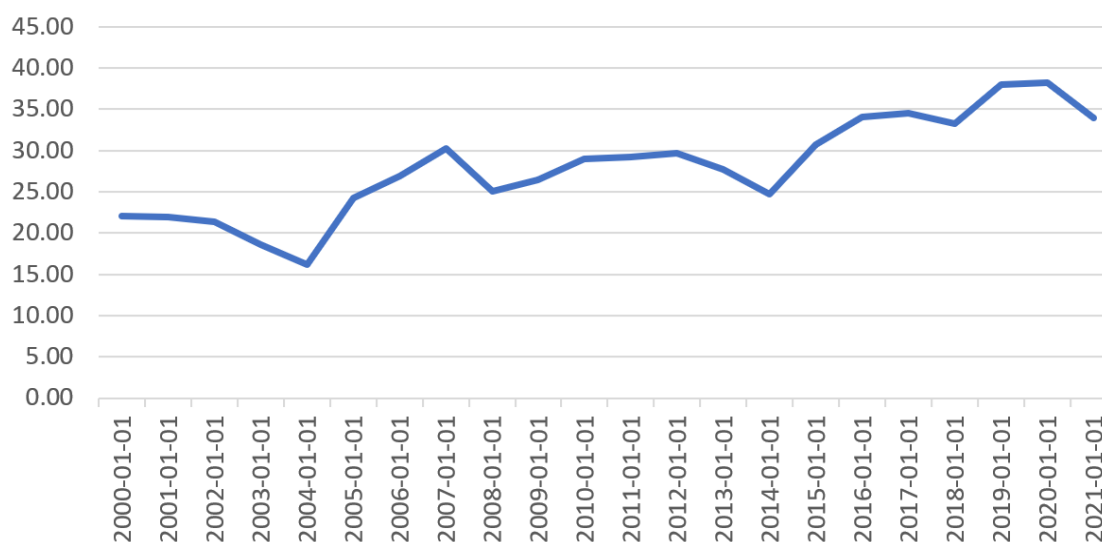
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Figure 1. Malaysian banks non-interest income percentage to total income.

Source: World bank: (http://fred.stlouisfed.org).

According to Asif and Akhter (2019) non-interest revenue can improve the performance of the bank, but its impact depends on the size of the financial institution. Since banks vary greatly in size and operational scope, understanding how income diversification strategies differ across banks of varying sizes is crucial. A recent study by Šeho, Bacha, and Smolo (2024) found that moderate non-interest income enhances the stability of conventional banks, but it did not address variations in bank size or other factors that could influence the performance of the bank. Similarly, a study by Bogari (2024) in the MENA region concluded that fee income and trading income provide stability to banks compared to those relying solely on interest income, assuming all banks share similar characteristics. However, since banks differ in size, business models, and market focus, a more detailed analysis is needed. The relationship between bank size and non-interest income remains underexplored, prompting this study to focus on examining its impact across the entire Malaysian banking industry, as well as specifically for large and small banks.

The outcome of this research provides valuable insights for banks to understand non-interest income and its impact on bank performance. The findings will be essential for banks and industry players in implementing strategies to utilize their non-interest income activities effectively. Given the variation in how bank size affects performance in Malaysia, both banks and regulators may need to adopt more tailored policies for the banking sector instead of a one-size-fits-all approach. Using the PMG estimator within the panel ARDL framework, this study reveals that non-interest income is advantageous for larger banks in both the short and long term, while smaller banks in Malaysia continue to rely predominantly on interest income. The contributions of this study to the existing body of knowledge are evident in the following aspects. First, many studies have analyzed income diversification and bank performance from a general perspective, but very few have focused on how bank size relates to income diversification and its contribution to bank performance. Furthermore, the present study contributes to the existing research among Malaysian banks by Brahmana, Kontesa, and Gilbert (2018), analyzing the relationship between the size of Malaysian banks and income diversification. This will provide further clarity on the types of banks that should focus on diversification to gain maximum benefits. To the best of our knowledge, the present study is the first in Malaysia regarding bank size and income diversification. Second, according to the authors' knowledge, most previous studies have analyzed the impacts of diversification only in the long term, with short-term effects being overlooked. The present study covers the short-term impact of diversification, and the findings will be beneficial for banks to implement appropriate strategies accordingly in the short term as well. Third, the present study explores the potential of non-interest income as a tool to enhance banks' performance, particularly in situations where core interest income is under pressure due to external shocks such as economic downturns, reductions in interest rates, regulatory changes,

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etc. The present study found that non-interest income is beneficial for large banks in Malaysia, and these types of banks can focus more on non-interest income businesses whenever their interest income is affected by external shocks. The present study is more specific in identifying the use of non-interest income as a buffer against the volatility of interest income compared to existing literature (Ho et al., 2023; Moudud-Ul-Huq, Zheng, Gupta, Hossain, & Biswas, 2023). The upcoming section includes a literature review, research methodology, and research findings, followed by a conclusion.

2. LITERATURE REVIEW

2.1. Theoretical Underpinning

The financial intermediation theory is the dominant theory in banking, which posits that financial institutions collect deposits and lend out funds, playing a key role in the economy by channeling money from surplus units to deficit units (Casu, Philip, & Claudia, 2016). This process is based on information asymmetry, where banks have more market and borrower information than individuals. Traditionally, banks used deposits to create loans and manage risk. With financial innovations, banks now offer products like futures, options, and insurance, generating income from both interest and non-interest sources. Balancing these income types is key to bank performance.

