Factors Affecting the Net Interest Margin of Commercial Banks in Vietnam: An Analysis of Panel Regression

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Abstract – This study investigates the factors of net interest margin of commercial banks in Vietnam. Pooled OLS, fixed and random effects regression were used for panel data of 10 Vietnamese banks in the period 2016-2020. The study result has shown that operating expenses and return on assets have a positive and significant effect on net interest margin. Moreover, the paper also finds that loan to deposit has negative and significant effect on the net interest margin of commercial banks in Vietnam.

Keywords – Factors, Net Interest Margin, Commercial Banks, Vietnam.

I. INTRODUCTION

Commercial banks always play a very important role in the market economy. For commercial banks, lending activity is the main source of banks' income. Therefore, loan effectiveness is a particularly important content that attracts the interest of commercial banks. In Vietnam, the effectiveness of bank loans is more important and complicated than that in developed countries. Current statistics show that interest income is the main source of income for commercial banks (Income from this source accounts for more than 80% of the bank's total income). In order to evaluate the effectiveness of lending activity, researchers use the net interest margin (NIM) - the difference between the interest earned and the interest paid by the bank divided by the total assets of the bank. Moreover, according to Levine (1996), this indicator can be considered as an indicator of the commercial banks' performance. Therefore, in this article, we conduct research on the internal and external factors that affect the net interest margin of commercial banks and then give some suggestions to help commercial banks to improve their performance.

II. LITERATURE REVIEW

There are many studies that have shown different factors affecting the net interest margin of banks. Factors included include bank characteristics (internal factors) and macro factors (external factors). Below is a summary of the notable studies: Ho and Saunders (1981) "The bank's net interest margin, theory and empirical evidence" set the stage for many later studies on the marginal interest rate.

In 1985, McShane and Sharpe built a model based on hedging theory and argued that risk in the Australian market is associated with a constant change in short-term money market rates rather than deposit interest rates and loans interest rate.

In 1997, Angbazo in his built an empirical model including factors such as bank position, default risk, interest rate fluctuations in the money market and additional factors such as the interaction between default risk and interest rate fluctuations. Research results show that the net interest margin is affected by default risk factor but not by interest rate risk in the short term and off-balance sheet accounts of center banks. However, for super reg-

-ional banks, they are very sensitive to interest rate risk while not affected by the risk of default.

Robinson (2002) has identified the operating cost as a key indicator of operating efficiency in the context of Jamaica and found the positive influence on NIM. Maudos and Guevara (2004) found the positive significant impact on NIM from operating cost, risk aversion levels, interest rate risk, credit risk and size of operation. In the meantime, Anthony et al. (2008) has highlighted the decomposition need of bank specific variables as operating cost, operating scale, risk aversion level, credit risk and management quality. They have shown the capital cost as a negatively influencing factor on NIM, The positive influence from risk aversion level on NIM has evidenced empirically in the countries of Ghana, Turkey, and Tunisia. Maintaining higher equity will signal the higher risk aversion level and hence higher equity requires higher cost on equity. Ultimately the greater the risk aversion level of the individual bank will result greater NIM (Naceur, S.B., Goaied, M., 2003, Maudos et al., 2004, Kaiguo et al., 2008, and Aysen et al., 2009).

Another factor that comes under the banking operations is credit risk. Maintaining higher level of provision implies higher level of credit risk and thus need of higher margin. Maudos and de Guevara (2004) found a significant and positive relationship between net interest margin and the credit risk measured by loans to total assets ratio. According to Angbazo (1997), when the net interest margin of a bank decrease, bank's management changes the credit policy, making it riskier and thus accept more risk. In contrast, Williams (2007) who studied empirically factors determining net interest margin in licensed banks operating in Australia, found a significant and negative relationship between the net interest margin and banks' risk. He suggests that the deregulation environment contributes in accepting banks by lower interest margin and lower credit quality. Meanwhile, Marty'nez Peria and Mody (2004) provides evidence for insignificant effect of the share of nonperforming loans on spreads but significant impact from concentration measures and administrative costs.

