

Determinants of Non-performing Loans: The Case of Vietnam

Doan Thanh Ha¹, Hoang Thi Thanh Hang² (1. Department of Finance, Banking University of Hochiminh City, Vietnam; 2. Business Administration Faculty, Banking University of Hochiminh City, Vietnam)

Abstract: This research investigates the determinants of non-performing loan (NPL) in the banking system of Vienam. We employed panel data analysis with fixed effect and random effect estimation for 29 Vietnamese commercial banks for the period from 2005 to 2014. The empirical results suggest that NPL was determined by both macroeconomic variables and bank-specific characteristics. Specifically, the economic growth, inflation, bank profitability, liquidity and credit growth significantly affect bank credit risk via rising NPL. From these results, we suggest important policy implication for the State Bank of Vietnam and bank managers in reducing NPLs.

Key words: credit risk; non-performing loan–NPL; macroeconomic variables; bank-specific characteristics **JEL code:** G

1. Introduction

Bad debts, usually refered as NPL, is defined as sub-standard loans, overdue or need to be considered as loan loss when the debtor is insolvent. The literature has showed that NPLs are determined by macroeconomic and bank specific factors, but most of the studies focus on investigating European countries like Greece, Spain, and East Europe.

In Vietnam, there were some researches on NPL such as Vo Thi Ngoc Ha & Le VinhTrien (2014) and Nguyen Thi Minh Hue (2015). Vo Thi Ngoc Ha and Le Vinh Trien (2014) employed the panel regression and data from 8 listed banks in the period from 2008 to 2013 to analyze the relationship between the macro-economic variables (such as GDP growth, inflation, interest rate, and foreign exchange) and the NPL ratio of the Vietnamese Banking System. The empirical results showed that GDP has an inverse relationship with the NPL, while the interest rate is positively correlated with NPL ratio, foreign exchange and inflation has no significant impact on NPL. Nguyen Thi Minh Hue (2015) analyzed the specific factors affecting the NPLs ratio of Vietnamese Banking System. Data gathered from the financial statements of 20 commercial banks within the period from 2009 to 2012. The studied factors are lag of NPL, loan-total asset ratio, total assets, and the state ownership. The results showed that all these factors have the significant impacts on the NPL.

This study revisits the determinants of NPL in Vietnamese banking sector. We focus on macroeconomic variables and bank-specific characteristics and apply panel data analysis for 29 commercial banks during the

Doan Thanh Ha, Dr., Associate Professor, Banking University of Ho Chi Minh City; research areas/interests: finance, banking. E-mail: hadt@buh.edu.vn.

Hoang Thi Thanh Hang, Dr., Banking University of Ho Chi Minh City; research areas/interests: risk management. E-mail: hanghtt@buh.edu.vn.

period from 2005-2014. From the empirical results, important policy implication will be discussed to mitigate NPL ratio and improve loan portfolio quality for banks.

2. Literature Review

NPL is the most common indicator to represent credit risk (Makri, Tsagkanos, & Bellas, 2014). In recent years, there have been many researches to figure out the real situation of NPL and key factor affecting NPL ratio. The literature suggests two groups of factors: macro-economic variables and bank-specific characteristics.

2.1 Macro-economic Factors

Carey (1998) assumed that the situation of the economy is the main and most important factor which affects the risk exposure of a diversified loan portfolio. Some searches mainly analyzed the effect of macro-economic factors on NPL such as Nkusu (2011); Beck, Jakubik, and Piloiu (2013); Tanasković and Jandrić (2015)... and other researchers analyzed the effect of macro-economic factors and unique factors of banks such as: Salas and Saurina (2002); Rajan and Dhal (2003); Louzis, Vouldis, and Metaxas (2012); Makri et al. (2014); Klein (2013)... To the extents of these researches, some researches employed data of a specific country such as: research of Salas and Saurina (2002) which analyzed the non-performing loan of commercial banks and saving banks in Spain in the period from 1985 to 1997; Ranjan and Dhal (2003) analyzed the NPL of Indian state banks in the period from 1993 to 2003; Louzis et al. (2012) analyzed the factors affecting the NPL of Greece banking system in the period from 2003 to 2009; Zheng and Hu (2006) analyzed the Taiwanese banking system in the period from 1996 to 1999. Other researches employed the data from many countries such as: Klein (2013) which analyzed the NPL in Central and South, East countries of Europe (CESEE) in the period from 1998 to 2011; Tanasković and Jandrić (2015) employed the data of these countries in the period from 2006 to 2013; Messai and Jouini (2013) employed the data of 85 banks in Italy, Greece and Spain in the period from 2004 to 2008; Makri et al. (2014) analyzed data of economy and banking system of 26 developed countries in the period from 1998 to 2009; Beck et al. (2013) employed the biggest data from 75 countries in the period from 2000 to 2010