Most of the existing studies have used Markowitz (1952) modern portfolio theory (MPT) to demonstrate how generating income from non-interest activities can reduce risk and enhance performance (Antao & Karnik, 2022; Ashraf & Nazir, 2023; Phan, Nguyen, & Hoang, 2022; Wang & Lin, 2021). The theory suggests that offering a variety of products reduces income volatility and increases profitability (Stiroh & Rumble, 2006). MPT suggests that banks can reduce financial risk and enhance performance by engaging in a mix of activities that generate interest revenue and non-interest revenue. The efficient frontier concept highlights the optimal mix of these revenues, maximizing returns for a given level of risk. The portfolio that falls on the efficient frontier is the best combination that provides the greatest return with the lowest risk (Aarflot & Arnegard, 2017).

This study aims to explore the impact of non-interest revenue on risk-adjusted bank performance in Malaysia, focusing on overall commercial banks, large banks, and small banks. To optimize returns and mitigate risk, banks with significant non-interest income should seek an optimal balance between interest and non-interest income, drawing on the Efficient Frontier concept from modern portfolio theory. If non-interest income is not significant, banks should concentrate on their core product, lending, which aligns with Financial Intermediation Theory.

2.2. Bank Performance and Non-Interest Income

Research on non-interest income and bank performance yields three main conclusions: some studies found it to be unbeneficial and to favor traditional banking activities, some concluded it improves profitability and reduces risk through diversification, while others show no clear or consistent relationship.

A study conducted by Nguyen (2019) among Vietnamese banks revealed that diversification had a negative effect on profitability. The researcher cited structural challenges, such as regulatory and economic constraints, hindering the adoption of diversified revenue models in Vietnam's banking environment. The study recommends increased investment in digital services like e-banking to modernize revenue streams in Vietnam's banking industry. Another study among conventional banks and Islamic banks in Gulf Cooperation Council Countries (GCC) by AlKhouri and Arouri (2019) found that revenue diversification negatively affects performance but improves stability for Islamic banks. However, non-interest revenue among GCC countries shows a negative relationship with performance, indicating inefficiencies or higher risks in these activities for GCC banks. There are several other studies that align with the negative effect of revenue diversification on performance, such as the study by Ashyari and Rokhim (2020) among Indonesian banks and the study by Duho, Onumah, and Owodo (2020) among banks in Ghana. The negative impact of diversification on bank performance could be due to various reasons, such as operational complexity, excessive diversification leading to inefficiencies, regulatory scrutiny, and the local interest rate environment.

On the contrary, there are many existing studies that reveal that non-interest revenue positively impacts bank performance, such as the study by Chandramohan and Lunawat (2022), which found that diversification among Indian banks, particularly through commission income, has a significant positive effect on stability, but the impact of trading income is less consistent. This is aligned with the latest study by Ho et al. (2023) among 1,231 banks in 90 countries that found a positive correlation of fee-based revenue, trading revenue, and forex revenue with bank performance. This evidence indicates that each component of non-interest revenue has different impacts on performance. A comprehensive study conducted across 14 Asia Pacific countries by Wang and Lin (2021) revealed non-interest impacts observed in both emerging nations and developed nations. The study indicates that non-interest income enhances stability and profitability in emerging markets such as Malaysia and Thailand, but has limited impact in developed countries like Australia and Japan. In emerging economies, the benefits are greater due to the relatively recent development of non-interest income, whereas in developed economies, the impact is minimal. Many studies suggest that banks can improve their performance through diversification (Addai, Tang, & Agyeman, 2022; Ammar & Boughrara, 2019; Ashraf & Nazir, 2023; Karimli & Bulut, 2024). Non-traditional banking activities enable banks to distribute risk across various sectors and asset classes, which enhances their ability to withstand economic downturns and ensures more stable performance (Ho et al., 2023). Positive impacts of non-interest activities could be because they reduce reliance on a single income source of interest revenue, making banks less vulnerable to interest rate fluctuations. Well-diversified banks can also improve performance through cross-selling opportunities.

Finally, some existing studies have found that non-interest income is ambiguous or that there is no definitive relationship between non-interest income and bank performance. For example, Baek, Lee and Mohanty (2018) in their research among Korean banks, find no substantial performance benefits from diversification into non-interest revenue activities because expenses associated with it often offset any potential revenue gains. Similarly, a study by Moudud-Ul-Huq et al. (2023) discovered that non-interest income among South African banks provides no tangible benefits. Non-interest revenue does not provide any benefits if there is a positive correlation between interest revenue and non-interest revenue (Karkowska, 2019).

Table 1 presents various studies examining the link between non-interest revenue and bank performance across diverse regions and timeframes. The mixed findings in studies examining non-interest income and bank performance could arise from various factors, such as variations in methodologies, complexities of banking operations, bank size, the nature of non-interest revenue products, economic conditions of the country, regulatory differences, and cost implications.

Table 1. Summary of past studies on non-interest impact on bank performance.

