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University of Southampton

Faculty of Social Sciences

Southampton Business School

An Analysis of Non-Performing Loans, Non-Performing Loans to Loan Loss Reserves, And Diversification Effects on Lending: Three Essays

By

Thi Thuong Nguyen

Thesis for the degree of Doctor of Philosophy

2021

University of Southampton

Abstract

Faculty of Social Sciences
Southampton Business School
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An Analysis of Non-Performing Loans, Non-Performing Loans to Loan Loss Reserves, And Diversification Effects on Lending: Three Essays

Thi Thuong Nguyen

The thesis concentrates on credit risk associated with the traditional lending activity of commercial banks. To this end, three empirical analyses are conducted in this thesis. We begin with a study of the determinants of non-performing loans (NPL) and their impact in the Vietnamese banking sector. Following this, we inspect how the changes in NPL regulations impact upon the NPLs of commercial banks. Next, we expand our analysis and investigate whether the ratio of non-performing loans (NPL) to Loan Loss Reserves (LLR) adds valuable information to provide a signal about bank future profitability. Finally, we examine how diversification affects loan growth and whether a difference arises between the various categories of loans.

By applying various economic approaches, we demonstrate robust and consistent evidence for the following findings. Firstly, we find that NPL remain sensitive to both macroeconomic and bank-specific factors. We find strong evidence to support the significant impact of the changes in NPL regulations on NPL. Secondly, our findings also suggest that banks with lower NPL_{it} to LLR_{it-1} ratios have greater future earnings. Additionally, we also ascertain that during an economic upswing, the prediction of a bank's profit increases as a result of a decrease in the ratio between NPL_{it} and LLR_{it-1}. Finally, the subsequent analysis of diversification within this PhD also suggests that engaging in a geographic diversity strategy could lead to an expansion of gross loans as well as the growth of consumer and corporate loans. However, banks with a higher level of deposit diversification reduce the growth rates of their consumer loans.

The empirical results obtained in the above three analyses have numerous policy implications. The robustly positive association between NPL and key macroeconomic indicators suggests that the degree of credit risk is dependent on the management of the business cycle. Consequently, policymakers could aim to reinforce control actions. The results regarding the effect of bank-specific characteristics on problem loans suggests that regulators should consider these factors as leading indicators of future problem loans and to implement prompt corrective action. Moreover, this finding also highlights that tighter risk controls induce banks to take on less riskier loans which therefore suggests that loan restriction policies should be considered to mitigate loan losses. Next, based on robust evidence of analysis, bank supervisors can consider the ratio between loan losses and its expected value as an early warning indicator of future performance of banks. Lastly, findings from this PhD research show that traditional bank lending activity is highly responsive to a bank's regionalization strategy and accordingly, the design of regulatory policies and strategies should consider the influences of diversification.

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Declaration of Authorship

Thi Thuong Nguyen

An Analysis of Non-Performing Loans, Non-Performing Loans to Loan Loss Reserves, And Diversification Effects on Lending: Three Essays

I declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5. I have acknowledged all main sources of help;
6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. Parts of this work have been published as:

   - Nguyen, T.T. and Wolfe, S., 2020. Does Diversification Affect Loan Growth? Evidence from the Vietnamese Banking Sector. *Journal of International Money, Banking and Finance*, *1*(1).

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Signature: ..... Date:.....

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Southampton, 2021

Thuong Nguyen

Definitions and Abbreviations

Abbreviation	Description
ATM	Automated Teller Machine
CDS	Credit Default Swaps
CEE	Central and Eastern European
CESEE	Central, Eastern and South-eastern European
DID	Difference-in-Differences
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
HHI	Herfindahl-Hirschman Index
IV	Instrumental variable
LGD	Loss Given Default
LLP	Loan Loss Provisions
LLR	Loan Loss Reserves
NPL	Non-performing loans
ROA	Return on Assets
ROE	Return on Equity
SBV	State Bank of Vietnam
2SLS	Two-stage least squares

Chapter 1 Introduction

1.1 Aims

This thesis aims to offer new insights into credit risk embedded in bank lending activity, and bank stability. Accordingly, non-performing loans (NPL) are used as a traditional proxy for credit risk in this study. To this end, this thesis provides a distinctive analysis of the NPL drivers, the relationship between the ratio of NPL to Loan Loss Reserves (LLR) and banks' future profitability. An additional and unique analysis of the diversification role in lending activity is also conducted within this thesis.

