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Does income diversification reduce banks' risk-taking? The difference between large and small banking groups: Evidence from an emerging country

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Abstract

This paper aims to examine whether income diversification enhances the bank's risk-taking in emerging markets. It analyzes how this relationship varies between different bank sizes. This study utilizes the S-GMM (system Generalized Method of Moments) estimation [1] to conduct panel data regression. Additionally, it follows the framework outlined by Laeven [2] and Wang et al. [3] to categorize banks into large and small based on their average total assets. Large banks are characterized as institutions with total assets exceeding the median value of assets within the banking sector. In contrast, small banks are identified as those with total assets that fall below this median threshold. The empirical results reveal that income diversification negatively affects banks' risk-taking in small banks. Conversely, for large banks, the study shows that income diversification has a positive impact on banks' risk-taking. This study marks the inaugural effort to explore the varying impacts of income diversification on risk-taking behavior among different banking groups in emerging markets. The results may offer valuable insights for researchers, policymakers, and bank managers, enabling them to develop targeted diversification strategies for each banking group to enhance the overall safety of the banking sector in today's competitive environment.

Keywords: Bank's risk-taking, Commercial banking, Income diversification.

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1. Introduction

Bank diversification has been a significant topic of interest for researchers over the years. A primary concern for bankers and policymakers is whether diversification effectively mitigates bank risk, as empirical evidence on this matter has yielded inconsistent findings.

Some studies indicate that income diversification can lower the likelihood of default, particularly among larger banks [4] or within specific emerging markets [5]. There are opposing views regarding income diversification, with some experts

suggesting that it can increase risk due to the fact that a significant portion of funding is not derived from deposits [6]. The objective of income diversification is to enhance bank stability and improve liquidity creation activities [7]. Approach from the perspective of geographical diversification, [8] argues that global expansion generally reduces liquidity, influencing banks' risks [9]. Both strategies present potential advantages and disadvantages concerning bank stability. The discrepancies in conclusions among preceding studies may result from variations in the measurement of diversification [10].

A variety of topics associated with diversification have been examined by researchers in recent years. These include the interactions between diversification and the capital structure of banks [11]; Income diversification for liquidity creation [7, 12]; the role of intellectual capital as a mediating factor in the relationship between diversification, financial stability, and performance within the banking sector [13]; geographical diversification [14]; board gender diversity and financial stability [15]. Furthermore, numerous studies have investigated the relationship between income diversification and bank liquidity creation in developed economies [16, 17].

In Vietnam, the topic of diversification continues to attract the attention of recent researchers. For instance, studies by Le [8] and Van Dan [18] examine the relationship between diversification and monetary policy; [19] focus on diversification in relation to ownership structure; while [20] investigate how diversification impacts business efficiency. Moreover, there are various perspectives on how the unique characteristics of banks such as size, capital, and liquidity tend to evolve and have diverse effects across different groups of banks. Additionally, various perspectives suggest that bank-specific characteristics, such as size, capital, and liquidity, can differ and have varying effects on different categories of banks

First, Khan et al. [21] suggested that the size of a bank and its capital buffers often restrict its capacity to assume higher risks. In contrast, Banna et al. [22] contend that larger banks tend to be more risk-averse, as they typically maintain ample liquidity and can allocate significant capital for diversified activities to minimize costs. Meanwhile, smaller banks may have greater incentives to engage in risk-taking [22]. Second, many contend that banks exhibit varying behaviors depending on their ownership structures, which can influence their risk-taking tendencies [23]. Larger banks, possessing more extensive experience in lending transactions than their smaller counterparts, are more inclined to innovate technologically to enhance lending processes, streamline information transmission, and reduce costs, thereby facilitating ongoing improvements in lending practices. Conversely, smaller banks tend to be slower in their investment in technology and the adoption of technological innovations [24]. This has led to investigations into how various factors influence the relationship between income diversification and banks' risk-taking. Overall, the authors noted that no existing studies have explored the differing effects of income diversification on banks' risk-taking across various bank size categories. As a result, the study outlines policy implications tailored for each group of banks within a competitive framework. Thus, empirical evidence is necessary to clarify this issue. The central hypothesis of this study posits that bank diversification either enhances or diminishes banks' risk-taking.