No	Author	Sample	Period of study	Key findings
1	Šeho et al. (2024)	24 conventional & 18 Islamic banks in Malaysia	2003-2019	Moderate diversification into non-interest income improves stability for conventional banks, while there are no impacts on Islamic banks.
2	Karimli and Bulut (2024)	25 banks in Turkey	2002-2022	Non-interest income boosts profitability but can increase risks if over-relied upon.
3	Bogari (2024)	136 banks in 14 MENA countries	2005-2021	Stability in the MENA region is enhanced by diversification, but only up to a certain threshold.
4	Hendra and Bustaman (2024)	62 commercial banks in Indonesia	2015-2022	Non-interest income enhances stability for smaller banks in Indonesia.
5	Tang, Hu, Corbet, Hou, and Oxley (2024)	101 banks in China	2011-2021	Development of financial technology helps to increase banks' non-interest income among Chinese banks.

No	Author	Sample	Period of study	Key findings
6	Ho et al. (2023)	1,231 banks in 90 countries	2018-2021	Fee-based services reduce the adverse effects on bank performance during COVID-19.
7	Nguyen, Tran, and Pham (2023)	23 commercial banks in Vietnam	2012-2020	Larger banks in Vietnam have a more significant impact on income diversification.
8	Ashraf and Nazir (2023)	20 Pakistani commercial banks	2007-2020	Non-Interest revenue enhances RAROA of banks in Pakistan especially larger banks.
9	Phan, Pham, Le, and Lam (2022)	36 banks ASEAN countries	2008 – 2020	In ASEAN countries, non-interest income generally harms bank performance. However, it becomes positive if total non-traditional activities are less than 59.3% of total income.
10	Phan et al. (2022)	29 Vietnamese banks	2010-2020	Non-interest income, credit activity scale, and management efficiency significantly affect the performance of Vietnamese banks.
11	Antao and Karnik (2022)	Banks in 24 Asian countries	1996-2018	Non-interest income increases bank risk.
12	Benjakik and Habba (2021)	390 African banks	2012-2019	For African banks, particularly larger ones, diversifying income streams leads to better performance.
13	Quyen, Ha, Darsono, and Minh (2021)	29 Vietnam banks	2005-2018	Non-interest income benefits banks in Vietnam, particularly larger and state-owned banks, during periods of crisis.
14	Olalere, Islam, Marniati, and Rahmi (2021)	26 Malaysian and Nigerian banks	2009-2017	In Nigeria, non-interest revenue contributes to stability, but it does not impact Malaysian banks.
15	Wang and Lin (2021)	14 Asia pacific countries	2001 – 2016	Diversification decreases bank risk in emerging countries, whereas it does not have any significant impact in developed countries.

2.3. Bank Performance and Other Variables

Existing research has incorporated several variables that influence bank performance in addition to non-interest income, such as equity ratio, loan ratio, and asset growth, to provide a more thorough analysis.

The first is the equity ratio, which is a financial measure indicating how much of a bank's total assets are funded by its own capital. This ratio reflects the financial stability and solvency of a bank, demonstrating its capacity to absorb losses with its own capital.

Numerous studies worldwide support the positive relationship between equity capital and bank profitability. Examples include research conducted in Pakistan (Ismail, Ahmad, Hanif, & Choudhary, 2020), MENA countries (Ammar & Boughrara, 2019), and Vietnam (Nguyen, 2019). In contrast, there are several studies that found a negative correlation between equity capital and bank performance. For example, research by Sun, Wu, Zhu, and Stephenson (2017) on commercial banks in China and another study by among banks in Nepal.

The next control variable identified in the present study is the loan ratio, which is closely linked to bank performance. The loan ratio is a key indicator of a bank's lending activities, which are the principal activities of banks that contribute to interest income.

Higher loans from banks can lead to an increase in the bank's revenue, but they also raise the financial risk of the bank. For example, studies among banks in Pakistan by Ismail et al. (2020) and among Indian banks by Vidyarthi (2020) found that lending increases the profitability of banks. In contrast, some banks may adopt a conservative

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approach with lower loans, which is safer for the bank but may result in lower overall returns. This is evidenced by a study of banks in Nepal, which found that higher loans negatively impact bank performance in Nepal.

The third control variable in the present study is the asset growth of the banks, which reflects the banks' expansion. Bank assets consist of various items such as loans, cash, and different financial instruments. Consequently, higher asset growth often contributes to improved financial performance. Many studies highlight a positive relationship between asset growth and bank profitability (Ammar & Boughrara, 2019; Gueyié, Guidara, & Lai, 2019).

2.4. Non-Interest Income and Bank Size

Bank size, defined by total assets, is a key metric in the financial sector. Larger banks benefit from a larger asset base, lower fees for customers, and economies of scale advantages. Furthermore, larger financial institutions often wield greater influence in financial markets and are better positioned to offer a variety of products and services, thereby attracting a broader customer base. Numerous studies have established that bank size is a pivotal determinant of bank performance (Ali & Khattak, 2020; Ashyari & Rokhim, 2020; Buyuran & Ekşi, 2020; Ismail et al., 2020; Nguyen, 2019).

A notable gap in the existing research is the relationship between bank performance and income diversification, with a limited number of studies focusing on bank size. For example, a study by Nguyen et al. (2023) among commercial banks in Vietnam concluded that non-interest income is beneficial for large banks in Vietnam. The study further explained that this benefit for large banks is due to various advantages they possess in the industry, such as a large customer base, brand recognition, and strong capital.

Similarly, another detailed study of 390 banks in African countries found that non-interest income increased the performance of the large banks under study (Benjakik & Habba, 2021). Contrarily, non-interest income benefits smaller banks in Indonesia (Hendra & Bustaman, 2024). The study found that smaller banks in Indonesia are focusing on non-interest income to maintain stability, while large banks in Indonesia are focusing on interest income activities, as interest rates in Indonesia are higher compared to other Asian countries.