Overall, these studies had provided convincing evidence which supports the theory of the tight relationship between NPL ratio and macro economic factors such as GDP growth and inflation rate. GDP growth is the most common macro-economic factor to be proved to be the driver of NPL ratios. The inverse relationship between GDP growth and NPL ratio is mentioned on researches of Salas and Saurina (2002); Louzis et al. (2012); Messai and Jouini (2013); Nkusu (2011); Makri et al. (2014); Klein (2013); Beck et al. (2013); and Tanasković and Jandrić (2015). When the economy experiences high GDP growth, the earnings of enterprises and citizen rise, in turn, it enhances the ability to repay the debt and reduce to NPL ratios. On the other hand, when the economy experiences low or negative GDP growth, the NPL ratio will increase.

By analyzing the data from CESEE countries in the period from 1998 to 2011, Klein (2013) assumed that the NPL ratio inclines to increase when the inflation rate is high. However, other researches of Fofack (2005), Tanasković and Jandrić (2015 had not confirmed this relationship. High inflation will reduce the interest rate and real value of loan, and enhance the payment ability. On the other hand, it will also reduce real earning of debtor with fixed wage and reduce the ability to pay-off the debt. We should also notice that, according to Fisher Effect, high inflation will lead to high interest rate, this will prevent the debtor to meet his/her obligation.

2.2 Bank-specific Characteristics

Inside factors will also affect the quality of loans. Berger and DeYoung (1997) had tested the theory of the

relationship between loan quality, the effort to control cost, and fund structure of banks based on the data of American Bank in the period from 1985 to 1994, such as hypotheses of "bad management" and "moral hazard". Bad management hypothesis assumed that failure to effectively control the cost is a sign of incompetent management and it would raise the NPL ratio. Moral hazard hypothesis assumed that the low ratio of owners' equity would be a motivation for accepting high-risk loan, it would lead to higher average NPL ratio in the future. Besides, Louzis et al. (2012) also mentioned the "diversification" theory. The diversification of loan will help to mitigate the non-systematic risk, and reduce the credit risk and NPL in the future. These hypotheses are the important base for researchers to define specific factors of banks which affecting the NPL ratio.

From these three hypotheses, empirical studies had defined specific factors of banks to affect the NPL ratio and tested the impact of these factors. The impact of indicators such as ROA, ROE were analyzed by Klein (2013); Louzis et al. (2012); Makri et al. (2014); Messai and Jouini (2013)... The realistic evidence has shown that there is an inverse and significant relationship between ROE, ROA and NPL ratios. Klein (2013) explained that the quality of management could be measured by the profitability from the old quarters; high profitability ratio expresses good management and low NPL ratio. This fits with the bad management hypothesis also found the adverse relationship between capital ratio (Equity/total asset) and NPL ratio. Studies of Louzis et al. (2012) and Klein (2013) had also confirmed this relationship. This could be explained by moral hazard theory. Based on this theory, Zheng and Hu (2006) had analyzed the relationship between the NPL and the ownership structure of Taiwanese banks in the period from 1996-1999. This study had proved that the bank with high ratio of state ownership has low motivation to seek for high profit, they would rather not incline to accept high-risk loan than the private banks do. However, banks with high state-ownership ratio are driven by political intervention to make decision on loan, this leads to high NPL ratio.