During the study period, the Vietnamese banking industry experienced significant milestones, particularly evident in the sharp increase in the annual credit growth rate from 2008 to 2012. This was followed by a steep decline due to a surge in problematic debts, with stabilization only occurring in 2017 [18]. In light of the potential for recurring bad debts, the State Bank of Vietnam (SBV) proposed comprehensive reforms aimed at enhancing safety and efficiency in the banking sector. This included a focus on shifting activities toward non-lending banking services. Between 2006 and 2015, the number of banks decreased due to various mergers and acquisitions; however, by 2015, the total number of bank branches had doubled compared to 2006 [8].

The State Bank of Vietnam (SBV) pursues a range of objectives in the execution of its monetary policy, including the management of inflation, the promotion of economic growth, and the maintenance of macroeconomic stability. However, no single main objective is distinctly defined. Furthermore, Vietnam's stock market remains relatively underdeveloped, making the Vietnamese banking system the backbone of the economy, contributing between 16% and 18% to the gross domestic product [8]. In this landscape, traditional lending and deposit markets exhibit strong competition primarily among domestic banks, resulting in fierce rivalry over deposits and loans, which in turn diminishes interest income for these banks. To sustain a stable revenue stream, domestic banks have begun to diversify beyond traditional lending activities into non-traditional pursuits. This shift raises crucial questions about whether such diversification enhances banks' risk-taking. Vietnam offers a significant opportunity for the examination of this critical issue. This study represents the inaugural effort to analyze the varying effects of income diversification on the risk-taking behavior of different banking groups in Vietnam.

This manuscript is organized into five distinct sections. Section 2 provides the theoretical framework. Section 3 delineates the research models and the methodologies employed for variable measurement. Section 4 elucidates the findings of the research. Finally, Section 5 articulates the conclusions drawn from the research and discusses their implications for policy.

2. Theoretical Framework Concerning the Income Diversification and Bank's Risk-Taking

Empirical research has not established a definitive consensus concerning the relationship between income diversification and bank risk-taking. This ongoing uncertainty underscores the need for additional study to better understand the intricacies involved in this relationship.

The perspective that income diversification enhances the bank's risk-taking or that such diversification positively influences the risk tolerance of banking institutions is noteworthy.

Rooted in portfolio theory, which asserts that negatively or imperfectly positively correlated cash flows offer opportunities to enhance risk-return metrics [25], modern portfolio theory provides insights into why banks pursue diversified income streams. This theory suggests that diversification increases business value and mitigates risk in scenarios where asset returns are not perfectly correlated. Consequently, banks can optimize their profits by ensuring that their interest income does

not perfectly align with their non-interest income. Additionally, other factors driving diversification include risk management, operational efficiency and resource exploitation [26].

While income diversification has the potential to improve financial performance for banks, it may also expose them to new risks. Corporate finance theorists maintain that firms should concentrate on specific areas to leverage specialized knowledge and expertise [27]. Numerous empirical studies have been undertaken to evaluate these theories. For instance, Kim et al. [28] illustrate that moderate levels of income diversification enhance bank stability, whereas excessive diversification can undermine this stability in OECD countries, a relationship that exhibits a time-varying trend.

The perspective that income diversification reduces the bank's risk-taking or that income diversification negatively affects the bank's risk tolerance

A study conducted by Abedifar et al. [29] examined the impact of non-interest activities on bank lending across 6,921 U.S. commercial banks from 2007 to 2016. The findings indicated that banks with a higher proportion of non-interest activities tended to have lower credit risk. According to a study by Moudud-Ul-Huq [30], a sample of 1,397 banks across 10 emerging economies from 2007 to 2015 revealed that revenue diversification enhances bank performance and mitigates overall risk. Similarly, Wang and Lin [31] explored the effect of income diversification on bank risk using data from 14 Asia-Pacific economies between 2011 and 2016. Their findings indicated that banks with higher levels of income diversification exhibited lower risk levels. Le and McMillan [32] explored the effects of geographic expansion and income diversification on bank stability, concluding that while geographic expansion enhances bank stability, income diversification tends to have an adverse effect.