Aysen et al., (2009) found that the macro-economic and the industry common factors have played dominant role in explaining the NIM. Under the analysis, inflation, growth, interbank rate are considered and there were statistically positive significant impact from inflation and interbank rate while negative impact from growth rate. Afanasieff et al (2002), using the Ho & Saunders (1981) two-step approach to investigate whether macro- and micro-economic factors are relevant to explaining spread behavior in Brazil, conclude that the factors most relevant to explaining such behavior are macroeconomic variables, such as the basic interest rate and output growth. In a comprehensive study, Demirguc-Kunt and Huizinga (1999) investigate the determinants of NIM using bank-level data for 80 countries in the years 1988- 1995. They reported that the bank interest margin is positively influenced by the ratio of equity to total assets, the ratio of loans to total assets, a foreign ownership, bank size, the ratio of overhead costs to total assets, inflation rate, and the short-term market interest rate. The ratio of non-interest earning assets to total assets, on the other hand, is negatively related to the bank interest margin. Output growth, by contrast, does not seem to have any impact on bank spread.

Ines Ghazouani Ben Ameur, Sonia Moussa Mhiri (2013) studied the factors that explain bank performance, using the GMM model according to the technique described by Blundell and Bond (1998), on data of 10 commercial banks from 1998 to 2011. According to the author's study in terms of bank size variable, there is evidence that small-sized banks are more profitable than large banks. These results reinforce the results of Smirlock (1985) and Bikker and Hu (2002), who argue that large banks are more likely to increase profits from better products and to diversify their loans.

III. METHODOLOGY

3.1. *Hypothesis and Panel Data Model*

In order to study the relationship between determinants the net interest margin, the research has proposed the following hypotheses:

Hypothesis 1: Loan to Deposit Ratio (LDR) has significantly affect commercial banks' NIM.

Hypothesis 2: Bank assets growth (LNSIZE) has significantly affect commercial banks' NIM.

Hypothesis 3: Loan to Non Performing Loan (NPL) has significantly affect commercial banks' NIM.

Hypothesis 4: Operating expenses (OP) has significantly affect commercial banks' NIM.

Hypothesis 5: Implicit interest costs (IP) has significantly affect commercial banks' NIM.

Hypothesis 6: Equity size (CAP) has significantly affect commercial banks' NIM.

Hypothesis 7: Statutory reserves (GWM) has significantly affect commercial banks' NIM.

Hypothesis 8: GDP growth (GDP) has significantly affect commercial banks' NIM.

Hypothesis 9: Inflation has significantly affect commercial banks' NIM.

In order to study the factors affecting the net interest margin of Vietnamese commercial banks, Based on the models of previous scholars Ho and Saunders (1981), Maudos and Guevara (2004), Brock and Suarez (2000), Buser et al. (1981), Berger (1995) Barajas, Steiner and Salazar (1999), Perry (1992) Bikker and Hu (2002), the panel data model used as follows:

$$NIM_{it} = \beta_0 + \beta_1 * LDR_{it} + \beta_2 * LNSIZE_{it} + \beta_3 * NPL_{it} + \beta_4 * OP_{it} + \beta_8 IP + \beta_6 CAP_{it} + \beta_7 GWM + \beta_8 GDP + \beta_9 INF + \varepsilon_{it}$$

Where:

LDR: Loan to deposit.

LNSIZE: Bank assets growth.

NPL: Non Performing Loan.

OP: Operating expenses.

IP: Implicit interest costs.

CAP: Equity size.

GWM: Statutory reserves.

GDP: GDP growth.

INF: Inflation rate.

β_0: Intercept coefficient, reflecting the influence of other factors on analytical criteria; β_1, β_2, β_3, β_4, β_5, β_6, β_7, β_8, β_9: this coefficient estimates the effect of the independent variable on the dependent variable; i and t refer to bank and year, respectively; ε_{it}: the error term.

3.2. *Variable Measurements*

In accordance with the research objectives, the dependent and independent variables used in this study and their measurement were adopted from existing literature in order to produce or construct a worthwhile comparison with previous empirical studies. The variables used in the study are described in the Table 1 below:

Table 1. Variable and their measurements.