1.2 Overview

A commercial bank is considered as the most important type of financial intermediary and its activity is necessary to guarantee that the financial system and the economy run smoothly and efficiently (Mishkin, 1989). Whereas commercial banks play a crucial role in channeling funds to borrowers with productive investment opportunities, their profits are primarily made by issuing loans. Additionally, banks must make successful loans that are paid back in full if they are to earn high profits. However, credit risk (primarily captured by non-performing loans – NPL) may occur because of asymmetric information. There is asymmetric information or lack of information in loan markets because lenders have less information about the investment opportunities and activities of borrowers. Asymmetric information arises in the financial system on two fronts: before the transaction is entered into and after the loan has been agreed (Berndt and Gupta, 2009; Mishkin, 1989; Darrough and Stoughton, 1986).

Firstly, adverse selection refers to a problem created by asymmetric information before a transaction occurs. I financial markets, adverse selection is possible to happen when the potential borrowers are the most likely to make a poor (adverse) performance (e.g. a bad credit risk) and most actively apply for a loan (Mishkin, 1989; Gorton and Pennacchi, 1995; Pennacchi, 1988). Thus,

there is a high probability that the loans of these customers are approved. Furthermore, riskier investment projects enable borrowers to gain more if the projects achieve their potential. Consequently, these borrowers have more intensives to take out loans. On the contrary, they may be less likely to repay their loans with the high-risk investments. Manifestly, adverse selection may result in loans being made to bad credit risks, lenders, therefore, are more likely to decide not to provide loans despite good credit risks in the marketplace (Mishkin, 1989). Secondly, moral hazard problem is created by asymmetric information after the transaction occurs (Mishkin, 1989; Gorton and Pennacchi, 1988; Pennacchi, 1988). From the view of the lenders, the borrower might engage in undesirable activities (e.g. uneconomic or illegal) that lessen the full repayments of loans and result in moral hazard in financial markets. Because moral hazard lowers the probability that the loan will be repaid, lenders may decide that they would rather not make a loan (Duran and Lozano-Vivas, 2015; Mishkin, 1989; Jensen and Meckling, 1976).

The recent global financial crisis has resulted in surges in NPL in most countries including developed and developing countries (Ghosh, 2015). A rising share of NPL in banks' loan portfolio implies greater risks which influence both bank profitability and stability (Ghosh, 2015). The deterioration of loan quality significantly reduces bank soundness and can lead to a decline in economic efficiency. In addition, the 2008 financial crisis has highlighted the importance of evaluating loan quality and in consequence, loan growth and NPL have become major policy concerns in recent years (Abedifar et al., 2018; Ghosh, 2017; Kim and Sohn, 2017; Ghosh, 2015). To an emerging country like Vietnam, lending is one of the traditional core activities for banks and is the source of capital financing for the development of the country. Similarly, interest income from banks' lending accounts for the majority of bank revenue. However, the high level of NPL that resulted from financial liberalization and the recent crisis forces banks to improve risk management efficiency to boost stability. Motivated by this, the thesis aspires to shed light on further information beneficial for early warning systems.

In order to reach this goal, the empirical research concentrates on the following ways. Firstly, this research contributes to the burgeoning literature of credit risk by investigating bank-specific as

well as macroeconomic factors that influence NPL. It also extends the analysis by considering the reaction of NPL concerning the changes in NPL regulations. It enhances and deepens the understanding of minimizing NPL to restore a sounder banking system and ensure bank stability. Secondly, this thesis analyses the nexus between NPL, the expected value of NPL captured by LLR and bank future earnings. To our best knowledge, there are no previous studies that employs the ratio of NPL_{it} to LLR_{it-1}, thus we introduce a new dimension to the extant literature, thereby providing new and interesting recommendations for bank regulations and supervisions. Thirdly, the analysis assesses the role of diversification strategy in loan growth directly related to NPL, bank profitability, and bank stability. In doing so, the work offers insights into the ongoing debate around diversification, bank risk and bank performance.