According to "diversification" theory, when bank loan portfolios are well-diversified, the credit risk will reduce, and the NPL ratio will be low. Many researchers have employed bank size to analyze the chance for diversification, the bigger the banks is, the more chance to diversify the loan portfolios. Salas and Saurina (2002) had acknowledged the adverse relationship between the size of a bank and its NPL ratio. Rajan and Dhal (2003), Louzis et al. (2012) had reached the same conclusion with banks in India and Greece. The size of a bank can be measured by different indicators such as total asset, total deposit, total lending... Besides, Klein (2013), Khemraj and Pasha (2009) had employed loan to total asset — LTA or loan to deposit-LTD as indicators for diversification which expresses the fact that bank depends on. When the LTD is higher than 1, this means the bank's loan exceeds its deposit. When the money market is unstable, the bank will face credit risk, and will not have enough credit to revolve the old loan, it raise the NPL ratio. In addition to 3 factors of these theories, some other factors have been considered. Khemraj and Pasha (2009)had defined the relationship between the credit growth and NPL ratio from last quarter to current quarter.

2.3 Models and Hypotheses

2.3.1 Models

The research focused on the impact of inner factors and macroeconomic factors on NPL_t with the following variables: NPL_{t-1}(last year NPL), Size (bank size), Equity (Equity-to-total-asset ratio), ROE (return on equity), LTD (loan-to-deposit ratio), STL_t (Short-term-loan ratio), STL_{t-1} (last year Short-term-loan ratio); Credit_t, (Credit growth) Credit_{t-1}, (Last year credit growth); GDP (GDP growth); INF (inflation rate). The model is set up as the followings:

$$\pi_{it} = c_{it} + \alpha_j B_{it} + \beta_k X_t + \varepsilon_{it} \tag{1}$$

Where, π is the dependent variable, *c* is an intercept, α and β are parameters, *B* is unique variable of the bank, *X* is macro-economic variables, ε is an error term of the model, *i* stands for the order of banks, *t* is year and *j* is the order of bank's inner variables and *k* is the order of macro-economic variables.

2.3.2 Variable and Hypothesis Description

(1) The Non-performing Loan (NPL_t)

Jimenez, Salas, and Saurina (2006) assumed that the NPL ratio in the past goes in the same direction with current NPL ratio. The NPL is calculated by the below formation:

$$NPL = \frac{\text{loan balance group 3+loan balance group 4+loan balance group 5}}{\text{Total loan balance}}$$
(2)

The loan balances of groups 3, 4, 5; Total loan balances are obtained from financial statements and annual reports. The formula (2) is used to calculate the NPL ratio of each bank, each year.

When performing the regression, the researchers took the logarithm of NPL ratio: $Ln = \frac{NPL_{it}}{1-NPL_{it}}$ and $Ln = \frac{NPL_{it-1}}{1-NPL_{it-1}}$ respectively in the left side and the right side of the model, and replace for NPL_t and NPL_{t-1}. Because the value of NPL ranges from $0 \le NPL \le 1$, $-\infty \le \frac{NPL}{1-NPL} \le +\infty$. On the other hand, if $Ln = \frac{NPL_{it}}{1-NPL_{it}}$ rises NPL_{it} increases and vice versa.

During the operation, banks could not avoid the fact that some loans could turn into NPL, high NPL ratio showed that the bank risk-management was not good. It takes time for banks to improve the operation mechanism. In reality, the operation of Vietnam commercial banks has recently showed that banks that had suffered high NPL ratio in the year before would subsequently coped with high NPL ratio in the current year and vice versa. *The Hypothesis* H_1 *is that the NPL in the past has a direct relationship with current NPL ratio*.