There is a significant gap in existing studies analyzing how bank size impacts the relationship between non-interest income and its performance.

Therefore, this area requires further research to identify the effects on bank performance. Building on these findings, the current study separates the sample based on size to examine the specific effects of non-interest income on each group.

3. RESEARCH METHODOLOGY

3.1. Data

This empirical study analyzes a panel dataset of Malaysian commercial banks from 2008 to 2023, covering a 16-year period with a total of 210 observations. This dataset includes key financial indicators from all commercial banks in Malaysia. Two criteria were used to determine the sample period: i) the availability of consistent data over 16 years and ii) the accessibility of data relevant to the variables of the study. However, the decision to exclude data prior to 2008 was driven by limitations in the availability and consistency of the required data for earlier years, ensuring that the analysis is based on the most accurate and consistent data.

The data was obtained from Thomson Reuters' DataStream and Eikon databases, which are considered reliable and accurate. The study includes 14 banks, representing the majority of the commercial banking sector in Malaysia. In 2023, the total assets of Malaysian commercial banks amounted to RM 3.453 trillion (CEIC Data, 2024), with the 14 selected banks holding RM 3.262 trillion, or 94% of the sector's total assets, making them a strong representative sample for the study. The 14 banks in the study are categorized based on asset size, where large banks are those in the top 75% of total assets, while small banks fall within the bottom 25%, as shown in Table 2. This categorization of banks by size is based on the criteria used in studies by Karkowska (2019) and Mndeme (2015).

Table 2. Classification of banks in Malaysia.

No	Name of bank	Asset size (RM) in million	Percentage (%)	Type of banks	Top 70% and bottom 30% assets
1	Malayan Banking Berhad	1,027,674	31.49%	Large banks	Comprises the top 76.47% of the total assets selected in this study.
2	CIMB Bank Berhad	628,230	19.26%		
3	Public Bank Berhad	510,597	15.65%		
4	RHB Bank Berhad	328,692	10.07%		
5	Hong Leong Bank Berhad	279,850	8.58%	Small banks	Comprises 23.53% of the total assets selected in this study.
6	Ambank Berhad	136,855	4.2%		
7	OCBC Bank (Malaysia) Berhad	97,951	3%		
8	Affin Bank Berhad	105,247	3.23%		
9	Alliance Bank Malaysia Berhad	66,311	2.03%		
10	MUFG Bank Malaysia Berhad	35,069 16,425.4	1.07%		
11	Bank of China (Malaysia) Berhad	16,425.4	0.5%		
12	HSBC Bank (Malaysia) Berhad	12,314.8	0.39%		
13	Deutsche Bank (Malaysia) Berhad	13,033	0.4%		
14	Bangkok Bank Berhad	4,309	0.13%		

3.2. Variables of the Study and Model Specification

Table 3 shows the variables used in the present study, highlighting the measurement techniques and the specific aspects each variable is designed to evaluate.

Table 3. Variables Specification.

Variables	Measurement	Measures	Expected sign.	Reference
Risk-adjusted return on assets (RAROA)	Return on assets (ROA) over the standard deviation of ROA	Measures the stability of banks' return on assets.		Chiorazzo, Milani, and Salvini (2008)
Risk-adjusted return on equity (RAROE)	Return on equity (ROE) over the standard deviation of ROE.	Measures the stability of returns to the shareholder.		Chiorazzo et al. (2008)
Diversification index (HHI)	$HHI = (NII /NOI)^2 + (NON/NOI)^2$ NII = Net interest income NON = Non-interest income NOI = Net operating income	Assesses the level of diversification in the bank (with a value of 1 or 0 indicating the lowest level of diversification, and a value of 0.5 representing perfect diversification).	(+)	Brahmana et al. (2018); Ashyari and Rokhim (2020) and Ho et al. (2023)
Capital adequacy ratio (CAR)	Total shareholders' equity over total assets (Equity / Total assets)	Measures the bank's capital size in relation to risk-weighted assets, reflecting its ability to absorb losses.	(+)	AlKhouri and Arouri (2019); Baek et al. (2018); Liang, Kuo, Chan, and Chen (2018) and Ashraf and Nazir (2023)

Variables	Measurement	Measures	Expected sign.	Reference
Loan ratio	Total outstanding loans over total assets (Total loans/Total assets)	Evaluates the proportion of loans (as a percentage) relative to the bank's total assets.	(+)	Ismail et al. (2020); Edirisuriya, Gunasekarage, and Perera (2018); Ashraf and Nazir (2023) and Isshaq, Amoah, and Appiah-Gyamerah (2019)
Asset growth	(Asset in one year – asset in previous year) / Asset in previous year * 100	Tracks the bank's asset growth on an annual basis.	(+)	Ashyari and Rokhim (2020); Paltrinieri, Dreassi, Rossi, and Khan (2021); Ferreira, Zanini, and Alves (2019) and AlKhouri and Arouri (2019)

Our model is based on the research of Brahmana et al. (2018), where bank performance is determined by the diversification index (HHI), capital adequacy ratio (CAR), loan ratio (LR), and asset growth (AG). A significant number of studies have incorporated both bank-specific and external control variables to assess the impact of diversification on bank performance. The inclusion of control variables is essential, as the primary independent variables may not fully account for all external factors that influence the dependent variables (Aarflot & Arnegard, 2017). Consequently, the present study incorporates three key bank-specific control variables: equity ratio, loan ratio, and asset growth. To empirically estimate this model, we pooled all sample banks and estimated the following regression model.

$$Performance = f(HHI, CAR, Loan\ Ratio, Asset\ GRowth) \qquad (1)$$

$$Performance_{It} = \beta_0 + \beta_1\ HHI + \beta_2\ CAR_{It} + \beta_3\ Loan\ Ratio_{It} + \beta_4\ Asset\ Growth_{It} \qquad (2)$$

Where performance $_{It}$ is bank performance of a bank I in time t.

