

DETERMINANTS OF NET INTEREST MARGIN IN COMMERCIAL BANKS IN VIET NAM

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Abstract. *This riveting study dives into the dynamics of net interest margin (NIM) within Vietnam's commercial banking sector from 2007-2018, offering fresh perspectives by considering factors like mergers and foreign ownership ratios. Our findings unveil a positive correlation between NIM and variables such as credit risk, risk aversion, loan-to-customer ratio, implicit interest rate, foreign equity ratio, and inflation. Conversely, NIM takes a hit with better management efficiency, during mergers, and in times of economic crises. Interestingly, ownership and GDP growth rate remain neutral, showing no influence on NIM.*

Keywords

Net interest margin.

1. Introduction

Acting as key financial intermediaries, commercial banks bolster economic development by redistributing investment capital. They generate principal income from interest expenses paid by depositors and interest income received from borrowers. Among various performance metrics, the net interest margin (NIM)—calculated as the ratio of net interest income to total income assets—stands as a critical measure of financial

intermediation efficiency. Scholars such as Sen-sarma and Ghosh [1], and Claeys and Vander Venet [2] argue that a high NIM indicates inefficiency and slower economic activity, whereas a low NIM denotes a more developed and vibrant financial market, promoting economic growth. However, this low NIM can be detrimental to bank profits (Fungáčová and Poghosyan, [3]), leading to a conflict of interest between policy makers aiming to maximize societal benefits and banks striving for profit maximization.

Given this tension, various studies over the past three decades, including those by Ho and Saunders [4], McShane and Sharpe [5], Fungáčová and Poghosyan [3], Dumičić and Rizdak [6], and Agoraki and Kouretas [7], along with Vietnamese studies (An and Huong, [8]), (Sang, [9]), (Thu and Huyen, [10]), (Hoang and Vu, [11]), (Dien et al., [12]), (Linh and Huong, [13]), (Tu and Nghia, [14])) have sought to understand the factors influencing the NIM.

Recently, Vietnam has initiated the merging of weaker banks into larger ones and reduced state ownership in banks, thereby attracting foreign investment. These developments prompt crucial questions: Do these mergers affect the NIM? Will an increase in foreign investment boost bank efficiency and profit margins? Despite the breadth of prior research on NIM determinants, these contemporary variables within Vietnam's banking sector remain largely unexplored. Our study is designed to address this gap,

offering contributions to Vietnam's theoretical framework and providing empirical insights to aid bank managers in decision-making. We further previous research by investigating the impact of recent mergers and increased foreign equity on NIM in Vietnamese commercial banks.

2. LITERATURE REVIEW

2.1. Studies abroad

Research by Ho and Saunders [4] laid the groundwork for subsequent studies on net interest margin (NIM). They identified four factors affecting NIM: risk aversion, transaction size, banking market structure, and interest rate variation. Additionally, the debt and asset structure was included in their analysis due to its direct impact on bank risk. Their study suggested that term diversification of deposit and loan products serves as an optimal hedging strategy aimed at maximizing bank profits.

Building upon Ho and Saunders' research, McShane and Sharpe [15] created a model centered on the hedging theory among commercial banks in Australia. They discovered a relationship between interest rate risk in the money market and the margin rate of interest. Specifically, a bank's interest rate risk is tied to the constant fluctuations of interest rates in the money market, not to deposit and lending rates. Furthermore, they found that shifting lending from businesses to individuals could help increase the rate of interest income.

Sharma and Gounder [16] investigated the determinants of NIM in banks in Fiji, a developing South Pacific country, from 2000-2010. Using Ho and Saunders' [4] model as a foundation, they found that NIM positively correlates with subterranean interest rates, operating costs, market power, and credit risk, and negatively correlates with management quality and liquidity risk. However, the relationship with bank capital and the opportunity cost of compulsory reserves did not align with expectations.

Kansoy [17] studied the determinants of NIM in the Turkish banking sector, with a particular

emphasis on the bank's ownership structure, using data from 2001-2012. The study revealed that operational diversity, credit risk, and operating costs significantly determine the interest rate in Turkey. The impact of key determinants such as credit risk, bank size, market concentration, and inflation varies among state-owned and private banks. However, the effects of interest payment, operational diversity, and operating costs are consistent across all banks. Agoraki and Kouretas [18] conducted research in the banking sector of Central and Eastern European countries (CEE) during the transition period from 1998-2016. The study focused on the impact of the legal framework along with bank-specific, sectoral, and macroeconomic factors on NIM. Besides the standard determinants used in previous studies, this research also examined the effectiveness of the banking sector reforms that took place during this period in CEE countries. The study concluded that NIM is determined by bank-specific characteristics such as equity, risk, and operating costs. Moreover, it highlighted the significant role of the legal framework and the presence of foreign-owned organizations in defining NIM in CEE countries. As financial systems evolve and reform processes conclude, both current and future economic growth may exert an even greater influence on bank profits.

2.2. Studies in Vietnam

An and Huong [8] delved into the impact of ownership structures on the net interest margin (NIM) in Vietnamese commercial banks for the period spanning 2008-2012. They discovered that state-owned banks had a lower NIM than their counterparts. This could be attributed to different management practices or regulatory conditions affecting state-owned banks. Moreover, they identified several factors positively influencing NIM, such as operating costs, credit risk, equity ratio, liquidity risk, and lending size. This indicates that banks with better control of operating costs and risk management, and those having a higher equity ratio and lending size, tended to have a higher NIM. Interestingly, they observed that the influence of these factors

diminished over time, suggesting that banks might have adapted to these conditions over the years, reducing their impact.