(2) Size

According to Rajan and Dhal (2003), the size of bank positively affects the NPL ratio of a bank. For a bank of which total asset is a big figure, researchers always take the logarithm of total asset to represent the size:

$$Size = Ln(total asset)$$
(3)

Where, total asset is obtained from the balance sheet of a bank. The size (of bank) variable is calculated by the above formula (3). *The Hypothesis* H_2 *is that the size has a positive impact on NPLs*

(3) Equity Ratio (Equity):

Many studies suggested that the Equity/Total Asset ratio were always employed rather than the absolute value of Owners' equity. A large number of researches employed the variable of Equity/Total Asset ratio. Fofack (2005) studied NPL of African Bank; Louzis et al. (2012) studied factor impacting the NPL ratio in Greece. Thus, according to past studies, the Equity was calculated as the following formula:

$$Equity = \frac{Owners' Equity}{Total Asset}$$
(4)

Where, the Owners' Equity and total asset were obtained from banks' balance sheets. The Equity in this study is calculated by the formula (4). Louzis, Voulds, Metaxas (2010) had realized that the Equity has an inverse relationship with NPL. *The Hypothesis* H_3 *is that the Equity has inverse relationship with NPL*.

(4) Return on Equity (ROE)

Studies of Louzis et al. (2012) had found out the relationship between the poor earning result and NPL. The return of equity was calculated by the below formula:

$$ROE = \frac{\text{Net in come}}{\text{Equity}}$$
(5)

Where the net income is obtained from the Income Statement, the Equity is obtained from the balance sheet. Formula (5) is used according to Vietnamese Standard. The higher the profit of the bank is, the more dividend shareholders gets, because when the bank performs well, it enjoys strong credit growth, low NPL ratio and low provision. *The hypothesis* H_4 *put on the table is ROE and NPL ratio has an adverse relationship.*

(5) Loan to Deposit Ratio (LTD)

According to Louzis et al. (2012), the LTD positively correlates with NPL for commercial and consuming loan, LTD negatively correlates with NPL for mortgage loan. The calculation for LTD is as below:

$$LTD = \frac{\text{Loan Balance}}{\text{Deposit}}$$
(6)

Where, the loan balance and deposit were obtained from the balance sheet of banks. This ratio expresses the fact that bank funds it loan by deposit or other sources, cross-ownership would be taken into the account. *Hypothesis H5 mentioned is the loan to deposit ratio is in line with the NPL ratio.*

(6) Credit growth (Credit_t)

Credit growth is defined as the loan balance growth from last period to this period (in terms of percentage)

$$Credit_{t} = \frac{Loan \, balance_{t} - Loan \, balance_{t-1}}{Loan \, balance_{t-1}}$$
(7)

The loan balance is obtained from balance sheets or credit growth is obtained from the bank's audited annual reported. The study employed the formula (7) to calculate the credit growth. In studies of NPL, many authors considered the relationship between credit growth and NPL, such as: Dash and Kabra (2010) and Espinoza and Prasad (2010). Besides, some authors also considered the relationship between past credit growth and current NPL, such as Jimenez and Saurina (2005) on correlation of last year credit growth (Creditg₋₁) and NPL; Espinoza and Prasad (2010) on correlation of credit growth in year_{t-2} (Creditg₋₂) and current NPL ratio.

The results showed that the high credit growth contribute to mitigate the NPL of banks in current year. However, high credit growth in the past would contribute to enhance the NPL in current year, this result also reflected the performance of commercial bank *Hypothesis H6 mentioned here is about the adverse relationship between credit growth and NPL ratio and hypothesis H7 is that the last year credit growth is in line with the NPL ratio.*

(7) Short-term Loan Ratio (STL_t)

According to Ranjan and Dahal (2003) Study on factors impacting NPL, they employed STL as the independent variable for their study. The STL ratio is defined as:

$$STL = \frac{Short-term \, loan}{Total \, Loan} \tag{8}$$

Formula (8) is used to calculate data for studies. Short Term Loan is classified as loan with maturity of less than one year which can be obtained from the footnotes of the financial statement or board of management reports, or board of directors. STL is usually the loan to add in the working capital of debtor when the economy is favorable, and banks expand loans, and increase the loan balances, including STL and this helps mitigate the NPL. On the other hand, when the economy is unfavorable, the inflation raises. Therefore, the banks limit lending, the NPL will increase. This means the past NPL has a positive impact on current NPL. *The Hypothesis* H_8 *is that the STL in the current year has an negative impact on NPL, and Hypothesis* H_9 *has an positive impact on NPL*