Variable		Indicator	Expected Sign
Dependent variable			
Net interest margin	NIM	(Interest Received – Interest Paid) /Total Assets	
Independent variables			
Bank assets growth	LNSIZE	Lognormal growth of bank assets on year basis of bank	
Non Performing Loan	NPL	Number of non performing loans / total loans	-
Operating expenses	OP	Operating cost/Total asset	+
Implicit interest costs	IP	net noninterest expenses divided by total assets	+
Loan to deposit	LDR	Total loan/Total deposit	-
Equity size	CAP	Equity to total asset	+
Statutory reserves	GWM	Average bank checking accountbalane at central bank/total deposits	-
GDP growth	GDP	An increase in GDP year t compared to t-1	+
Inflation	INF	Average inflation rate per year	-

3.3. *Data Collection and Data Analysis*

In this research, financial statements of 10 commercial banks in Vietnam for the period 2016-2020 were collected to calculate the net interest margin and other financial indicators.

To analyze the relationship between determinants and net interest margin, Pool OLS, Fixed effects model (FEM) and random effects model (REM) were used in the panel data analysis. Therefore, the Hausman test (1978) is used to select the appropriate method.

IV. EMPIRICAL RESULTS

4.1. *Descriptive Data Analysis*

Data of the study was collected from 10 commercial banks in the period 2016-2020 with the statistical result shown in the following table:

Table 2. Summary of descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
NIM	50	2.931	0.6582049	1.35	4.9
LDR	50	85.05089	7.564229	69.23251	101.9668
LNSIZE	50	19.348	1.336	17.021	21.095

Variable	Obs	Mean	Std. Dev.	Min	Max
CAP	50	7.300995	2.528959	4.06177	14.08019
NPL	50	1.739173	0.6629629	0.6227247	3.225023
OP	50	1.608544	0.3081242	1.146182	2.410488
IP	50	-0.7289692	0.3661886	-1.592734	0.2225215
GWM	50	0.0350673	0.0199201	.0085613	0.0907781
GDP	50	6.005256	1.593651	2.91	7.075789
Inflation	50	3.150791	0.3650057	2.668248	3.539628

(*Source: Stata 15 output*)

Table 2 shows the descriptive statistics of the variables in the model in the period 2016-2020. The data are collected by year, so there are 50 observations.

NIM: This is the dependent variable that represents the net interest margins of commercial banks. This variable has an average value of 2.93% with a fairly high standard deviation of 0.66%. The minimum and maximum values of the marginal interest rate are 1.35% and 4.9%, respectively. This figure shows the difference in net interest margins between banks. In general, the marginal income of banks in this period was relatively low.

LDR: This is an independent variable that shows the percentage of loan to deposit. This ratio assesses the safety of banks. The LDR has an average value of 85.05%. Standard deviation is 7.56%. The smallest value is 69.23% while the largest value is 101.97%.

LNSIZE: This is an independent variable that reflects the size of the bank. This indicator has the average value of 19,348. The smallest value is 17,021, the maximum value is 21,095 and the standard deviation is 17,021.

CAP: This is the independent variable that reflects the equity to total asset ratio of banks. The CAP has an average value of 7.30. The standard deviation of the CAP is also relatively high at 2.53%. Minimum and maximum CAP values are 4.06 and 14.08, respectively.

NPL: This is the independent variable that represents the bad debt ratio of commercial banks. The average NPL ratio is 1.74%. The standard deviation of this variable is as high as 0.66%. The difference between the minimum and maximum value is very large. While the smallest value is 0.62%, the largest value is up to 3.23%. From there, it can be seen that there are big differences in the credit risks between banks.

OP: This is the independent variable that reflects the ratio of operating expenses to total assets of the bank. The mean value of the variable OP is 1.61%. The standard deviation of the variable is 0.31%. Minimum and maximum value of OP are 1.15% and 2.41%, respectively.