The core focus of this study is HHI, which indicates the diversification of banks into non-interest income businesses. This study will further run regression models to examine the impact of HHI on all banks, large banks, and small banks in Malaysia separately. For robustness, this study employs two performance measurements, which are RAROA and RAROE.

3.3. Methodology

This study uses the ARDL bounds testing approach introduced by Pesaran, Shin, and Smith (1999) and Pesaran and Smith (1995) to investigate the relationship between HHI, loan ratio, CAR and asset growth with bank performance. It involves modeling dynamic relationships in panel data, where multiple bank entities are observed over time. It incorporates both lagged dependent and independent variables to capture short-term dynamics and long-term relationships between variables. The methodology allows for heterogeneous effects across banks, making it suitable for situations where individual bank differences exist. Panel ARDL can handle variables that are integrated of different orders (Pesaran et al., 1999). The ARDL model allows for the modeling of both short-run and long-run relationships. The ARDL method is valuable because, unlike traditional estimation techniques, it enables the examination of how variables adjust to both short-run and long-run equilibrium (Zardoub, 2023). To determine the long-run and short-run consequences of HHI and other independent variables on bank performance, PMG was utilized. In the PMG estimator, the assumption is that the long-run coefficients are the same across all cross-sectional units of banks, but the short-run dynamics can vary. This allows for heterogeneity in the short run (different responses for each bank) but homogeneity in the long run (same coefficients for all cross-sectional units). Here are the short-run dynamics (captured by first-differenced terms) and long-run equilibrium relationships (captured by lagged levels of the variables).The PMG estimator is considered the most effective approach by Asteriou, Pilbeam, and Pratiwi (2021) because it uniquely permits banks to have different short-run reactions while maintaining a

uniform long-run relationship. This method is particularly useful for datasets with a small number of entities, such as the 14 banks examined here.

Thus, Equation 3 as follows was estimated.

$$\Delta \text{Performance}_{it} = \beta_0 + \sum_{k=1}^{p} \beta_{1k}\Delta \text{HHI}_{it-k} + \sum_{k=1}^{p} \beta_{2k}\Delta \text{CAR}_{it-k} + \sum_{k=1}^{p} \beta_{3k}\Delta \text{Loan Ratio}_{it-k} + \sum_{k=1}^{p} \beta_{4k}\Delta \text{Asset Growth}_{it-k} + \lambda_1 \text{Performance}_{i,t-1} + \lambda_2 \text{HHI}_{i,t-1} + \lambda_3 \text{CAR}_{i,t-1} + \lambda_4 \text{Loan Ratio}_{i,t-1} + \lambda_5 \text{Asset Growth}_{i,t-1} + \alpha_i + \epsilon_{it}$$

(3)

Where:

- Δ represents the first difference (Captures short-term changes).
- $\sum_{k=1}^{p}$ represents the lag of each variables (For both dependent and independent variables
- The lagged terms of the dependent variable (Performance $_{i,t-1}$) and independent variables (HHI, CAR, Loan Ratio, Asset Growth) capture the long-run effects.
- $\lambda_1, \lambda_2, \lambda_3, \lambda_4, \lambda_5$ are the long run coefficient that represent the long-term equilibrium relationship between the dependent and independent variables. All $\lambda_1, \lambda_2, \lambda_3, \lambda_4, \lambda_5$ are assumed to be the same for all cross-sectional units of banks
- Short-run coefficients (e.g., β1k, β2k, β3k, β4k) allow heterogeneity across banks in how they respond to changes in the independent variables.
- The fixed effects α_i account for individual-specific characteristics that are constant over time (e.g., unobserved factors specific to each bank).
- ϵ_{it} The error term captures unobserved shocks or factors that influence performance but are not included in the model.

Table 4. Descriptive analysis for all commercial banks, large banks and small banks in Malaysia.

Variables	Number of observations	Mean	Standard deviation	Minimum	Maximum
RAROA	210	3.793	2.21636	−3.333	10
RAROE	210	2.875	1.6598	−1.788	7.8737
HHI	210	0.537	0.0897	0.1973	0.79
CAR	210	0.122	0.1054	0.01	0.95
Loan ratio	210	1.321	5.9776	0.0630	55.81
Asset growth	210	0.154	0.6869	−0.3406	7.36
Panel B – Large banks	Number of observations	Mean	Standard deviation	Minimum	Maximum
RAROA	60	4.198	1.2149	0.5714	6.25
RAROE	60	3.185	1.0403	0.5145	5.1829
HHI	60	0.527	0.1011	0.4999	0.7063
CAR	60	0.983	0.1011	0.01	0.86
Loan ratio	60	0.685	0.6595	0.5787	0.7964
Asset growth		0.084	0.0580	0.0273	0.3412
Panel C – Small banks	Number of observations	Mean	Standard deviation	Minimum	Maximum
RAROA	150	3.631	2.4926	−3.33	10
RAROE	150	2.752	1.8390	−1.788	7.8737
HHI	150	0.541	0.1038	0.1973	0.79
CAR	150	0.131	0.1058	0.5132	0.95
Loan ratio	150	1.570	7.0633	0.6309	55.81
Asset growth	150	0.183	0.8109	−0.3406	7.36