(8) GDP Growth (GDP)

According to Salas and Saurina (2002), Jimenez et al. (2006), Fofack (2005), there is an adverse relationship between GDP and NPL. When the economy goes into a crisis, the financial ability of household and companies deteriorate. When the economy is booming, the earning of household and companies are good enough to improve the repayment ability, the NPL will be decreased. The GDP is calculated as the followings:

$$GDP_{t} = \frac{GDP_{t} - GDP_{t-1}}{GDP_{t-1}}$$
(9)

The study employed the GDP growth from General Statistical Office of Vietnam. The Vietnamese Economy accommodate it GDP growth mainly based on the Credit Supply from banks, so high GDP growth means high credit growth, and the operation of business and individuals in the economy will achieve better results, higher liquidity, which helps NPL ratio. On the other hand, when the economy contracts, the inflation is high, the credit supply growth is low, liquidity get distressed, this will increase the NPL. *Hypothesis* H_{10} *is that the Credit growth goes in opposite direction to the NPL*.

(9) Inflation Rate (INF)

According to Fofack (2005) showed that inflation rate contributes to the increase of NPL ratio of African Nations which are nearby Sahara Desert. The formula to calculate the inflation is as below:

$$INF_{t} = \frac{CPI_{t} - CPI_{t-1}}{CPI_{t-1}}$$
(10)

The data of inflation in Vietnam is measured and published by General Statistical Office of Vietnam. Inflation is defined as the high and continuous increase of price in a long period. We can prove that the inflation is one of the key factors affecting the NPL of Banking system in Vietnam. When the economy suffers high inflation, there are negative adjustments such as: Prime rate increases, the depreciation of local currency, the access to loan *The hypothesis* H_{11} *is that the Inflation rate has a inverse relationship with* NPL.

Variable	Variable description	Formula	Expectation
NPLt	NPL ratio	$Ln = \frac{NPL_{it}}{1 - NPL_{it}}$	
NPT _{t-1}	Last Year NPL ratio	Lagged variable of NPL	(+)
Size _t	Bank Size	Ln(Total Asset)	(+)
Equity _t	Equity Ratio	Equity/Total Asset	(-)
ROEt	Return on Equity	Net income /Equity	(-)
LTD _t	Loan to Deposit Ratio	Loan balance/Total Deposit	(+)
Credit _t	Credit growth	Loan Balance	(-)
Credit _{t-1}	Last year credit growth	Lagged variable of Credit	(+)
STLt	Short-Term Loan	STL balance/ Total Loan	(-)
STL _{t-1}	Last year Short-Term Loan	Lagged variable of STL	(+)
GDPt	GDP growth	Current Real Annual GDP	(-)
INFt	Inflation rate	Current inflation rate	(+)

Table 1	Description	of	Variables
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3. Methodology and Data

3.1 Data

This study employs secondary data from the financial statements and annual reports of 29 commercial banks in Vietnam for the period from 2005 to 2014. We select data based on size, equity, market-share with a total of 290 observations annually. Macroeconomic data such as GDP and inflation rate are obtained from General Statistical Office of Vietnam.

3.2 Methodology

In this study, we perform the statistic on NPL ratio, and macro-economic data which affect the NPL ratios concluded from Vietnamese commercial banks, General Statistical Office of Vietnam. Then, we employed table-regression technique to build regression model and test the hypotheses to analyze the impact and impact-exposure of factors on NPL ratio of Vietnamese Commercial Banks. The methodology to be employed in this study is Panel Least Squares.

4. Result

4.1 Descriptive Statistics

The descriptive statistics of input data (reported in Table 2) shows that the average NPL ration in the period from 2005 to 2014 is 2.42% with a dispersion of 1.91%. The bank with lowest NPL rate is PGbank (2007) — 2.42% and bank with highest NPL ratio is Agribank (2013) — 12.71%.