In Vietnam, a study conducted by Nguyen [5] investigated the relationship between revenue diversification, risk, and the performance of Vietnamese commercial banks, utilizing a sample of 26 listed and unlisted commercial banks from 2010 to 2018. The study indicates a positive relationship between revenue diversification and the risk-taking behavior of Vietnamese commercial banks. Abbas and Ali [33] examined the impact of income diversification on the risk-taking of U.S. commercial banks from 2002 to 2019 using the GMM technique. Their findings reveal that while income diversification tends to decrease bank stability, asset and capital diversification positively contribute to it. Specifically, asset and capital diversification are associated with reduced risk, whereas income diversification has a significant negative effect on the stability of banks. The influence of income diversification on risk-taking and stability varies across different types and stages of crises. Case studies of banks from the GCC, Malaysia [34], Vietnam [18], and Indonesia [35].

Based on these findings, the authors conclude that an increase in non-traditional sources of income heightens the operational risk faced by banks. Consequently, this study contributes to the existing empirical literature by exploring the following hypothesis:

H1: Diversification has a negative effect on banks' risk-taking in Vietnam.

Most literature on bank diversification tends to focus on income diversification, specifically revenue or activity diversification. Recent studies have intriguingly highlighted the importance of adopting a more nuanced perspective by examining how the relationship between diversification and banks' risk-taking may vary across different types or sizes of banks.

Banks with moderate risk exposure derive the most significant benefits from diversifying their income sources between interest and non-interest activities, according to Sanya and Wolfe [36] and Köhler [4] notes that while income diversification enhances the stability of small and medium-sized European banks, it does not have a substantial impact on the stability of larger institutions. The study indicates that income diversification improves both the stability and profitability of savings and cooperative banks, while it tends to increase the volatility of investment banks. AlKhouri and Arouri [37] examined data from 69 Islamic and conventional banks listed in six GCC markets from 2003 to 2015, finding that revenue diversification affects the stability of both traditional and Islamic banks in the GCC. However, the stability of Islamic banks is further enhanced through asset diversification. Sahul and Ibrahim [38] argue that revenue diversification can diminish the stability of banks, thereby raising the risks associated with dual banking systems. Wu [39] explored the relationship between bank diversification and performance within the Japanese banking sector using a panel dataset encompassing 141 banks from 2000 to 2022. The findings indicate that diversification can enhance bank profitability, albeit at the cost of reduced net interest margins. This suggests that banks may be leveraging interest rate trading to bolster their other business lines.

Moreover, Azmi et al. [40] found no difference in the impact of diversification on bank stability among various types of banks [40].

Subsequently, Paltrinieri et al. [41] examined the influence of income diversification on the profitability and risk profiles of banks within selected OIC countries from 2007 to 2016. Utilizing a comprehensive dataset that included 47 Islamic banks and 154 conventional banks, their findings indicated that diversification yields lower returns for Islamic banks compared to their traditional counterparts. Additionally, the study revealed no discernible relationship between income diversification and stability for either conventional or Islamic banks in those OIC countries. Interestingly, research by Šeho et al. [11] indicates that the impact of financial diversification on bank stability in GCC countries is non-linear and varies between Islamic and conventional banks. Specifically, at medium (or low) levels of diversification, it undermines the stability of Islamic (or conventional) banks, whereas at high levels, it proves beneficial for conventional banks.

3. Research Methods and Data

3.1. Research Data

The research sample comprises 25 commercial banks in Vietnam for the years 2011 to 2023, representing nearly 80% of the total assets within the country's commercial banking system [42]. Bank-specific data were sourced from Fiinpro's database

and verified through audited financial statements. Macro-level data, including GDP growth and the CPI inflation rate, were obtained from the World Bank database.