Sang [9] expanded on the previous findings by examining the determinants of NIM in Vietnamese banks from 2008-2013. His findings echoed those of An and Huong, reinforcing the role of equity ratio, credit risk, liquidity risk, and operating expenses in shaping NIM. Furthermore, Sang introduced two additional factors - inflation and building development - and found that they positively correlated with NIM. This suggests that banks might have been able to adjust their interest rates to cover inflation and that a booming building development sector might have increased demand for loans, thus boosting NIM. Conversely, Sang [9] found that GDP was negatively correlated with NIM, indicating that in times of economic growth, competition among banks might increase, leading to a lower NIM.

Hoang and Vu [11] utilized a different approach by analyzing audited consolidated financial statements of Vietnamese commercial banks from 2008, the onset of the global financial crisis, through 2012. They found that operating costs, management quality, risk aversion, and inflation rates all positively influenced NIM. The positive impact of management quality and risk aversion suggests that banks with better management practices and those that are more cautious in their operations, tend to have a higher NIM. However, they also observed that the concentration of the banking sector negatively impacted NIM, indicating that higher competition among a small number of banks could lead to lower interest rates and thus a lower NIM.

In their 2017 study, Dien et al. [12] examined the influence of the Lerner index, the opportunity cost of reserves, and operating costs on the NIM of 27 Vietnamese commercial banks between 2011-2015. The Lerner index, a measure of market power, and operating costs were found to positively correlate with NIM. This suggests that banks with greater market power and higher operating costs tend to have a higher NIM. They also observed that market share negatively affected NIM, indicating that larger banks might face more competitive pressure, leading to lower interest

rates and a lower NIM. Interestingly, they found no evidence of a relationship between the HHI index, a measure of market concentration, and credit risk, suggesting that the competitive environment might not directly affect a bank's credit risk.

Tu and Nghia [14] took a macroeconomic perspective by considering the impact of economic crises on the NIM of 27 Vietnamese commercial banks from 2005-2017. They discovered that economic crises had a substantial negative correlation with NIM at a high significance level, with an impact magnitude of 60% - 70%. This suggests that economic downturns significantly affect banks' profitability, possibly due to reduced loan demand and higher default rates during such periods. In conclusion, numerous studies have provided insights into the factors influencing the net interest margin (NIM) of Vietnamese commercial banks. Ownership types, operating costs, credit risk, equity ratio, liquidity risk, lending size, inflation, building development, GDP, management quality, risk aversion, and banking sector concentration all have significant roles. Notably, economic crises exert a substantial negative impact on NIM. These findings underscore the multifaceted nature of NIM determinants, necessitating a comprehensive approach in bank management and policy-making to optimize financial performance and stability.

3. METHODOLOGY

3.1. DATA COLLECTION

The empirical basis of this research paper lies in the comprehensive analysis of audited financial statements spanning from 2007 to 2018 for 35 joint-stock commercial banks operating in Vietnam. This data was procured from the esteemed Bankscope database, maintained by Bureau van Dijk. It's important to note, however, that starting from January 1, 2017, the discontinuation of Bankscope by its providers necessitated the use of an alternative resource—Orbis Bank Focus. Throughout the data gathering phase, there was a necessary exclusion of 10 commercial

banks due to the unfortunate incompleteness of their data, manifested in missing values for specific years or particular financial indicators. Consequently, the final data corpus for this study encompasses 26 commercial banks. To supplement this primary data, macroeconomic variables, inclusive of economic growth (as indicated by GDP) and inflation rates, were sourced from the authoritative and globally recognized World Bank database.

3.2. BASIC MODEL

Building upon the foundational research conducted in Vietnam on the determinants influencing the net interest margin, this dissertation introduces an advanced research model. This model, proposed by the author, harnesses the intellectual legacy of preceding investigations while endeavoring to contribute fresh perspectives and insights to the discourse: $NIM=f(CR, RA, LDR, CTI, IIP, OWNERSHIP, MA, FO, GDP, INF, CRISIS)$ In which the variables are detailed in Table. 1.

3.3. Theory of research

1) Credit risk (CR)

Research not only from abroad (Maudos and Solís, [23]; Sharma and Gounder, [16]; Tarus et al., [21]; Agoraki and Kouretas, [18]), but also from Vietnam (Sang, [9]; Linh and Huong, [13]; An and Huong, [8]; Pham et al., [24]; Dien et al., [12]) has supported the positive correlation between credit risk (CR) and net interest margin (NIM). In particular, Maudos and Fernández de Guevara [24] argued that the risk of insolvency or credit default necessitates that banks incorporate an implicit risk premium in interest rates. Despite the diversification of income streams in Vietnamese banks, credit remains the primary source of profit. Banks facing high credit risks are likely to increase lending rates as a risk offset strategy. Thus, the author hypothesizes a positive correlation between credit risk and profit margin.

H1: Credit risk (CR) is positively correlated

with net interest margin (NIM).