IP: The independent variable IP represents the ratio of implicit interest costs of the bank to total assets. The mean value of the variable IP is 0.72%. The standard deviation of the variable is 0.37%. Minimum and maximum value of OP are -1.59% and 0.22%, respectively.

GWM: This is the independent variable to measure the reserve policy of the State Bank. GWM has an average value of 0.035%. GWM's standard deviation is also relatively high at 0.02%. The minimum and maximum value of this variable are 0.008% and 0.09%, respectively.

GDP: This is an independent variable reflecting the growth rate of Vietnam's gross domestic product with the average value in 5 years reaching 6.01%/year. Standard deviation is as low as 1.59%. Thus, it can be seen that the GDP growth rate in Vietnam in this period was quite stable. The smallest value of this variable is 2.91% and the maximum value is 7.08%.

INFLATION: This is an independent variable reflecting the inflation rate of Vietnam over the years. This indicator has the average value of 3,15%. This indicator has a high level of variation with a standard deviation of 0.37. Minimum and maximum value are 2.67% and 3.54%, respectively.

4.2. *Correlation Test Results*

Correlation coefficient matrix is used to show the correlation relationship between the variables in the model. The two variables are correlated when the statistical significance is less than 5%. The coefficient r ranges from -1 to 1. The closer the coefficient is to +/- 1, the closer correlation the two variables are. The closer r is to 0, the weaker the correlation between the variables.

Table 3. Correlation matrix between variables.

	Nim	Size	LDR	CAP	NPL	OP	IP	GWMTTS	GDP	INFLATION
Nim	1.0000									
Size	0.4250*	1.0000								
LDR	-0.3008*	0.1438	1.0000							
CAP	0.4006*	-0.4917*	-0.2284	1.0000						
NPL	-0.3136*	-0.0475	-0.0754	0.4035*	1.0000					
OP	0.5428*	-0.1891	-0.2535	0.4321*	0.2560	1.0000				
IP	-0.2522	-0.0905	-0.0125	-0.2521	-0.0799	-0.2542	1.0000			
GWMTTS	0.1163	0.0480	-0.1740	-0.1077	-0.0315	-0.1066	0.0552	1.0000		
GDP	0.3601*	-0.0724	0.0455	-0.0235	0.1226	0.1232	0.0953	0.1048	1.0000	
INFLATION	-0.0392	0.0299	0.2089	-0.0944	-0.0365	-0.0029	-0.0820	-0.0938	0.0038	1.0000

(*Data Source: Stata 15 output*)

According to the Pearson correlation coefficient on the correlation coefficient matrix, NIM has a statistically significant correlation relationship with Size, CAP, OP and GDP with values of 0.4250, 0.4006, 0.5428 and 0.3601, respectively. However, NIM has an inverse correlation with LDR and NPL with a correlation coefficient of 0.3008 and 0.3136.

4.3. *Regression Model and Test Result*

4.3.1. *Multi-Collinearity Phenomenon Test Result*

To ensure the accuracy of the model estimates, multi-collinearity tests were performed using the VIF.

Table 4. Multicollinearity tests result.

Variable	VIF 1	1/VIF
LNSIZE	4.19	0.238592
LDR	1.33	0.754274
CAP	2.70	0.371004
NPL	1.73	0.576843
OP	1.51	0.662267
IP	1.82	0.548005
GWMTTS	1.09	0.915191
GDP	1.09	0.925137
INFLATION	1.11	0.901821

(*Data Source: Stata 15 output*)

According to VIF result, all variables in the model are satisfied with VIF less than 10. Therefore, these variables will be used to run the regression model.

4.3.2. *Regression Model Result*

Table 5. Regression result.