The selection of this time period is justified by the notable transformations occurring within the operations of Vietnamese commercial banks, particularly related to the restructuring of the banking sector and the significant impact of the COVID-19 pandemic on the recovery trajectory of these institutions. As of December 2023, the State Bank of Vietnam indicates that there are 31 Vietnamese commercial banks in operation. However, due to the lack of sufficient data published by certain banks for this study, the research focuses exclusively on 25 banks that fulfill specific criteria, including continuous operation throughout the research period. These banks have also provided adequate data necessary for the analysis. Importantly, the total assets of these 25 commercial banks represent over 80% of the aggregate assets of the Vietnamese commercial banking system, thereby ensuring their representativeness in this study.

3.2. Model And Research Variables

Drawing upon the theoretical framework and building on prior research conducted by Toh et al. [7] and Shabir et al. [43], the author proposes the development of a model to evaluate the influence of diversification (INCDIV) on the risk tolerance (RISK) of banking institutions in Vietnam.

$$RISK_{i,t} = \gamma_0 + \gamma_1 RISK_{i,t-1} + \gamma_2 INCDIV_{it} + \gamma_3 SIZE_{i,t} + \gamma_4 ETA_{it} + \gamma_5 DLR_{it} + \gamma_6 COSTE_{it} + \gamma_7 COSTA_{it} + \gamma_8 GDP_t + \gamma_9 INF_t + \varepsilon_{i,t}$$

In this expression, the dependent variable $RISK_{i,t}$ reflects the risk tolerance of bank i at the end of year t. The variable $INCDIV_{it}$ represents the diversification index of bank i for that year. Additionally, the bank-specific coefficients for bank i in year t include factors such as SIZE, ETA, DLR, COSTE, and COSTA, along with macroeconomic indicators for that year, such as GDP and INF. The variable f_i denotes the time-invariant characteristics of the bank, while ε_{it} signifies the characteristic error term, often referred to as the unobserved residual for bank i at time t. The indices i and t indicate the bank i in year t.

The Z-score is extensively utilized in banking and finance literature to assess a bank's risk-taking capacity [4]. A higher Z-score indicates a lower probability of default, suggesting that an increased Z-score corresponds to a greater risk-taking capability (and, consequently, higher stability) of the bank, and vice versa [44, 45]. To mitigate large data fluctuations and enhance estimation efficiency, the Z-score calculation is converted to its natural logarithm [2, 46]. The Z-score exhibits an inverse correlation with a bank's default probability [47]. In all regression models, the Z-scores were logarithmically transformed to diminish the risk of skewed distributions [48]. Additionally, the authors employed the measurement method proposed by Köhler [49], which involves dividing the Z-score index by the variable RAROA, reflecting risk-adjusted profitability. This indicator was assessed using the same method as reported in studies conducted in Vietnam [50].

The variable DIV_REV_{it} is an income diversification indicator measured using the Herfindahl-Hirschman index (HHI) for bank i in year t, based on previous studies [51, 52]. The formula is defined as follows:

$$HHI = \left(\frac{NON}{NOI}\right)^2 + \left(\frac{NII}{NOI}\right)^2$$

NON (non-interest income) refers to income derived from service provision activities, including revenues from fees and commissions, as well as investment activities such as gold and foreign currency trading, securities trading, capital contributions, share purchases, and other related activities. NII represents net interest income, and it can be expressed as NOI = NON + NII. The HHI (Herfindahl-Hirschman Index) ranges from 0.0 to 1.0; as the HHI increases, it indicates that the bank becomes less diversified and more focused on lending.

The bank's control variables include SIZE, ETA, DLR, COSTE, and COSTA, along with macroeconomic variables such as GDP, the GDP growth rate, and INF (the inflation rate). ε_{it} – represents the unobserved residual for bank i at time t.