2) Level of risk aversion (RA)

Risk aversion (RA) is characterized as the extent to which a bank prefers not to assume additional risk for an equivalent return. If the level of risk aversion is high, the bank is considered risk-averse. Conversely, if the risk aversion is low, the bank is seen as more accepting of risk. Previous research has indicated a positive correlation between risk level and net profit margin. This perspective is corroborated by specific studies such as McShane and Sharpe [15], as well as more recent research by Thu and Huyen [10], Hoang and Vu [11], Tu and Nghia [14], Sang [9], Maudos and Solis [23], Fungacova and Poghosyan [23], Ahmad et al. [25], and Agoraki and Kouretas [7]. In this study, the author anticipates a positive correlation between the level of risk aversion and the net interest margin. Risk-averse banks, possessing substantial equity, tend to rely less on external borrowing, which may increase the average cost of capital due to the reduction of tax shield benefits from loan interest. Consequently, banks may transfer the cost of equity to loan interest rates, resulting in higher loan interest rates and, consequently, elevated net interest margins.

H2: The level of risk aversion (RA) is positively correlated with the marginal interest rate of return (NIM).

3) Loans to customer deposits ratio (LDR)

Most commercial banks utilize this indicator to gauge the level of safety and liquidity risk. Given that banks mobilize capital and disburse loans with varying maturities, they continually face the risk of sudden customer withdrawals. When this ratio is excessively high, the bank possesses a smaller secure "buffer", confronting liquidity risk if it is unable to meet the withdrawal demands of customers. Ahmad et al. [26], Hamadi and Awdeh [27], and Tu and Nghia [14] have all indicated that the ratio of

Tab. 1: List of independent variables, sources of data, measurements and expected correlations.

Variable	Variable name	Symbol	Source	Measure	Expected correlation
Dependent variable	Net interest margin	NIM	[3]	Interest income/Total assets- Interest expenses/Total assets	-
	Credit risk	CR	[3]	Loss loan provisions/Total loans	+
	Net interest margin	NIM	[18]	Interest income/Total assets- Interest expenses/Total assets	-
	Level of risk aversion	RA	[18]	Equity/Total assets	+
	Loan to customer deposit ratio	LDR	[19]	Outstanding loans/Customer deposits	+
	Efficiency management	CTI	[19]	Operating expenses/Total income	+
	Net interest margin	NIM	[18]	Interest income/Total assets Interest expenses/Total assets	-
	Implicit interest rate	IIP	[10]	Non interest expense/Total assets- non interest income/Total assets	+
	Ownership	OWNER SHIP	[20]	0: joint stock commercial bank 1: state-owned commercial bank	+
	Merger	MA	<i>Offer</i>	Dummy equal to 1	+
Macro variable	Proportion of foreign equity	FO	[21]	Foreign owned capital/Total equity capital	+
	Economic growth	GDP	[21]	Annual GDP growth	+
	Inflation rate	INF	[22]	Annual CPI growth	+
	Economic Crisis	CRISIS	[22]	1: 2007 or 2008 0: the remaining years	+

loans to customer deposits positively affects the net interest margin. This is primarily due to the increased risk banks face, such as credit and liquidity risk, when this ratio escalates. Consequently, banks exercise greater caution in lending, which results in higher lending rates and, subsequently, a higher net interest margin. Based on this rationale, this study anticipates that the ratio of outstanding loans to customer deposits will exert a positive influence on the net interest margin.

H3: The ratio of loans to customer deposits (LDR) is positively correlated with the marginal interest rate (NIM).

4) Management effectiveness (CTI)

Management efficiency, represented as a ratio of operating expenses to total income, indicates the cost of generating one unit of income. A lower ratio suggests that the bank's management system is operating effectively, yielding significant profits, and consequently resulting in a high net profit margin. The majority of past studies, including those by Maudos and Fernández de Guevara [24], Zhou and Wong [28], Hawtrey and Liang [29], and Maudos and Solís [23], have demonstrated an inverse

relationship between management effectiveness and net profit margin. Based on these studies, this research hypothesizes that management efficiency inversely affects the net interest margin.

H4: Management efficiency (CTI) has a negative correlation with the margin profit margin (NIM).

5) Implicit interest rate (IIP)

In order to defray the costs of banking services, banks often employ supplemental interest rates, known as implicit interest rates. Research conducted by Ho and Saunders [4], Angbazo [30], Saunders and Schumacher [31], Maudos and Fernández de Guevara [24], Zhou and Wong [28], Dien et al. [12], and Thu and Huyen [10] all highlight a positive correlation between implicit interest expense and the net interest margin. This correlation is attributed to the necessity for banks to augment income in order to offset expenditures incurred to attract customers through goods or services. This study anticipates that the variable of implicit interest cost will have a positive impact on the net interest margin.

H5: Underground interest cost (IIP) is posi-

tively correlated with the marginal interest rate (NIM).