Variables	Pool OLS	FEM	REM	GLS AR1
Size	0.170*	0.820*	0.170*	0.309**
	(0.0990)	(0.408)	(0.0990)	(0.122)
LDR	-0.0105	-0.0379**	-0.0105	-0.0281**
	(0.00981)	(0.0164)	(0.00981)	(0.0116)
CAP	0.0341	0.245***	0.0341	0.0732
	(0.0418)	(0.0883)	(0.0418)	(0.0552)
NPL	-0.365***	0.0633	-0.115	-0.365***
	(0.128)	(0.131)	(0.128)	(0.116)
OP	1.462***	0.884**	1.462***	1.171***
	(0.257)	(0.345)	(0.257)	(0.286)
IP	-0.0579	0.0103	-0.0579	-0.0134
	(0.238)	(0.245)	(0.238)	(0.227)
GWMTTS	4.554	-0.0160	4.554	1.489
	(3.381)	(2.774)	(3.381)	(2.562)
GDP	0.0603	0.110***	0.0603	0.0677**
	(0.0420)	(0.0382)	(0.0420)	(0.0320)
INFLATION	-0.0245	0.170	-0.0245	0.0718

Variables	Pool OLS	FEM	REM	GLS AR1
	(0.186)	(0.133)	(0.186)	(0.128)
Constant	-1.949	-14.34*	-1.949	-3.613
	(2.382)	(7.897)	(2.382)	(2.867)
Observations	50	50	50	50
R-squared	0.617	0.492		
Number of Name		10	10	10
Prob>F/Prob>Wald Chi2	0.000	0.000	0.000	
Hausman test (Prob>chi2)		1.000		
Breusch and Pagan Lagrangian multiplier test (Prob>chibar2)			1.000	
Wooldridge test (Prob > F)			0.0272	

(*Data Source: Stata 15 output*)

The estimation results of OLS, FEM and REM show different variables as well as different degree of influence of the variables on net interest margin of commercial banks.

OLS Regression Results:

Size variable has a statistically significant positive effect on net interest margin among Vietnamese commercial banks for the period 2016-2020. This result shows that the higher the Size is, the higher the bank's net interest margin will be.

OP variable has a statistically significant positive effect on net interest margin among Vietnamese commercial banks for the period 2016-2020. This result shows that the higher the OP, the higher the bank's net interest margin will be.

NPL variable has a statistically significant negative effect on net interest margin among Vietnamese commercial banks for the period 2016-2020. This result shows that the higher the NPL, the lower the bank's net interest margin will be.

The R-squared coefficient of the model reaches 61,7% hence the suitability level of the variables in the model are relatively high. The F-statistic value is statistically significant at the 1% level, therefore the OLS estimate could be a suitable estimate.

Regression Results using the Fixed Effects Model:

Size variable has a statistically significant positive effect on net interest margin among Vietnamese commercial banks for the period 2016-2020. This result shows that the higher the Size is, the higher the bank's net interest margin will be.

CAP has a statistically significant positive effect on net interest margin among Vietnamese commercial banks for the period 2016-2020. This shows that the higher the CAP is, the higher the bank's net interest margin will be.

The loan-to-deposit ratio has a negative effect and statistical significance with the net interest margin in commercial banks in Vietnam for the period 2016-2020. So when the ratio increases, the net interest margin of commercial banks will decrease.

OP has a statistically significant positive effect on marginal interest rates among Vietnamese commercial banks for the period 2016-2020. This shows that the higher the OP, the higher the bank's net interest margin will be.

Size variable has a statistically significant positive effect on net interest margin among Vietnamese commercial banks for the period 2016-2020. This result shows that the higher the Size is, the higher the bank's net interest margin will be.

The results of the F-statistic test with p-value less than 0.05 show the difference between commercial banks. In this case the fixed impact model is more suitable than Pool OLS.

GDP has a positive positive effect with net interest margin in Vietnamese commercial banks for the period 2016-2020. Therefore, when GDP increases, the net interest margin of commercial banks also increases.

Regression Results with Random Effects Model:

Size variable has a statistically significant positive effect on net interest margin among Vietnamese commercial banks for the period 2016-2020. This result shows that the higher the Size is, the higher the bank's net interest margin will be.

CAP has a statistically significant positive effect on net interest margin among Vietnamese commercial banks for the period 2016-2020. This shows that the higher the CAP is, the higher the bank's net interest margin will be.

OP has a statistically significant positive effect on net interest margin among Vietnamese commercial banks for the period 2016-2020. This shows that the higher the OP, the higher the bank's net interest margin will be.