The Panel ARDL method offers several advantages, including its ability to capture both short-term and long-term effects by incorporating lagged dependent and independent variables. The ARDL approach addresses endogeneity issues and allows us to estimate how things change over time, providing a robust framework for analyzing panel data. This method takes into account individual heterogeneity of banks, and it is suitable even for research with a small sample size (N<50). Panel ARDL is an effective and efficient method compared to the various

traditional panel methods. It has the capability of handling different integrated orders, modelling both short-term and long-term relationships, and providing robust results even with a small sample size. Therefore, according to Ramos-Herrera and Prats (2020) and Nguyen (2019), ARDL methodology has been widely used, and its effectiveness has been proven in recent research.

4. RESEARCH FINDINGS

Table 4 presents descriptive statistics for two dependent variables, RAROA and RAROE, across three distinct panels. The average HHI values (0.537 for all banks, 0.527 for large banks, and 0.541 for small banks) and low standard deviations for all three panels indicate that Malaysian banks are moderately concentrated in both interest income and non-interest income businesses. The HHI values across the three panels suggest that the Malaysian banking sector is moderately concentrated, with no extreme concentration in a single type of business. Both large and small banks in Malaysia exhibit similar patterns, focusing on both interest activities and non-interest income activities.

The correlation analysis in Table 5 confirms that there are no multicollinearity issues, as the correlation coefficients among the independent variables (HHI, CAR, loan ratio, and asset growth) are all well below 0.7, indicating that these variables are not highly correlated with each other. Specifically, RAROA and RAROE show a negative correlation with CAR across all three panels, suggesting that higher CAR tends to reduce bank performance, regardless of the bank's size. Additionally, the correlation between HHI and RAROE is negative for both all banks and small banks, implying that diversification of banking operations results in lower profitability. However, for large banks, the correlation between HHI and RAROE is minimal and positive, indicating little to no significant relationship. In contrast, the relationship between HHI and RAROA is very weakly positive across all panels, suggesting that diversification into non-interest revenue has a minimal effect. Overall, HHI does not exhibit a strong or consistent impact on bank performance, with other factors likely playing a more significant role in shaping bank performance.

Table 5. Correlation results for all commercial banks, large banks and small banks in Malaysia.

Variables	RAROA	RAROE	HHI	CAR	Loan ratio	Asset growth
Panel A – All banks						
RAROA/RAROE	1.0000	1.0000				
HHI	0.0013	-0.1887	1.0000			
CAR	-0.1527	-0.1646	0.1186	1.0000		
Loan ratio	0.0778	-0.1135	-0.2273	-0.0010	1.0000	
Asset growth	0.0485	-0.0784	-0.0294	-0.0251	0.6221	1.0000
Panel B- Large banks						
RAROA/RAROE	1.0000	1.0000				
HHI	0.0349	0.0409	1.0000			
CAR	-0.3089	-0.3172	0.2795	1.0000		
Loan ratio	0.2825	-0.0969	-0.1442	-0.1124	1.0000	
Asset growth	0.2271	0.4530	0.0181	-0.2074	-0.2786	1.0000
Panel C – Small banks						
RAROA/RAROE	1.0000	1.0000				
HHI	0.0080	-0.2003	1.0000			
CAR	-0.1120	-0.1182	0.0961	1.0000		
Loan ratio	0.0899	-0.1129	-0.0328	-0.0123	1.0000	
Asset growth	0.0561	-0.0830	-0.0351	-0.0352	0.6228	1.0000

Table 6. Stationary test for all variables.

Variables	PP Fisher		Levin, Lin and Chu (LLC)	
	At level	At first difference	At level	At first difference
Model 1A (All Malaysian banks)				
RAROE	100.2605***	158.1574***	–1.6024*	–4.4580 ***
	(0.000)	(0.000)	(0.054)	(0.000)
RAROA	132.4452***	214.7910***	–3.0231***	–3.8295***
	(0.000)	(0.000)	(0.001)	(0.000)
HHI	36.5439	156.9033***	–3.9055***	–6.3978***
	(0.1293)	(0.000)	(0.000)	(0.000)
CAR	26.8729	112.2623***	–2.6739***	–5.5398***
	(0.5252)	(0.000)	(0.003)	(0.000)
Loan ratio	60.6344***	222.0824***	–2.7733***	–7.1385***
	(0.000)	(0.000)	(0.002)	(0.000)
Asset growth	95.0010***	282.2840***	–4.3919***	–15.6267***
	(0.000)	(0.000)	(0.000)	(0.000)

Note: The table reports estimation results with ***, * denotes 1% and 10% significance level. The value in parentheses is the p-value of the t-statistic.