Variable	Minimum value	Maximum value	Average value	Standard Deviation	
NPL	0.0620	12.7100	2.4208	1.9071	
CREDIT	-41.6298	1,134.2780	61.6375	120.6922	
ROE	0.0679	36.5200	11.6723	6.8955	
SIZE	448.000	634,505	94,246	129,692	
LTD	40.7293	382.8681	100.9239	44.2119	
STL	22.5306	83.1099	58.8817	11.4995	
EQUITY	2.0535	58.2555	10.6619	8.4425	
GDP	5.2500	5.5000	6.4588	1.2034	
INF	6.0400	23.1163	11.0667	5.8695	

 Table 2
 Descriptive Statistics of Input Variables in the Model

4.2 Correlation Analysis

The correlation matrix of variables in model is expressed in Table 3, which shows that the absolute correlation value between pair of variables is all very low (below 0.5). However, to ensure that there is no multicollinearity between variables in the model, Wooldridge (2002) had suggested to test the Variance Inflation Factor (VIF) to check the multicollinearity problem. If the VIF is higher than 10, there is the multicollinearity. Table 4 reports the VIF of all variables in the model, which all well below 10, and there is no multicollinearity between independent variables in the model.

Table 3 Correlation Matrix of Variable in the Model									
	NPL	SIZE	ROE	EQUITY	LTD	CREDIT	STL	GDP	INF
NPL	1								
SIZE	0.219	1							
ROE	-0.386	0.220	1						
EQUITY	-0.007	-0.675	-0.305	1					
LTD	-0.187	-0.392	0.035	0.436	1				
CREDIT	-0.0400	-0.281	0.027	0.117	0.147	1			
STL	-0.128	-0.062	0.109	-0.069	-0.087	-0.086	1		
GDP	-0.436	-0.407	0.274	0.096	0.210	0.375	0.149	1	
INF	0.067	0.004	0.058	0.050	-0.017	-0.182	0.017	-0.119	1

Table 4	Variance Inflation Factor of the Model
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Variable	Model
C	
NPL _{t-1}	1.5376
Size	2.7789
LTD	1.3737
Equity	2.2539
ROE	1.5076
Credit _t	1.3640
Credit _{t-1}	1.5509
STL _t	1.9571
STL _{t-1}	1.0104
GDP	1.6659
INF	1.3570

4.3 Estimation Results

The estimated results from Pooled Regression Model, Fixed Effects Model (FEM), Random Effects Model (REM) for panel data were reported in Table 5. The Pooled regression results show that both macroeconomic and bank-specific variables have significant impacts on NPL. Where, GDP is inversely proportional to NPL, and INF is directly proportional to NPL. For FEM, credit growth, bank size, and equity have no statistical effects. To be consistent with Pooled regression, the two macro factors of GDP and INF significantly affect NPL. While GDP is inversely proportional to NPL, INF is directly proportional to NPL. For REM, all the variables have statistical effects at the significant level of 5%.

To select the appropriate model, we applied Wald to analyze the accordance of Pooled Model and FEM, the results showed that the Chi-square value = 46.8190 and Prob. = $0.0143 < \alpha = 0.05$ so, we deny H₀. That means there is a difference between vertical factor and independent variables, so we select the FEM.

Next, we use Hausmantest to choose between FEM and REM, the result is $X^2 = 0$ and Prob. = $1 > \alpha = 0.05$, so we accept H_0 and come to a conclusion that the REM is more suitable than FEM.