The analyses offer a considerable insight into these above ideas by employing different approaches. In particular, using a Generalized Method of Moments (GMM) estimation as the starting point for the thesis, this study contributes to the deeper understanding of the relationship between NPL and its determinants. It not only focuses on the nexus between NPL and the factors, but also extends this analysis by investigating the impact of the new NPL regulations on NPL. To meet this target, we apply differences-in-differences (DID) regressions in which we make a comparison between the change of NPL before and after these new rules implemented (in 2014). Parallel with these approaches, the two stage least squares (2SLS) methodolody is used in the final analyses of this thesis. We extend previous literature on bank performance by examing the link between the NPL to LLR ratio and bank future profitability. We also add clear evidence on the importance of diversification to loan growth.

1.3 Structure of the Thesis

The thesis is structured along the aforementioned distinctive perspectives. Consequently, one chapter in this thesis is concerned with each one of the three distinct research lines and every analysis is designed to address further these issues of each chapter. In spite of the clear distinction,

the ultimate focus on bank lending activity and bank stability is common in these three lines of research.

Chapter 2 consists of the departure point for the analysis of the NPL determinants using data for the 22 largest Vietnamese commercial banks. Chapter 3 adopts a different methodology to investigate how the ratio of NPL to LLR could provide a signal to banks' earnings in the future. Chapter 4 analyses the influences of diversification on loan growth. Chapter 5 produces an overall summary to the thesis and highlights the crucial policy implications.

Chapter 2: Determinants of non-performing loans at Vietnamese commercial banks

Motivated by the hypothesis that several macroeconomic and bank-level characteristics could affect loan quality, this chapter shows an empirical analysis of the determinants of non-performing loans in the Vietnamese banking system. Whilst previous studies in the existing literature rely heavily on the banking industry in developed region such as the United States (US), the Euro region, and other European countries, this chapter concentrates on an emerging country in South East Asia. Following a detailed review of the existing literature on factors affecting NPL, this chapter empirically tests the hypothesis if NPL change when i) macroeconomic indicators are estimated as primary regressors, ii) each bank-level determinant is added in baseline estimation and iii) tighter restrictions are presented. Using a sample of annual observations of 22 Vietnamese commercial banks, the results of this chapter identify the important impacts of both macroeconomic and bank level determinants on NPL. More importantly, this is the first study to contain evidence that the new NPL rules implemented in the Vietnamese banking system in 2014 have had a significant effect on NPL. These findings are robust and consistent to various sensitivity checks with the combination of the GMM estimation and a DID approach. The findings highlight potential policy implication for an improvement in sustainable economic condition. Furthermore, the results suggest that banks' managers and regulatory authorities design control strategies built upon bank-specific characteristics as well as policy decisions in regard to growth and risk-taking incentives.

Chapter 3: Does the ratio of Non-performing loans to Loan loss reserves provide a signal about bank future profitability? Evidence from Vietnam

Chapter 3 makes further important contributions to the literature on bank performance and an early warning system of bank performance. The main objective of this chapter is to examine whether the link between NPL at present year (NPL_{it}) and LLR from the previous year (LLR_{it-1}) signal information about a bank's future profitability. To cope with this goal, the two-stage least squares (2SLS) methodology is employed. Controlling internal and external factors that could influence bank predicted earnings, the result reveals that banks with lower ratio of NPL_{it} to LLR_{it-1} are likely to increase their future profitability. Specifically, we find robust evidence that bank profitability in the future tends to be more responsive to the NPL_{it} to LLR_{it-1} ratio upon an upswing period. In terms of policy implications, the NPL_{it}/LLR_{it-1} could be used as a forward-looking measure, thus, both investors and supervisors could apply this ratio to analyse the prospect of banks' future value. Following the empirical results, it is apparent that banks with a relatively low NPL_{it} to LLR_{it-1} ratio can be potential targets and potentially, policymakers are therefore likely to design regulations for loan losses and loan loss provisions (or a buffer against loan losses) or credit risk management based on this evidence.