Before proceeding with the ARDL model, it is essential to test the stationarity of all relevant variables in this study. Table 6 presents the results of the stationarity tests for all variables concerning Malaysian banks. As shown in Table 7, both HHI and CAR exhibit a unit root at the level for the PP Fisher test. These variables become stationary after the first difference is applied. Therefore, it can be concluded that all the variables under consideration are integrated at level I(0) and at first difference I(1) for the PP Fisher test, whereas all variables are integrated at level for the LLC method, with none of the variables integrated at the second difference. Given that all variables are either stationary or exhibit mixed integration at level I(0) and first difference I(1), the panel ARDL model regression is appropriate for use in this study (Al-Habashneh, Khatatbeh, & Alzubi, 2023; Garidzirai & Muzindutsi, 2020). This method is more appropriate, as it is more efficient and consistent in its ability to reconcile long-term relationships with flexibility for short-term relationships to be bank-specific for each bank (Shaari, Abidin, & Karim, 2020).

Table 7. Estimating result of PMG for Malaysian banks for dependent variable RAROA.

Variables	PMG	
	Long run	Short run
Panel A: All banks		
HHI	–15.4123***	3.7212
	(0.000)	(0.49)
CAR	–1.7521**	–9.9628
	(0.025)	(0.282)
Loan ratio	–0.0966	1.7622
	(0.929)	(0.477)
Asset growth	2.5628***	–0.4095
	(0.006)	(0.811)
Panel B: Large banks		
HHI	38.7030***	7.4637***
	(0.003)	(0.003)
CAR	–17.9334*	30.1671**
	(0.086)	(0.015)
Loan ratio	12.4016***	12.6062
	(0.003)	(0.103)
Asset growth	9.7298***	6.0832***
	(0.003)	(0.000)
Panel C: Small banks		
HHI	–15.7122***	4.3180
	(0.000)	(0.552)
CAR	–1.7325**	–13.2322
	(0.033)	(0.182)
Loan ratio	–0.0289	–0.5618
	(0.98)	(0.849)
Asset growth	2.1877**	–1.5958
	(0.012)	(0.488)

Note: The table report estimation results with ***, **, * denotes 1%, 5% and 10% significance level. The value in parentheses is the p-value of t-statistic.

Panel A of Table 7 presents the results of the PMG estimation for all Malaysian banks, with RAROA as the dependent variable. The results show that CAR negatively affects the performance of all banks in Malaysia in the long run (-1.7521**), suggesting that higher capital reserves are associated with reduced bank performance. Conversely, asset growth has a positive and statistically significant effect in the long run (2.5628***), indicating that asset expansion contributes to improved performance.

However, neither CAR nor asset growth is significant in the short run. Additionally, HHI has a significantly negative impact on bank performance in the long run (-15.4123***), suggesting that banks' efforts to diverge from traditional banking only lead to lower performance, whereas HHI is not relevant in the short run.

The analysis indicates that Malaysian banks reliant on interest-based products contribute positively to their performance. This finding contrasts with a previous study by Brahmana et al. (2018), which employed fixed-effect panel regression and concluded that non-interest revenue enhances bank performance. The discrepancy may be attributed to various factors, including differences in research methodologies, study periods, or external influences such as economic conditions or interest rates.

Additionally, Brahmana et al. (2018) did not examine the impact of diversification by bank size, as their study provided a more generalized view of Malaysian banks. In contrast, the current study specifically addresses this aspect, as shown in Panels B and C of Table 8.

The analysis presented in Panels B and C of Table 8 reveals some intriguing insights based on bank size. For large banks, HHI shows a strong and statistically significant positive effect on RAROA, both in the long run (38.7030***) and short run (7.4637***), with both p-values being significant at the 1% level. In contrast, small banks exhibit a negative and significant long-run effect of HHI (-15.7122***), with no significant effect in the short run. This shows that non-interest income impacts large banks and small banks in Malaysia differently. For large banks, greater diversification enhances their RAROA, reflecting their ability to leverage multiple revenue streams. Unlike large banks, small banks still predominantly rely on traditional banking products, where non-interest income offers fewer advantages.

This finding aligns with studies by Nguyen et al. (2023) on Vietnamese banks, Vidyarthi (2020) on Indian banks, and Ali and Khattak (2020) on Indonesian banks, which similarly found that larger banks benefit from non-interest income in their respective countries. The above results suggest that large banks in Malaysia, such as Maybank, CIMB, Public Bank, and RHB Bank, have broadened their business activities beyond interest income. This diversification helps them maintain consistent performance and balance risks, making them better equipped to handle changing market conditions. Additionally, economies of scale and extensive market reach allow large banks to manage multiple business lines efficiently.

Moreover, the positive short-term impact of diversification on RAROA of large banks could be attributed to synergies across business units, such as cross-selling products and bundling interest-based products with non-interest products. This could be due to bundled marketing by banks, such as interest products being marketed together with credit cards, mutual funds, or insurance, boosting revenues and profitability in the short run. In contrast, small banks face greater challenges with income diversification due to their limited focus on specific areas, such as retail banking or niche markets.

Small banks often lack the scale, resources, and infrastructure required to manage multiple operations effectively. Expanding into new sectors may bring higher costs and risks, and their limited geographic reach and market influence further hinder their ability to diversify. These factors likely explain why small banks remain reliant on traditional interest-based products and services.

Table 8. Estimating result of PMG for Malaysian banks for dependent variable RAROE.