GDP has a positive positive effect with net interest margin in Vietnamese commercial banks for the period 2016-2020. Therefore, when GDP increases, the net interest margin of commercial banks also increases.

The results of estimating the model has shown that p-value is less than 0.05. Therefore, the random effect model is more suitable than the Pool OLS estimate.

The Hausman test is conducted to choose between a fixed and random impact model. The test results show that the p-value is 0.7347. Thus, the Ho hypothesis is rejected, the random impact effects is more suitable than the fixed impact model.

In order to check the heteroscedasticity phenomenon in the model, the Breusch and Pagan Lagrangian test was used, the Chi-squared statistical result is 263.62 with a p-value of 0.000 (less than 0.05). Therefore the heteroscedasticity exists in the model. The phenomenon makes the OLS estimate be unbiased and consistent. Additionally, this is not the most efficient estimate anymore. Hence, the regression coefficient test and the F-test of the model become unreliable. Therefore estimate with standard errors or robust standard errors was used to correct the model.

In order to test the autocorrelation phenomenon in the model, the Wooldridge test was used, the statistic result

p-value of 0.0503 (greater than 0.05). Hence, there is not autocorrelation phenomenon in the model.

To solve the heteroscedasticity phenomenon, the FGLS estimate is used, the adjusted model results is shown as follows:

The Adjusted Model Results:

OP has a statistically significant positive effect on net interest margin among Vietnamese commercial banks for the period 2016-2020. This result shows that the higher the OP, the higher the bank's net interest margin will be. This situation means that higher operating expenses will increase interest spread to compensate for the increase in operating costs. This result is consistent with previous studies of authors Barajas, Steiner and Salazar (1999); Kwan (2003); Carbo and Rodriguez (2007); Maria and Agoraki (2010); Maudos and Fernadez (2004); Mathuva (2009); Athanasoglou (2005); Sufian & Chong (2008); Pham Hoang An (2013); Hoang Trung Khanh (2015).

GDP has a positive positive effect with net interest margin in Vietnamese commercial banks for the period 2016-2020. Therefore, when GDP increases, the net interest margin of commercial banks also increases. This result is consistent with the previous studies: Demirguc-Kunt and Huizinga (1999), Bikker and Hu (2002), Kosmidou (2005), Pasiouras and Kosmidou (2007), Athanasoglou (2008), Gur et al (2011), Trujilo-Ponce (2012) and Zeitun (2012), Ben Naceur and Goaid (2005), Staikouras and Wood (2003); Hoang Trung Khanh (2015).

The loan-to-deposit ratio had a negative effect on the opposite and has statistical significance with the net interest margin in commercial banks in Vietnam for the period. LDR increases as a result of greater loan growth compared to the growth of third party funds collected by the bank. This condition causes a decrease in the bank's net interest income as a result of interest revenue growth less than growth of interest expense to be paid by the bank. This result is consistent with the previous studies of Brock and Suarez (2006); Manurung and Anugrah (2013).

NPL variable has a statistically significant negative effect on net interest margin among Vietnamese commercial banks for the period 2016-2020. This result shows that the higher the NPL, the lower the bank's net interest margin will be. This result is consistent with previous studies such as Angbazo (1997); Demirguc-Kunt and Huizinga (1999); Rodriguez (2007); Drakos, 2002; Maudos and Fernandez de Guevara (2004), Pham Minh Dien (2017); Pham Hoang An (2013); Nguyen Kim Thu (2015).

V. DISCUSSION AND CONCLUSIONS

The study result has shown that size of bank and operating expense has a positive and significant impact on net interest margin of the commercial banks in Vietnam. Similarly, the loan-to-deposit and non performing loan tend to be negative associated with net interest margin. We found that the higher loan to deposit ratio and non performing loan the lower the net interest margin. From the results of this study, we suggest that Vietnamese commercial banks need to increase their operational efficiency by effectively utilizing existing operating costs and enlarge the size of bank, while reducing loan to deposit ratio and non performing loan.

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