Chapter 4: How does diversification affect loan growth? Evidence from the Vietnamese banking sector

Chapter 4 presents empirical evidence in order to shed some light on the question of whether banks get benefit from diversification regarding loan growth. Both deposit diversification and geography diversification strategies are estimated as the main factors in this analysis by applying the two-stage least squares (2SLS) methodology. Moreover, the analysis also extends to examine these effects varying between different loan categories. To the best of our knowledge, this is the first study that investigates the impact of diversification in geography and deposit on bank lending in a developing country. We find that a higher level of geographic diversification is positively associated with greater gross loan expansion as well as consumer and corporate loan growth.

Deposit diversification, however, negatively influences the consumer loan growth only and deposit concentration seems to increase moderately the growth of this loan category. From a policy point of view, bank regulations, which may increase the level of geographic or deposit diversification, should be reflected.

Chapter 5: Summary, Conclusions, and Future Research

Chapter 5 presents a summary and the concluding remarks of this thesis. It also acknowledges the limitation of this study as well as outlining a number of appealing avenues for future research.

Chapter 2 Determinants of Non-performing Loans at Vietnamese Commercial Banks

Chapter 2: Determinants of Non-performing Loans at Vietnamese commercial Banks

Abstract

This chapter investigates the factors affecting Non-Performing Loans (NPL) and the effect of the recent NPL regulations on NPL in the Vietnamese banking sector for the years 2008-2017. In the empirical analysis, both the Generalized Method of Moments (GMM) and the differences-in-differences (DID) approaches are employed to address these issues. The findings show that the NPL ratio is driven by some macroeconomic determinants including the Gross Domestic Product (GDP) growth and lending interest rates, as well as a large number of the bank-specific determinants. In addition, the estimation results show that the changes in the NPL regulations have significantly reduced NPL in the Vietnamese banking system.

2.1 Introduction

Credit risk is considered as the greatest risk a bank faces and it is explained as the risk of a possible loss when borrowers, bond issuers and counterparties in loan transactions and derivatives transactions default (Hull, 2015). It is generally interpreted as the risk of a loan that it may not be paid either partially or totally to the creditor (Castro, 2013). From the literature, there are a number of indicators used to proxy credit risk. For instance, Hull et al. (2004) consider Credit Default Swaps (CDS) as an innovation in the financial markets that enabled firms to trade and control credit risk. Therefore, according to some experts, CDS spreads are introduced as measures to capture the probability of credit defaults (Kiesel and Spohnholtz, 2017; Aunon-Nerin et al., 2002). Additionally, the bond yield spread is also an indicator that is used to estimate default risk (Maltritz and Molchanov, 2013). Another proxy representing credit risk is the credit spread of a corporate bond (Kuehn and Schmid, 2014; Castagnetti and Rossi, 2013). Furthermore, prior analyses of previous studies (Dermine and De Carvalho, 2006; Crouhy et al., 2000) also revealed the use of Loss Given Default (LGD) as a measure of credit risk. Apart from these aforementioned indicators, Non-Performing Loans (NPL) is widely regarded as one of the most popular proxies captured credit risk in recent studies (Ghosh, 2017; Ghosh, 2015; Louzis et al., 2012).