Variables	PMG	
	Long run	Short run
Panel A: All banks		
HHI	–8.0412***	3.4044
	(0.000)	(0.512)
CAR	–6.8586***	–17.497**
	(0.000)	(0.022)
Loan ratio	–0.2190	–0.3776
	(0.202)	(0.832)
Asset growth	0.8863	–0.4840
	(0.492)	(0.598)
Panel B: Large banks		
HHI	35.4362***	5.4622**
	(0.000)	(0.023)
CAR	–15.3864	10.8035
	(0.063)	(0.259)
Loan ratio	16.0492***	7.9999
	(0.000)	(0.255)
Asset growth	8.4177***	4.3686***
	(0.000)	(0.000)
Panel C: Small banks		
HHI	–8.5987***	4.6143
	(0.000)	(0.508)
CAR	–6.6949***	–15.797**
	(0.000)	(0.022)
Loan ratio	–0.1838	–0.9584
	(0.317)	(0.602)
Asset growth	0.6112	–1.0113
	(0.659)	(0.368)

Note: The table reports estimation results with ***, ** denotes 1%, 5% significance level. The value in parentheses is the p-value of the t-statistic.

The PMG estimation results in Panel A of Table 8 reveal that both the HHI and CAR have a negative and significant long-term relationship with RAROE for all banks in Malaysia. Specifically, CAR shows a consistently negative impact on RAROE in both the long run (-6.8586***) and short run (-17.497**), suggesting that higher capital adequacy negatively affects shareholders' return. Similarly, diversification, as indicated by the HHI, is negatively associated with RAROE for all banks in Malaysia in the long run, with strong significance at the 1% level. This implies that, for optimal shareholder returns, Malaysian banks should focus primarily on interest-based products, particularly in the long term, as diversification does not appear to provide the same level of benefit to shareholders.

The detailed analysis based on bank size produced the same results as it gives to RAROA. Panel B reveals that HHI has a significant positive effect on RAROE in both the long run (35.4362***) and short run (5.4622**) for large banks. These findings are consistent with the studies by Nguyen et al. (2023) and Benjakik and Habba (2021), which also found that income diversification is advantageous for large banks. There are several reasons for this, including the ability of large banks to leverage advanced technology to boost non-interest income, their broad and diverse customer base, and more effective management strategies. Additionally, large banks are often pioneers in introducing new products and services, which can lead to more stable and predictable income streams. In contrast, small banks, as shown in Panel C, experience a significant negative impact from HHI in the long run (-8.5987***). This suggests that smaller banks depend on interest-based products. These findings align with those of Sharma and Anand (2018) and Nguyen et al. (2023), who observed similar trends in India and Vietnam, respectively. The continued focus of small banks in Malaysia on interest-based products can be attributed to various factors. Limited resources make it challenging for these banks to diversify, and they often lack the technological infrastructure and expertise required to implement non-interest-based products. Another factor could be the market segmentation of small banks, which primarily serve retail customers and small and medium enterprises (SMEs), while larger banks target a broader

market, including multinational corporations (MNCs) and high-net-worth individuals. These distinctions further explain why diversification may be less impactful for small banks.

The findings clearly demonstrate that diversification benefits large banks in Malaysia, both in the long and short term, while small banks remain heavily reliant on traditional interest-based products and services for their performance. The influence of small banks on traditional businesses is so significant that it skews the overall results for Malaysian banks, suggesting that all banks still largely depend on interest-based activities. In reality, however, large banks are actively diversifying their operations, while small banks continue to focus on traditional income sources. When core income is under pressure, large banks in Malaysia have the flexibility to redirect their resources towards non-interest activities to maintain performance, as found by Ho et al. (2023) during the COVID pandemic. However, it is crucial for banks to maintain a balanced approach between their lending portfolios and non-lending activities to optimize overall performance, in line with Markowitz's Modern Portfolio Theory.

5. CONCLUSION

Regulators play a crucial role in promoting diversification into non-interest revenue streams by encouraging the adoption of digital tools and fintech innovations. The BNM Financial Sector Blueprint 2022-2026 highlights the importance of income diversification, digitalization, and financial well-being for a sustainable economy. The rise of fintech, including mobile banking, e-wallets, and blockchain, is disrupting traditional banking models. In 2022, BNM granted five digital banking licenses, with three now operational, including GX Bank, AEON Bank, and Boost Bank. These digital banks and fintech partnerships create new non-interest income sources and reduce operating costs, helping banks diversify their revenue streams. BNM's support for digitalization and fintech collaboration is vital for facilitating income diversification, particularly for smaller banks in Malaysia. Policy implementation by regulators is crucial in determining the effectiveness of non-interest income. For example, enforcement of the EU's Liikanen Review and Dodd-Frank Act in the USA, which proposed a limit on trading activities in banks, has increased the systematic risk of banks (Engle, Moshirian, Sahgal, & Zhang, 2014). Moreover, the Chinese government's steps to loosen diversification restrictions in 2008 had a significant positive effect on diversification, which later turned into a significant negative relationship with bank performance (Liang et al., 2018). Hence, such blanket regulations on the non-interest income activities of the entire banking industry are not effective. The present findings show that income diversification affects large and small banks differently in Malaysia, suggesting that banks and BNM should tailor their policies to the banks' sizes accordingly. Customized policies addressing each bank's unique characteristics are recommended for the growth and sustainability of the banking sector. Policies implemented by BNM could be more focused on targeted groups rather than a blanket policy for the effective utilization of non-interest income. This study analyzed non-interest revenue generally, without specifically examining its individual components such as fee income, trading income, or others. To gain a more comprehensive understanding, future research should break down these components to assess how each uniquely affects the performance of banks in Malaysia.

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