6) Ownership

The commercial banking system in Vietnam comprises three categories of ownership: state-owned commercial banks, joint-stock commercial banks, and foreign commercial banks. Due to limitations in available data, this study will primarily focus on two groups: state-owned commercial banks and joint-stock commercial banks. Numerous global studies have demonstrated disparities in net interest margins among different types of banks. For instance, a study conducted by Fungáčová and Poghosyan [3] in Russia, examined the variances in net interest margins among three types of banks: foreign, public, and privately owned. They concluded that there was a discernible difference in net interest margins between state-owned commercial banks and the other two types of banks. Similarly, studies by Hamadi and Awdeh [27], Sensarma and Ghosh [1], and Ugur and Erkus [32] explored the net interest margin between two types of ownership: domestic and foreign. Hamadi and Awdeh [27] found a difference in net interest margins between the two ownership types, whereas Ugur and Erkus [32], and Sensarma and Ghosh [1] more specifically concluded that the net interest margins of foreign banks were higher than those of domestic banks. In Vietnam, state-owned commercial banks not only operate for profit like the other two types of banks, but they also carry out tasks on behalf of the Government. Therefore, based on these arguments, it is expected in this study that the net interest margin of state-owned commercial banks will be lower than that of joint-stock commercial banks.

H6: Marginal interest income ratio of a state-owned commercial bank is lower than the marginal interest rate of a joint stock commercial bank.

7) Merging (MA)

Merger and acquisition (M&A) activity is one of the most effective measures in restructuring commercial banks. It promotes the utilization of opportunities to augment resources in capital, technology, personnel, and market share, while mitigating the challenges associated with liquidity of bad debts and other limitations and shortcomings. In Vietnam, banking M&A activities are becoming increasingly dynamic. This raises the question of whether the net interest margin of larger banks, post-merger with weaker banks, is affected positively or negatively. Drawing upon the study by Mody and Peria [33], this paper proposes the addition of an M&A dummy variable model for the merging banks. When a bank engages in an acquisition or merger, it can leverage the existing network of branches, services, customers, and employees of the absorbed bank. Consequently, it does not need to invest significant resources in fixed assets, information technology, or the pursuit of potential customers. This, in turn, can enhance the bank's operational efficiency as well as its profit margin. Based on these arguments, it is anticipated that the merger variable will have a positive impact on the net interest margin.

H7: The merging factor (MA) is positively correlated with the marginal interest rate (NIM).

8) Proportion of foreign equity (FO)

In recent years, Vietnamese commercial banks have been actively engaging foreign strategic shareholders to implement an equitization strategy, aimed at reducing the state ownership ratio as mandated by the State Bank for 2030. By incorporating foreign strategic shareholders, Vietnamese banks anticipate gaining access to a more advanced internal management system. This will aid in human resource management and facilitate the restructuring of operating models in a more contemporary direction, thereby elevating Vietnamese banks to regional and international standards. Consequently, this study anticipates a positive correlation between the ratio of foreign capital and the net interest

margin (NIM); the higher the foreign capital ratio, the greater the NIM is expected to be. H8: The higher the ratio of foreign equity (FO), the higher the rate of profit margin (NIM).

9) GDP growth rate

Global studies present conflicting views about the correlation between economic growth and net interest margin (NIM). Claessens et al., [34], propose that economic growth is positively correlated with NIM. Conversely, Kansoy, [17]; Dumičić and Rizdak, [6]; Hoang and Vu, [11]; and Tu and Nghia, [14], found no discernable relationship between the two factors. However, Tarus et al., [21]; Agoraki and Kouretas, [18]; and Linh and Huong, [13], stated that they discovered a negative effect of economic growth on NIM. In this study, economic growth is expected to correlate negatively with the net interest margin. This is because an increase in economic growth can lead to improved market conditions, enhanced economic activity, and superior business efficiency. These improvements may reduce the risk of businesses being unable to fulfill their debt repayment obligations to the bank. Consequently, the risk premium may decrease, causing banks to tend towards reducing the net interest margin (Maria and Agoraki, [35]).

H9: Economic growth has a negative correlation with the margin interest rate.

10) Inflation (INF)

Recently, a few studies have heated the debate on whether the inflation rate affects the net interest margin (NIM). Dumičić and Rizdak, [6], suggest that the inflation rate has a positive effect on NIM. This conclusion is also supported by Sàng, [9]; Hoang and Vu, [11]; Pham et al., [24]; Tu and Nghia, [14]; Kansoy, [17]; and Agoraki and Kouretas, [7]. In contrast, some studies provide contradictory evidence. Mendes and Abreu, [36], demonstrate that the inflation rate negatively correlates with NIM. Meanwhile, Mody and Peria, [33], found that the inflation

rate has no effect on the net interest margin.

In this study, an increase in the inflation rate is expected to cause a rise in the net interest margin and vice versa. This is because an increase in the inflation rate tends to raise lending rates, leading to a surge in the net interest margin (Tarus et al., [21]). Moreover, even if the bank fails to accurately predict inflation, interest rates will be adjusted in the long term to offset inflation, thus increasing the net interest margin.

H10: Inflation rate (INF) is positively correlated with marginal interest income (NIM).

11) Economic Crisis (CRISIS)

There are prevalent views suggesting that, as the Vietnamese banking and financial system was in its early stages of integration during the aforementioned crisis, it was less impacted than other countries worldwide. However, scientific research is needed to understand the influence of this period on the Vietnamese banking system. Therefore, in alignment with the works of De Haas and Van Lelyveld, [37], and Tu and Nghia, [37], this study introduces the CRISIS dummy variable, representing the years of crisis.