				0 ,		
	Pooled			FEM		REM
	Correlation	Standard Error	Correlation	Standard Error	Correlation	Standard Error
NPL-1	0.5855***	0.0438	0.3082***	0.0681	0.5437***	0.0476
Size	0.0156	0.0340	-0.0526	0.0744	0.0023	0.0427
Equity	0.0041	0.0057	0.0089	0.0086	0.0027	0.0064
ROE	-0.0161***	0.0051	-0.0212**	0.0084	-0.0207***	0.0061
LTD	-0.0018*	0.0009	-0.0029**	0.0013	-0.0018*	0.0010
Credit	-0.0027**	0.0003	-0.0025***	0.0004	-0.0025***	0.0005
Credit_1	0.0013***	0.0003	-0.0002	0.0005	0.0008**	0.0004
STL	-0.0095**	0.0040	-0.0162***	0.0049	-0.0149***	0.0047
STL-1	0.0083**	0.0041	0.0141***	0.0052	0.0147***	0.0048
GDP	-0.0565*	0.0296	-0.1403***	0.0484	-0.1045**	0.0448
INF	0.0214***	0.0053	0.0163**	0.0075	0.0242***	0.0063
Obs.	290		290		290	
R ²	0.6572		0.6659		0.5912	
Adjusted R ²	0.6400		0.5981		0.5708	
DW	2.1296		2.1628		2.2238	

Table 5	The Estimated	Results of Pooled	Regression	FEM and REM
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Note: ***, ** and * denote the level of significance at 1%, 5% and 10%, respectively.

Table 6 Wald Test Results

Redundant Fixed Effects Tests						
Equation: FEM						
Test cross-section fixed effects						
Effects Test	Statistic	d.f	Prob.			
Cross-section F	1.5333	(28,192)	0.0505			
Cross-section Chi-square	46.8190	28	0.0143			

Table 7 Hausman Test Results

Rcorrelated Random Effects – Hausman Tests						
Equation: REM						
Test cross-section frandom effects						
Test Summary Chi-Sq. Statistic Chi-Sq. d.f Prob.						
Cross-section random	0.000	11	1.000			

In conclusion, from Wald test and Hausman test we find that REM is more revelant in modeling the determinants of NPLs in Vietnam, therefore estimation results in the last two columns of Table 5 should be analyzed.

4.4 Pre-estimation Test

4.4.1 Testing the Relevance of Model

The result of F-test is P (F-statistic) = $0.000 < \alpha = 0.05$, so we denied the hypothesis H₀, accept H₁: the model is suitable. The adjusted R² is 0.5708, which means that the model with selected macro and bank-specific factors can explain around 57.08% the fluctuation of NPL.

4.4.2 Testing the Alternative Variance

We used Wald test to check the alternative variance in the selected model and the result showed that the Chi-square value == 16.0867 and Prob. = $0.1379 > \alpha = 0.05$. So, the hypothesis H₀ is rejected, there is no variance change

4.4.3 Testing the Serial Correlation

The modified Dubin-Watson indicators of around 2.2 suggest that the models did not suffer from serial correlation problem.

4.5 Discussion on the Results

In all cases, the empirical results support our hypotheses, specifically:

• The past NPL (NPL_{t-1}) positively affects the current NPL ratio with a significant level of 1%. Keeping other factors unchanged, if (NPL_{t-1}) increases by 1% point, NPL will rise by 0.54% point. This result is consistent with the studies of Salas and Saurina (2002) and Jimenez et al. (2006) which stated that past NPL positively affects the current NPL. With this result, if banks can well-control the NPL in the current year, they will not face to risk of increasing NPL in the future and this result also give bankers some recommendations to focus on risk management, NPL control to cope with this trendy characteristics of NPL from time to time.

• The Return on Equity has negative impact on NPL at a significant level of 1%, meaning that if ROE rises by %, NPL will reduces by 0.0207%. This support the results of Louzis et al. (2012). This result also proved that bank with good performance, high ROE was more likely to have lower NPL. As banks can have good monitoring and screening skills, they can reduce the level of NPL.

• Loan-to-deposit ratio poses negative impact on current NPL with a significant level of 10%. Keeping other factors unchanged, if LTD rise by 1% reduces by 0.0018%, NPL will decrease. This result does not support the Hypothesis H5. However, with the selected sample, we cannot confirm the above Hypothesis H5. In fact, with describing statistics, the period from 2006 to 2014, except for 2011 and 2013, the LTD is inversely proportional to NPL. The credit performance of Vietnamese commercial banks have recently showed that the loan of subsidiaries belong to the related parties is almost asset-backed, the repayment of these loan is secured. This is consistent with the study of Louzis et al. (2012) which stated that for asset-backed loan, LTD is inversely proportional to NPL. This result shows that the lending behavior of Vietnamese commercial banks. When approving the loan, banks always focus on the collaterals rather than the profitability, cash flow of the project and social effect.