Over the past few decades, there have been a number of changes and restructuring in banking systems all over the world. More particularly, the recent global financial crisis of 2008 was marked by a significant number of NPL in most banking sectors. As a consequence, the worldwide banking system has been experiencing several dramatic losses. Hence, the exploration of how determinants affect NPL is the issue of utmost importance for the maintenance of financial stability by financial institutions, banks, and their regulatory authorities. NPL in the banking system are not only driven by a vast range of systemic factors but also by a number of bank-specific characteristics. Consequently, most articles in the existing literature have concentrated on the empirically distinguishing factors and the evaluation of their impacts on NPL as well as the performance of banks in recent years. Additionally, some recent studies have also investigated factors affecting NPL

in both advanced and emerging economies (e.g. Ghosh, 2015; Klein, 2013; Beck et al., 2013; Louzis et al., 2012). However, it is worthy of note that the above evidence are mainly focused on the banking industries in the US and the Euro area regions with little or no available empirical evidence about the determinants of NPL in Asia, and more especially, the South East Asian region.

This chapter contributes to the extant NPL literature in three distinctive ways. First of all, to the best of knowledge of the researcher, this is the first study that indepthly analyses the determinants of NPL in Vietnam over the recent 10 years period (2008-2017). Furthermore, no studies have so far examined the extent to which the changes in NPL regulations impact on NPL in Vietnam over this decade. The analysis presents evidence that NPL declines significantly following the application of the new NPL rules in Vietnam. Importantly, the analysis of this chapter provides a clear empirical analysis of factors affecting NPL in Vietnam and its comparison with previous research. Therefore, the aim of this study is to examine the influences of some bank-specific and economic indicators on NPL in Vietnam in the period between 2008 and 2017. The specific objectives are to (1). Identify the factors of NPL which are related to economic conditions and bank characteristics in Vietnam and (2). Ascertain how changes proposed in the new NPL regulations affect the change in NPL in the Vietnamese banking sector in recent years. Following Louzis et al. (2012) and Salas and Saurina (2002), the lagged variables as instruments in the Generalized Method of Moments (GMM) approach are applied in empirical analysis to investigate these ideas. Additionally, the differences-in-differences (DID) regression is utilised following Duchin et al. (2010) in order to address the second important objective as highlighted above.

The remaining aspect of this chapter is organized into six sections with brief descriptions below. Firstly, section 2.2 briefly presents the NPL in Vietnam whilst section 2.3 provides an overview of NPL literature. Secondly, section 2.4 describes the determinants of NPL identified from the literature review and section 2.5 describes the identified data and the details of the methodology used to examine the influences of some economic and bank-specific factors on NPL.

Finally, sections 2.6 and 2.7 discuss the findings of the analysis from the data reviewed and conclusions drawn respectively.

2.2 Non-performing Loans in the Vietnamese Baking System

The reform "Doi Moi" (Renovation) launched in 1986 has been considered the first systematic improvement and had several crucial implications for the Vietnamese economy. It initially remarked on the transition from a centrally planned to a market-orientated economy with the aim of loosening the Vietnamese government control over its economy (Kovsted et al.,2005). To the Vietnamese banking sector, after the August national Revolution in Vietnam, the crucial task of the Vietnamese Government regarding the nation's reconstruction was to build an independent and autonomous banking system. Based on a new economic and financial policy issued in 1951, this task was fulfilled which saw the birth of the Vietnam National Bank (later renamed the State Bank of Vietnam). The establishment of the bank marked a new developmental step of the national financial sector and represented the role of both the central and commercial banks. In May 1990, there was an official change in the operative mechanism of the Vietnamese banking system from a one-tier to a two-tier system. Since then, the SBV has officially functioned as the central bank of Vietnam. Following the promulgation of Ordinances on Banks, Credit cooperatives and financial companies issued in 1990, the SBV functioned the central bank's role properly. Additionally, four state-owned commercial banks were established which targeted at different segments of the economy and took over the banking activities from the SBV. Currently, the SBV has been in charge of the formulation of monetary policies, management of foreign exchange reserves, and licensing and supervision of credit institutions. Meanwhile, the commercial banks and credit institutions have conducted their banking businesses such as currency trading, credit provision, payments, foreign exchange and other banking services under the supervision of the SBV.