Research conducted by De Haas and Van Lelyveld, [37], and Tu and Nghia, [37], suggests that the economic crisis negatively affects net interest margin (NIM). Thus, this study also anticipates a negative correlation between the CRISIS variable and NIM.

H11: The economic crisis is negatively correlated with the marginal rate of interest income.

4. RESEARCH RESULTS

4.1. Descriptive statistics

The analysis of net interest margins (NIM) among 26 Vietnamese commercial banks from 2007 to 2018 revealed an average NIM of 2.57% with a standard deviation of 1.1%. This low standard deviation indicates minimal NIM variance across the examined banks. The

Tab. 2: Descriptive statistics.

Variable	Observation	Average	Standard deviation	Min	Max
NIM	312	.0257208	.011357	-.0048293	.0764079
CR	312	.0129059	.0064574	.0013752	.0397423
RA	312	.1040342	.0577353	.0322524	.4139745
LDR	312	.9094166	.2577303	.3718661	2.520384
CTI	312	.5146538	.1601005	.1742927	.9583859
IIP	312	-.0069061	.0065835	-.074165	.0110514
OWNERSHIP	312	.1538462	.3613808	0	1
MA	312	.1378205	.3452653	0	1
FO	312	9.195687	11.23198	0	.3
GDP	312	6.191667	.6234391	.053	.071
INF	312	8.133333	6.281749	.009	.231
CRISIS	312	.1666667	.3732767	0	1

Commercial Joint Stock Bank of Vietnam recorded the lowest NIM in 2014, at -0.5%. Conversely, the highest NIM was observed in the Vietnam Prosperity Joint Stock Commercial Bank (VPBank) in 2018, at 7.64%.

In the same sample, credit risk (CR) averaged 1.3%, with a standard deviation of 0.65%, suggesting slight heterogeneity among the banks. The maximum CR was 3.97% for Agribank in 2011, while the minimum, 0.14%, was recorded by Quoc Dan Commercial Bank in 2007.

Risk aversion (RA) displayed a mean of 10.4% and a standard deviation of 5.77%. The highest RA was 41.4%, observed in the Public Commercial Joint Stock Bank in 2008, while Saigon Commercial Joint Stock Bank reported the lowest RA of 3.23% in 2018. The loan to deposit ratio (LDR) exhibited considerable dispersion, with a mean value of 90.94% and a standard deviation of 25.77%. The values ranged from a minimum of 37.19% (Maritime Commercial Joint Stock Bank, 2014) to a maximum of 252.04% (Ban Viet Joint Stock Commercial Bank, 2007).

The cost to income ratio (CTI), a measure of management efficiency, averaged 51.47%. The range extended from a low of 17.43% at Techcombank in 2008, to a high of 95.83% at PGBank in 2016.

The average interest rate (IIP) cost was -0.69%, with a standard deviation of 0.66%, suggesting minimal variance between banks. The highest and lowest values were 1.11% and -7.42% respectively, both observed at Ban Viet Com-

mercial Joint Stock Bank, in 2008 and 2007, respectively.

The foreign equity ratio (FO) showed a substantial dispersion with an average value of 9.2% and a standard deviation of 11.23%, indicating marked differences in the level of foreign ownership among banks. As per Decree 01/2014/ND-CP, the total foreign investor's shareholding should not exceed 30% of a commercial bank's charter capital. Consequently, in this sample, the maximum observed FO was 30%, while the minimum was 0% for banks without foreign investors.

From 2007 to 2018, Vietnam's GDP growth rate (GDP) averaged 6.19%, ranging from a low of 5.3% in 2012 to a high of 7.1% in 2007 and 2018. The inflation rate (INF) in Vietnam over the same 12-year period averaged 8.13%, with the minimum and maximum rates observed in 2015 (0.9%) and 2008 (23.1%), respectively.

4.2. Multicollinearity test

The study used correlation matrix and variance magnification factor (VIF) method to check the multicollinearity phenomenon of the model. The results are presented in Tables 4.2.1 and 4.2.2.

The above results show that no pairs of variables have correlation index greater than 0.5, so there is no multi-collinear phenomenon

Tab. 3: Descriptive statistics.

Variable	CR	RA	LDR	CTI	IIP	OWN	MA	FO	GDP	INF	CRI
CR	1.0000										
RA	-0.2846	1.0000									
LDR	-0.2508	0.4122	1.0000								
CTI	0.0966	-0.0951	-0.2173	1.0000							
IIP	0.0167	-0.1708	-0.1746	0.2766	1.0000						
OWN	0.4361	-0.3306	0.1020	-0.1956	0.0315	1.0000					
MA	0.0717	-0.2220	-0.1756	0.2694	0.0125	0.0099	1.0000				
FO	-0.0310	-0.2027	-0.1534	-0.0377	0.0088	-0.0620	0.0348	1.0000			
GDP	-0.2390	-0.1474	0.1167	-0.1330	0.1404	0.0000	0.1473	0.0463	1.0000		
INF	-0.0021	0.2996	0.1962	-0.2299	-0.0331	0.0000	-0.2595	-0.1277	-0.3389	1.0000	
CRI	-0.2744	0.2799	0.2590	-0.3009	0.1883	0.0000	-0.1788	-0.1547	0.1497	0.5396	1.0000

in the model. To ensure the reliability of the results, the study conducted additional testing of magnification VIF.