Table 1.
Overview of Study Variables and Anticipated Sign Expectations

Variables	Measure	Expectation (+/-)	References
Dependent variable			
Z-SCORE	$\text{Z-score}_{it} = \frac{\mu(ROAA_t)+CAR_{it}}{\sigma(ROAA_t)}$ $ROAA_{it}$ Return on average total assets for Bank i at time t, $\mu(ROAA_t)$ is defined as the average ROAA of bank i; $\sigma(ROAA_t)$ is the standard deviation of ROAA of bank i, CAR_{it} is the ratio of average equity to average total assets for bank i at time t is also analyzed.		Ahmed, et al. [44] and Vučinić [53].
RAROA	$RAROA = ROAA_{it}/\ \sigma(\ ROAA_{it})$		Köhler [4]; Vinh and Mai [50] and Leckson-Leckey [54]
Independent variable			
DIV_REV	An income diversification indicator measured using the Herfindahl-Hirschman index (HHI) for bank i in year t	-	Van Dan [18]; Ammar and Boughrara [51] and Sissy, et al. [52]
SIZE	Logarithm of total assets	-	Van Dan [18]; Ammar and Boughrara [51] and Sissy, et al. [52]
ETA	The capital structure of a bank is the proportion of total equity	+	Hou, et al. [16]; Van Dan [18]; Ammar and Boughrara [51] and Sissy, et al. [52]
DLR	The ratio of Customer deposits relative to total debt	-	Toh, et al. [7]; Van Dan [18]; Ammar and Boughrara [51] and Sissy, et al. [52]
COSTE	The ratio of operating expenses relative to operatin		Hou, et al. [16]; Ammar and Boughrara [51] and Sissy, et al. [52]
COSTA	The ratio of operating expenses relative to total asset		Köhler [4]; Hou, et al. [16]; Ammar and Boughrara [51] and Sissy, et al. [52]
GDP	$GDP = \frac{GDP\ t - GDP\ (t-1)}{GDP\ (t-1)}$	+/-	Toh, et al. [7]; Hou, et al. [16]; Van Dan [18]; Sahul and Ibrahim [38]
INF	$INF = \frac{CPI\ t - CPI(t-1)}{CPI\ (t-1)}$	-	Toh, et al. [7]; Hou, et al. [16]; Van Dan [18]; Sahul and Ibrahim [38]

3.3. Research Methods

This study employs the S-GMM (systematic Generalized Method of Moments) estimation technique as outlined by Arellano and Bond [1] to analyze panel data. The GMM estimation effectively addresses two key issues: unobserved heterogeneity and endogeneity. By estimating time-invariant unobservables, the method achieves consistent parameter estimates through the use of multiple instruments, thereby enhancing the accuracy of the regression coefficients. Endogeneity is a common challenge in economic models [55], and the GMM approach leverages lagged dependent variables as independent variables. These lagged variables are typically endogenous but can serve as instrumental variables. To validate the appropriateness of the GMM estimates, this study employs the Arellano-Bond (AR) tests to assess for excessive restrictions and the Hansen tests to verify the validity of the instruments. The findings from the AR1 and AR2 tests indicate the presence of first-order autocorrelation while confirming the absence of second-order autocorrelation [1, 56].

Furthermore, this analysis categorizes banks into large and small groups based on their average total assets relative to the entire banking industry [2, 3]. Large banks are defined as those with assets exceeding the median value of the asset distribution in the banking sector, while small banks are those with assets falling below this median threshold.

4. Results and Discussion

4.1. Descriptive Analysis of Variables

Table 2.
Comprehensive Descriptive Statistics of Research Indicators (2011 – 2023).

Variables	N	Median	Medium	Standard Deviation	Min	Max
Z-Score |	224	2.899	3.200	0.066	0.934	4.567
RAROA	224	0.006	0.008	0.007	-0.000	0.036
INCDIV	224	0.007	0.063	0.04	-0.005	0.57
SIZE	224	17.06	19.09	1.135	16.20	21.28
ETA	224	0.074	0.081	0.033	0.026	0.255
DLR	224	1.114	1.135	0.203	0.680	1.736
GDP	224	0.062	0.055	0.016	0.025	0.070
INF	224	0.032	0.041	0.035	0.006	0.187
COSTE	224	0.207	0.216	0.086	0.056	0.762
COSTA	224	0.015	0.016	0.005	0.006	0.042

Note: The statistical table outlines the key variables, with the bank's risk-taking index (Z-score, RAROA) designated as dependent variables. The independent variable, INCDIV, represents the diversification aspect. Among the bank-specific variables, Size is determined as the logarithm of total assets; ETALEV denotes equity as a percentage of total assets; DLR refers to the ratio of customer deposits to total debt (%); and COSTE represents operating expenses relative to both operating income (%) and total assets (%). Additionally, the macroeconomic variables include GDP, which is examined in terms of growth rate and inflation index.