• The credit growth (Credit) has inverse impact on NPL with a significant level of 1%. A 1% point change in credit growth leads to a decrease in NPL by 0.0025%. This supports Hypothesis H6 and the studies of Dash and Kabra (2010). This result proved that if bank expands its loan in current year, the NPL will decrease. However, credit_1 has NPL reduces by 0.0025%, this leads to a decrease in NPL. This is consistent with the Hypothesis H6 and the studies of Dash and Kabra (2010), to prove that if bank expands its loan in current year, the NPL will decrease. However, the relationship between Credit of the current year and NPL of the following years will be discussed next part.

• The STL has a negative impact on current NPL at a significant level of 1%. The banks have continuously expanded its short-term loan to boost the credit growth, and reduce the NPL in the current year. This result is supported by the high annual average SLT-growth. Although high STL contributes to reduce the current NPL, it would increase the risk of a higher NPL in the future when the economy is not favorable. However, STL of last year (SLT_1) has a positive impact on NPL with the significant level of 1%. If STL rises by 1%, NPL rises by 0.0147%. This is consistent with the studies of Rajan and Dhal (2003). The banks have continuously expanded its short-term loan to boost the credit growth, and reduce the NPL in the current year, but it may lift the NPL in the following year. When these loans come due, the bank cannot make more loans to revolve the old loan, because of the impact from policy intervention of the government, this restricts the access of the business from STL and may cause the NPL to rise.

• GDP is inversely proportional to NPL at a significant level of 5%. This result supports the hypothesis H10 and those studies of Salas and Saurian (2002); Rajian and Dhal (2003); Jimenez et al. (2006) and Fofack (2005). When the economy is favorable, businesses and household perform well, the ability to repay the loan is improved, this leads to a reduction in NPL.

• Inflation rate-INF is directly proportional to the current NPL at a significant level of 1%. This result supports the hypothesis H11 and the study of Fofact (2015). When the economy suffers high inflation, the government usually implements tightening fiscal and monetary policies to restrict the credit growth to stabilize the macro-economics. This results higher NPL.

• Size and Equity have no significant correlation with NPL. Although some studies had mentioned that Size had a positive impact on NPL such as: Rajan and Dhal (2003), Dash and Kabra (2010), but other studies of Salas and Sauria (2002) and Zheng and Hu (2006) had showed that Size have negative impact on NPL. In Vietnam, small banks have low NPL ratio while big banks have high NPL ratio. Similarly, Equity has no statistical meaning; as descriptive statistics showed that if Equity-to-total-asset of a bank rises, the NPL will rise. This can be explained by the fact that the management competent is not well-manage the bank as it goes bigger in size and equity.

5. Conclusion and Recommendation

This study empirically analyzes the determinants of NPL in Vietnamese banking system in the period from 2005-2014. We apply Pooled regression, FEM and REM for a panel of 29 commercial banks, which results in 290 observations. The empirical results suggest that NPL are significantly affected by macro-economic variables and bank-specific characteristics. Specifically, GDP and credit growth, the proportion of short-term loan, profitability, and liquidity have negative effect on NPL. We also find that NPL depends positively on its last year level and the past level of credit growth and short-term lending. These results are consistent with other studies and support the hypotheses well. From the results, some recommendations are suggested for bank managers and policy makers to control and mitigate the NPL.

Firstly, the bank managers can control the NPL by boosting the ROE, diversifying the investment portfolios instead of lending, setting a reasonable credit growth, and restructuring the LTD. In addition, bank must stress on the risk management and strictly conform to credit rules and procedures.

Secondly, the government needs to have reasonable policies to maintain the stable economy growth, attract more investments by favorable mechanism, promote the growth of businesses, and improve the laws and financial system in accordance with international standards.

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