4.3. VIF results

Table. 4 presents the results of the VIF index, an important indicator for testing the collinearity phenomenon. All VIF indices of the independent variables in the model are less than 5. Therefore, it can be affirmed again that the model does not appear multi-collinear signs.

4.4. Regression results and testing of regression hypotheses

Table. 5 showcases the outcomes of an F-test, which is employed to compare the Pooled Ordinary Least Squares (OLS) and Fixed Effects Model (FEM) methodologies. The null hypothesis (H0) posits the suitability of the Pooled OLS model. However, given the significance level of 1%, and an F-statistic of 0, which is less than the 1% threshold, the null hypothesis is rejected. Consequently, the FEM approach is deemed more appropriate for estimating the model than the Pooled OLS approach.

The analysis then proceeds with the application of the Hausman test to discern between the FEM and the Random Effects Model (REM) methodologies. The null hypothesis for this test (H0) posits the absence of autocorrelation between the independent variables and the

random factors, thereby suggesting the REM model as the preferable choice. As depicted in Table. 6, the Chibar2 statistic is 0.6213, which exceeds the significance level of 1%. Therefore, the null hypothesis is not rejected, which validates the use of the REM approach for subsequent analysis.

4.5. The variance of error varies and autocorrelation of REM model

Given that the heteroscedasticity of the error term can compromise the efficiency of the estimation, it is crucial to test the constancy of the error variance. This is typically accomplished via the Lagrange multiplier test, where the null hypothesis (H0) is that the error variance is constant, denoted as $\text{var}(u) = 0$. Upon inspection of Table 4.5, we observe that the probability associated with the Chibar2 statistic is less than the significance level of 1% ($\text{Prob} > \text{Chibar2} = 0.000 < \alpha = 1\%$), leading to the rejection of H0. This suggests that the error variance in the REM model is not constant.

Subsequently, the study employs the Wooldridge test to scrutinize the presence of autocorrelation, with the null hypothesis asserting that no such correlation exists. As indicated in Table 4.5, the probability associated with the F-statistic is less than the 1% significance level ($\text{Prob} > F = 0.0000 < \alpha = 1\%$), which necessitates the rejection of H0. Therefore, the model exhibits autocorrelation.

Tab. 4: Results of VIF method.

Variable	VIF	1/VIF
INF	2.11	0.474481
CRISIS	2.01	0.497975
RA	1.75	0.572293
OWNERSHIP	1.66	0.603430
CR	1.64	0.611440
GDP	1.55	0.646974
LDR	1.51	0.663271
CTI	1.39	0.719260
IIP	1.22	0.821602
MA	1.19	0.839012
FO	1.10	0.908029
VIF average	1.56	

Tab. 5: F-Test.

Type	Pooled OLS-FEM	Result
F Test	$Prob > F = 0.0000 < \alpha = 1\%$	Select the FEM model

Tab. 6: Hausman test.

Type	Pooled OLS-FEM	Result
Hausman Test	$Prob > Chibar2 = 0.6213 > \alpha = 1\%$	Select the REM model

Tab. 7: Summary of REM model defects.

Test	Test	Result
The variance of error varies	$Prob > Chibar2 = 0.000 < \alpha = 1\%$	The model has variance change phenomenon

To address these two issues, the study will proceed with the implementation of the Feasible Generalized Least Squares (FGLS) estimation methodology.

4.6. Discuss the research results

Assessing the determinants of the net interest margin (NIM), several variables present statistically significant impacts:

- **Credit Risk (CR):** Positive correlation with the NIM is established at a 1% level of statistical significance. The FGLS regression reports a $\beta = 0.238$ with a p-value of 0.003. This implies that for every 1% increase in CR, the NIM increases by 0.238%, holding all else constant. The mechanism behind this relationship can be attributed to the higher lending rates commercial

banks adopt in the face of increasing credit risk, which effectively elevates the NIM. Such findings align with previous studies, including those by Sang [9], Linh and Huong [13], An and Huong [8], and others.

- **Risk Aversion (RA):** A positive impact on the NIM is observed at a 1% level of statistical significance. The regression coefficient is $\beta = 0.0821$ with a p-value of 0.000. This suggests that an increase in risk aversion by 1% results in a 0.0821% increase in the NIM, assuming other factors are held constant. The phenomenon can be attributed to the low interest expense and high profit margin resulting from strong equity capital of risk-averse commercial banks. This relationship is supported by various studies, including Thu and Huyen [10], Hoang and Vu [11], and others.

- **Loan-to-Deposit Ratio (LDR):** This variable is found to positively affect the NIM at a 1%

Tab. 8: Summary of research results.

Variable	Expected	Regression coefficient	p_value	Level of significance
CR	+	0.238	0.003 (***)	1%
RA	+	0.0821	0.000 (***)	1%
LDR	+	0.00613	0.002 (***)	1%
CTI	-	-0.0211	0.000 (***)	1%
IIP	+	0.359	0.000 (***)	1%
OWNERSHIP	-	0.00235	0.013 (**)	<i>Not – significance</i>
MA	+	-0.00390	0.236	5%
FO	+	0.00957	0.073 (*)	10%
GDP	+	-0.00313	0.959	<i>Not – significance</i>
INF	+	0.0189	0.004 (***)	1%
CRISIS	-	-0.00609	0.000 (***)	1%

level of statistical significance. The regression estimates a $\beta = 0.00613$ with a p-value of 0.002. This indicates that a 1% increase in the LDR leads to a 0.00613% rise in the NIM, ceteris paribus. The influence of the LDR on the NIM is minor but can be attributed to the higher lending rates adopted by commercial banks facing increased liquidity risks. This finding is consistent with Zhou and Wong [28] and Hamadi and Awdeh [27].