Table 2 presents descriptive statistics for the variables utilized in the research model, encompassing a sample of 224 observations from 25 Vietnamese commercial banks over the period from 2011 to 2023. The average risk tolerance indices, represented by the Z-score and RAROA, are 3.2 and 0.08, respectively, with corresponding standard deviations of 0.06 and 0.007. This indicates that the risk tolerance among Vietnamese commercial banks has exhibited relatively stable fluctuations over the years. In terms of income diversification, the average index stands at 6.3% with a standard deviation of 4%. The analysis of diversification activities reveals that commercial banks exhibit varying levels of income and asset diversification. Interestingly, the HHI variable shows a minimum value of -0.005 when interest income exceeds total income, suggesting that the non-interest activities of these banks do not generate sufficient income to cover expenses. Conversely, in certain years, some banks display low HHI values, indicating a balance between interest and non-interest income, suggesting a state of full diversification. Adesina [57] identified that banks with HHI values below 0.38 exhibit low asset diversification, while values approaching 0.75 indicate a high level of diversification. Moreover, during the period from 2011 to 2023, the average GDP growth was recorded at 5%, along with an inflation rate of 4.1%.

4.2. Correlation Coefficient Matrix

To assess the suitability of the variables included in the model, the study analyzes the correlation coefficients among the independent variables (refer to Table 3). High correlations among these variables could indicate issues related to multicollinearity. However, the findings reveal that the correlation among the independent variables in the model is relatively low, with the absolute value of the correlation coefficients remaining below 0.8. Consequently, the regression model does not exhibit multicollinearity, confirming that the selected variables and data are appropriate for the analysis.

Table 3.
Correlation coefficient matrix.

1.	**2. Z-SCORE**	**RAROA**	**INCDIV**	**SIZE**	**6. ETA**	**7. DLR**	**8. GDP**	**9. INF**	**10. COSTE**	**11. COSTA**	**12. VIF**
Z-SCORE	1										
RAROA	0.01	1									
INCDIV	-0.006	0.009	1								
SIZE	0.022	0.003	0.00	1							
ETA	-0.002	0.02	0.02	-0.05	1						
DLR	0.034	-0.00	-0.12*	-0.04	-0.09	1					
GDP	0.03	-0.00	-0.15**	-0.001	-0.03	0.08	1				
INF	-0.00	0.00	-0.104	-0.001	0.02	-0.001	0.07	1			
COSTE	0.011	-0.03	0.105	0.001	-0.001	-0.092	0.09	0.03	1		
COSTA	-0.02	-0.00	0.034	-0.07	0.032	-0.002	0.08	0.002	0.002	1	5.16

Note: The statistical table outlines the key variables, with the bank's risk-taking (Z-score, RAROA) designated as dependent variables. The independent variable, INCDIV, represents the diversification aspect. Among the bank-specific variables, Size is determined as the logarithm of total assets; ETALEV denotes equity as a percentage of total assets; DLR refers to the ratio of customer deposits to total debt (%); and COSTE represents operating expenses relative to both operating income (%) and total assets (%). Additionally, the macroeconomic variables include GDP, which is examined in terms of growth rate and inflation index.

5. Results of Testing to Select the Appropriate Regression Model

Table 4 presents the study's findings on the impact of diversification (measured by INCDIV) *bank's risk-taking* (measured by Z-SCORE and RAROA) in Vietnamese commercial banks. The results indicate that the diversification ratio (INCDIV) negatively affects risk tolerance for the small bank group, showing significant β coefficients of $\beta = -7.97$ and $\beta = -5.3$ ($p < 0.01$), respectively. Based on these findings, hypothesis H1 is accepted, suggesting that banks with greater income diversification tend to take excessive risks, leading to increased financial instability. This phenomenon may be attributed to three main factors:

First, the shift towards non-traditional activities may necessitate banks to invest more in technology and human capital, resulting in increased operating leverage and, consequently, higher earnings volatility.