- Management Efficiency (CTI): As anticipated, this variable exhibits a negative correlation with the NIM at a 1% level of statistical significance. A $\beta = -0.0211$ with a p-value of 0.000 is reported, meaning that a 1% rise in management efficiency results in a 0.0211% decrease in the NIM, all else being equal. This relationship can be explained by the high profit margins arising from low administrative costs in highly efficient banks. This finding is in line with studies such as Linh and Huong [13], Pham et al. [24], Zhou and Wong [28], and others.

Further variables explored include Implicit Interest Rate (IIP), Ownership Type (OWNERSHIP), Merger Activity (MA), Foreign Equity Ratio (FO), Inflation Rate (INF), and the Economic Crisis (CRISIS). Each of these variables displays unique influences on the NIM with varying degrees of statistical significance and in accordance with theoretical expectations and previous empirical research.

5. CONCLUSIONS AND POLICY IMPLICATIONS

5.1. Conclusion

The study details the primary outcomes, featuring a statistical table that outlines the explanatory variables in the model and explains the correlation between these variables. It also includes a multi-collinearity test. This section delineates the comparison of regression models using three methodologies: Ordinary Least Squares (OLS), Fixed Effects Model (FEM), and Random Effects Model (REM).

The study conducts an F test to decide between the OLS and FEM models, then proceeds to implement a Hausman test to choose between the FEM and REM models. The results suggest that the REM regression method is suitable, although this model exhibits two errors related to variance change and autocorrelation. Consequently, the study applies the Feasible Generalized Least Squares (FGLS) regression method to derive the most optimal estimated coefficients.

The obtained results indicate that the independent variables - credit risk, risk aversion level, loan-to-customer ratio, implicit interest rate, foreign equity ratio, and inflation - have a positive impact on the marginal interest income ratio. Conversely, management efficiency, mergers, and economic crisis variables negatively affect the Net Interest Margin (NIM). The

remaining two variables, ownership type and GDP growth rate, do not influence the marginal interest income.

5.2. Policy implications

1) Issues of credit risk management

In the realm of finance and economics, it has been noted that credit risk exhibits a positive correlation with marginal interest income ratios. This implies that an augmentation in credit risk could lead to a commensurate increase in the marginal interest rate. However, it is incumbent upon financial administrators to ascertain the most beneficial equilibrium of risk to achieve an optimal Net Interest Margin (NIM).

Currently, a noteworthy trend not merely confined to Vietnam, but observable on a global scale, involves banks transitioning from a wholesale to a retail focus. This shift emphasizes the diversification of income from service activities, thereby diminishing the dependence on traditional credit. Consequently, it is of paramount importance for banks to devise and implement a strategic plan that efficiently balances credit risks against profit margins.

2) Issues of risk aversion

The empirical findings from our regression analysis indicate that the degree of risk aversion exerts a positive influence on the marginal interest income ratio. This suggests that an elevation in the level of risk aversion could lead to an increase in the Net Interest Margin (NIM). In this study, the degree of risk aversion is gauged through the ratio of equity to total assets.

To augment the variable RA, it is proposed that commercial banks bolster their equity. This proposal aligns with the objective of augmenting charter capital to satisfy the capital adequacy ratio in accordance with Basel III regulations as stipulated by the Government. However, it is crucial to note that an increase in charter capital may inadvertently lead to an

uptick in the average cost of capital, owing to the forfeiture of the tax shield benefit associated with interest rates.

In response, banks may be inclined to offset the equity cost by increasing lending rates, resulting in an escalation of lending rates. Nonetheless, given the current competitive landscape of commercial banking in Vietnam, hiking up lending rates could potentially render these banks less appealing to prospective clientele.

Consequently, it is incumbent upon bank administrators to judiciously evaluate the capital adequacy ratio and the cost of capital to devise a strategic and effective capital utilization plan.

3) Lending to customer deposit issues

Our research findings elucidate that the ratio of loans to customer deposits exerts a positive impact on the marginal interest income ratio. This implies that a surge in this particular variable can lead to an increase in the net profit margin, and a decrease would entail the opposite effect. However, it is pertinent to note that banks may elevate this ratio, not merely with the objective of augmenting the Net Interest Margin (NIM), but they must do so mindful of potential risks. This ratio serves as an indicator of a bank's liquidity safety. Banks attract capital and extend loans with varying terms. In the current banking landscape, banks seem to be veering towards the attraction of inexpensive capital sources in an attempt to curtail interest expenses, implying a predilection for short-term capital mobilization.

It is therefore essential for bank administrators to carefully scrutinize the term structure between deposits and loans to ensure the ability to meet customer withdrawal demands at any given point in time. The term structure of capital may be adjusted by banks in line with their individual circumstances and the prevailing financial market conditions to strike an optimal balance between profitability and safety objectives.