Second, fee-based activities can elevate financial leverage, which is linked to earnings volatility and, ultimately, reduced bank stability.

Lastly, a lack of expertise in non-lending activities can lead to distractions and ineffective loan monitoring, increasing credit risk.

These findings align with previous studies on diversification [20, 28], but they contradict modern portfolio theory, Markowitz [25], which posits that income diversification reduces risk and improves returns, as non-interest income is not perfectly correlated with traditional interest income. In contrast, for the large bank group, the relationship between diversification (INCDIV) and banks' risk-taking (measured by Z-SCORE and RAROA) is positive and significant, with β coefficients of 6.81 and 6.53 ($p < 0.01$), respectively. This study supports the perspective of Duho and Onumah [58] who argue that well-capitalized banks tend to avoid non-lending activities to maintain stability and efficiency. Banks with sufficient financial capital are more inclined to allocate resources to non-lending activities. Coupled with advancements in financial technology, this enables banks to access customer information from these non-lending activities, thereby reducing information asymmetry between borrowers and lenders, minimizing credit risk, and ensuring financial efficiency.

All models presented in Table 4 show a Hansen test with a p-value exceeding 0.1, indicating that the chosen representative variables are reasonable and that the models have been appropriately determined. Furthermore, the AR1 tests for all models indicate p-values below 0.1, confirming the absence of first-order serial correlation. Conversely, the AR2 tests reveal p-values greater than 0.1, suggesting that there is no second-order serial correlation present in the residuals of the research models. Additionally, the models consistently exhibit a smaller number of instruments compared to the number of groups, which supports the appropriateness of the research model conclusions.

Table 4.
Results of diversification impact on risk tolerance among banking groups_SGMM.

Indicators	Small-Scale Bank		Large-Scale Bank	
	RAROA (1)	Z-SCORE (2)	RAROA (3)	Z-SCORE (4)
L. RAROA	0.581***		. 0.479*	
L. Z-SCORE		0.653**		0.393*
INCDIV	-7.97**	-5.3***	6.81**	6.53**
	(-2.07)	(-1.04)	(0.09)	(-0.74)
SIZE	1.199***	3.580	1.173***	5.964
	(3.69)	(0.42)	(3.66)	(0.70)
ETA	11.83	-9.048	-24.25*	132.4
	(1.10)	(-0.05)	(-1.90)	(0.48)
DLR	-3.978***	3.742	-2.350***	-13.24
	(-6.87)	(0.19)	(-2.83)	(-0.57)
COSTE	-0.186	-51.44	-15.33***	42.90
	(-0.03)	(-0.35)	(-2.74)	(0.31)
COSTA	23.43	763.0	172.2**	-2247.2
	(0.34)	(0.51)	(2.02)	(-1.07)
GDP	-5.702	121.9	-1.632	-54.90
	(-0.78)	(0.72)	(-0.22)	(-0.30)
INF	-5.712	-75.69	-0.314	39.64
	(-1.27)	(-0.89)	(-0.06)	(0.40)
_cons	-14.60**	-28.04	-14.49**	-40.63
	(-2.41)	(-0.17)	(-2.24)	(-0.22)
N	84	84	140	140
Group	25/20	25/20	40/34	40/34
AR1 (P.value)	0,004	0,002	0,002	0,001
AR2 (P.value)	0,065	0,065	0,06	0,078
Hansen Test (P-value)	0,51	0,62	078	0,67

Note: Large banks: ACB, AGR, BIDV, CTG, EIB, HDB, MBB, SCB, SHB, STB, TCB, VCB, VIB, VPB
Small banks: ABB,BVB, BVH, KLB, NAB, OCB, PVB, VAB, SSB, BAB, PGB, MSB
The table presents the estimated results obtained using the SGMM estimator. The variables are measured using the GMM procedure as outlined by Arellano and Bover (1995). The symbols ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively.