4) Management efficiency issues

Our empirical analysis unveils a counterintuitive relationship between managerial efficiency and the net interest margin (NIM), suggesting that an uptick in managerial efficiency may lead to a contraction in the interest income ratio, and conversely, a decrease in managerial efficiency could potentially expand it. The measure of managerial efficiency adopted in this investigation is the proportion of operating costs to total revenue. As a corollary, an enhancement in NIM can be achieved either through a reduction in operating costs or an escalation in income.

If a financial institution aspires to bolster its net interest margin, thereby increasing its profitability, it becomes imperative to pinpoint the critical determinants of operating costs. This understanding would facilitate the development of strategies designed to mitigate these costs. In tandem, it is incumbent upon bank managers to broaden their income portfolios by escalating the proportion of revenue sourced from service activities beyond conventional credit offerings. Such a strategy not only aligns with the bank's goal of optimizing managerial efficiency, but it also serves as a risk mitigation mechanism by reducing the reliance on credit risk.

5) The problem of underground interest costs

The outcomes of our regression analysis indicate a positive association between the implicit interest rate expense and the net interest margin (NIM), suggesting that an incremental rise in the implicit interest rate leads to an expansion in NIM. In this investigation, the implicit interest rate is quantified by the ratio of the difference between non-interest expenses and non-interest income to total assets.

In order to stimulate an increase in the net interest margin, it is incumbent upon banks to augment revenue streams from auxiliary service activities. This not only enables a diversification of revenue sources but also diminishes their reliance on credit activities. This strategy may pave the way for a more robust and resilient financial performance, particularly in light of

shifting market dynamics and evolving customer preferences.

6) Merging issue

The empirical analysis presented in this study elucidates that the variable of bank mergers negatively impacts the net interest margin (NIM), indicating that subsequent to the merger of a commercial bank in Vietnam, the interest income ratio tends to diminish relative to the pre-merger phase. This trend can be attributed primarily to the fact that a majority of the banks involved in mergers within the Vietnamese banking system are typically those grappling with high levels of non-performing loans, thereby casting an unfavorable shadow on the financial performance of the merging entities.

Nonetheless, it is important to bear in mind that such mergers, despite their immediate negative impact on NIM, are often necessitated by larger strategic objectives, such as banking system restructuring and consolidation. Over the long term, these structural changes aim to engender a more stable, resilient, and efficient banking system, capable of weathering economic shocks and serving the diverse financial needs of the economy. It is crucial, therefore, to evaluate the implications of bank mergers within this broader, longer-term perspective.

7) The issue of foreign equity ratio

The empirical findings of this study suggest that the proportion of foreign equity ownership positively influences the net interest margin (NIM), indicating that a higher degree of foreign investor ownership corresponds to an elevated NIM. As per the extant regulatory framework, Decree 01/2014/ND-CP stipulates that the equity ownership by a foreign investor should not exceed 20% of the charter capital, and the cumulative equity ownership by foreign investors should not surpass 30%.

Given these regulations, the appeal of Vietnamese commercial banks for foreign investors

may be relatively limited, primarily due to their constrained ability to significantly influence the banks' management and operational processes. Consequently, to augment operational efficiency and profit margins, it may be judicious for the government to consider increasing this foreign ownership limit to a higher level, such as 30%. However, it is crucial to recognize the pivotal role that banks play in the broader economic system. Therefore, any contemplated changes to foreign ownership limits should be carefully timed and calibrated, with an eye towards maximizing operational efficiency and profitability, while maintaining the safety and stability of the overall economy. Future policy adjustments in this area should be predicated on a careful assessment of their potential implications for financial system stability and the broader macroeconomic environment.

8) Problems with the financial crisis

The empirical findings from our regression analysis suggest that economic crises exert a negative influence on the net interest margin (NIM), a conclusion that aligns with intuitive expectations. As Vietnam increasingly integrates into the global economy, the magnitude of these impacts may exceed those experienced during the financial crisis of 2007-2008. Given these potential implications, it is of paramount importance for the government to establish a robust early warning system. This would equip commercial banks with the necessary tools to proactively adjust their policies to safeguard profitability in the face of impending economic downturns.

From the perspective of individual banks, it would be prudent for management to develop contingency plans to navigate various unexpected events. The objective of these strategies should be to minimize the adverse effects of such events on their operations. This proactive approach can serve to insulate banks from the potential negative impacts of future economic crises, thereby helping to ensure the stability of the financial system.

5.3. Limitations and suggest further researches

While the current study has contributed to the existing literature by unearthing novel findings and providing insights unique to the domestic context, it is not without limitations:

- **Temporal Scope:** The time frame under consideration is constrained to the period during and after the financial crisis of 2007-2008. Consequently, potential variations in the studied relationships prior to the crisis remain unexplored.
- **Data Availability:** The study's data set includes only 26 of the 35 banks operating during the period of interest, due to the exclusion of banks established post-2007.
- **Foreign Ownership:** Data pertaining to foreign-owned commercial banks operating in Vietnam was not incorporated into the study, preventing the assessment of the impact of foreign ownership type on the marginal interest income.

These constraints underline the need for subsequent research in this area, to further refine our understanding of the factors influencing marginal interest income. Future studies should aim to broaden the temporal scope, incorporate a more comprehensive set of banking institutions, and consider the role of foreign ownership in shaping the dynamics of marginal interest income.

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