6. Conclusion and Policy Implications

The study employs the SGMM estimation method on a panel dataset comprising 224 observations from 25 commercial banks (CBs) in Vietnam during the period of 2011–2023. Its objective is to determine whether diversification enhances the risk-taking ability of banks in the context of an emerging market.

The key findings of the study are as follows:

Firstly, income diversification appears to diminish the risk-taking ability of smaller banks. In contrast, for larger banks, the study reveals that income diversification actually enhances their risk-taking capacity.

Additionally, this research is the first of its kind in an emerging market to draw on previous studies Laeven [2] and Wang et al. [3] by distinguishing between large and small banks, thus elucidating the differences based on bank size. Furthermore, we observe that banks' risk-taking ability is notably influenced by several industry-specific factors, including bank size, financial structure, the ratio of customer deposits to total liabilities, cost management capabilities, and macroeconomic conditions. Based on these findings, several policy implications are proposed:

The following are some proposed policy implications for consideration:

The research findings indicate that diversification and banks' risk-taking have varying impacts on different groups of banks, offering valuable insights for policymakers. Small banks should focus on developing long-term innovation and growth strategies. By aligning their innovation approaches with their specific circumstances, these banks can optimize resource allocation, effectively manage risks, and maintain stable innovation activities, all while keeping costs in check. Failure to do so may lead to increased instability. Additionally, small banks need to evaluate their internal risk tolerance and implement external monitoring mechanisms to mitigate risks, ultimately enhancing their value and competitiveness.

Secondly, small banks should be diligent in diversifying their activities while effectively managing costs and allocating resources. This approach will enable them to strengthen their position amid unpredictable economic changes, particularly in light of ongoing competition and personalization trends.

Furthermore, the process of technological communication and innovation must be carefully and methodically planned to prevent resource waste and avoid unnecessary expenses.

Additionally, the Central Bank (CB) should implement clear and stringent measures along with timely monitoring mechanisms to manage risks effectively. It is crucial for the CB to fully acknowledge the diversity among banks and tailor its general policies to accommodate the unique characteristics of each bank and industry.

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Appendix

Table A.
Total Assets of Commercial Banks In Vietnam.

No	Bank code	Bank name	Total assets ('000 billion dongs)	Rank
1	ABB	An Binh Bank	130.06	20
2	ACB	Asia Commercial Bank	607.88	9
3	AGR	Agribank	1874.84	2
4	BAB	Bac A Commercial Bank	128.79	21
5	BID	BIDV	2120.61	1
6	BVB	Bao Viet Bank	79.07	24
7	CTG	VietinBank	1808.43	4
8	EIB	Eximbank	185.06	18
9	HDB	HDBank	416.27	12
10	KLB	Kien Long Bank	85.76	23
11	MBB	MBBAnk	728.53	5
12	MSB	MSBBank	212.78	16
13	NAB	Nam A Bank	177.58	19
14	OCB	OCB Bank	193.99	17
15	PGB	PG Bank	48.99	25
16	PVB	PVcomBank	235.15	14
17	SCB	Saigon Commercial Bank	703.16	6
18	SHB	SH Bank	550.90	11
19	SSB	SeABank	231.42	15
20	STB	Sacombank	591.91	10
21	TCB	Techcombank	699.03	7
22	VAB	Viet A Bank	105.15	22
23	VCB	Vietcombank	1813.82	3
24	VIB	VIBBank	342.80	13
25	VPB	VPBank	631.01	8

Note: Large Bank: ACB, AGR,BID,CTG,EIB,HDB,MBB,SCB,SHB,STB, TCB, VCB,VIB, VPB (14 bank)
Small Bank: ABB, BAB, BVB, KLB, MSB, NAB, OCB, PGB, PVB, SSB, VAB (11 bank).

Type	Total Asset Ratio	Total assets	Number of banks ratio	Number of banks
Small Bank	11.08%	1628.75	44.00%	11
Large Bank	88.92%	13074.24	56.00%	14
Full Bank		14702.99		25