The Vietnamese banking system has soared from a mono-banking system to a mass network of banks and financial institutions over the past 27 years. Remarkably, the efficiency and

competitiveness of the banking system in Vietnam have been enhanced by several reforms. In addition, the involvement in international trade and investment agreements, such as the United States-Vietnam Bilateral Trade Agreement in 2001 and its accession to the World Trade Organisation (WTO) in 2007 has motived the drastic changes in Vietnamese banks. Firstly, the following presence of foreign banks in Vietnam has encouraged the competitiveness and strengths of the banks. Secondly, the partial privatisation of the state-owned banks has been growing and greater efforts to comply with the international capital standards under the Basel capital accords. Furthermore, Vietnamese commercial banks have not only get more opportunities but also faced challenges since the country officially joined WTO in 2007. Moreover, the 2007-2008 finanical crisis has given a significant impact on the operatation of the economy and banking system.

According to the statistics of the SBV, there are currently 46 commercial banks in Vietnam consisting of 7 state-owned commercial banks, 28 joint-stock commercial banks, 9 foreign-owned banks, and two joint-venture banks (SBV, 2016). In recent times, there has been an exponential rise in the number of joint stock commercial banks in Vietnam, however, the state-owned banks have dominated the Vietnamese financial market by the four largest banks: Vietnam Bank for Agriculture and Rural Development (Agribank), Joint Stock Commercial Bank for Investment and Development of Vietnam (BIDV), Vietnam Joint Stock Commercial Bank for Industry and Trade (Vietinbank), Joint Stock Commercial Bank for Foreign Trade of Vietnam (VCB).

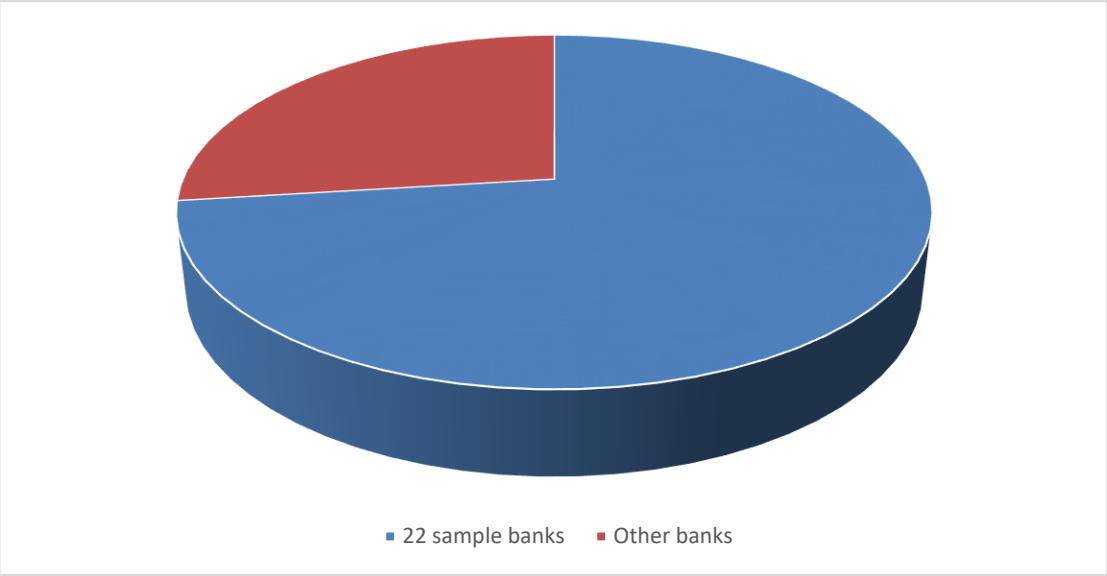

Figure 2-1 The share of the sample banks in the Vietnamese banking system between 2008 and 2017

Source: The State Bank of Vietnam and Author's calculation

Due to the limited data, 22 Vietnamese commercial banks are used in this analysis. Based upon the charter capital, these sample banks account for 73.04% total charter capital of the system. In addition, the three state-owned commercial bank take up a large number of shares.

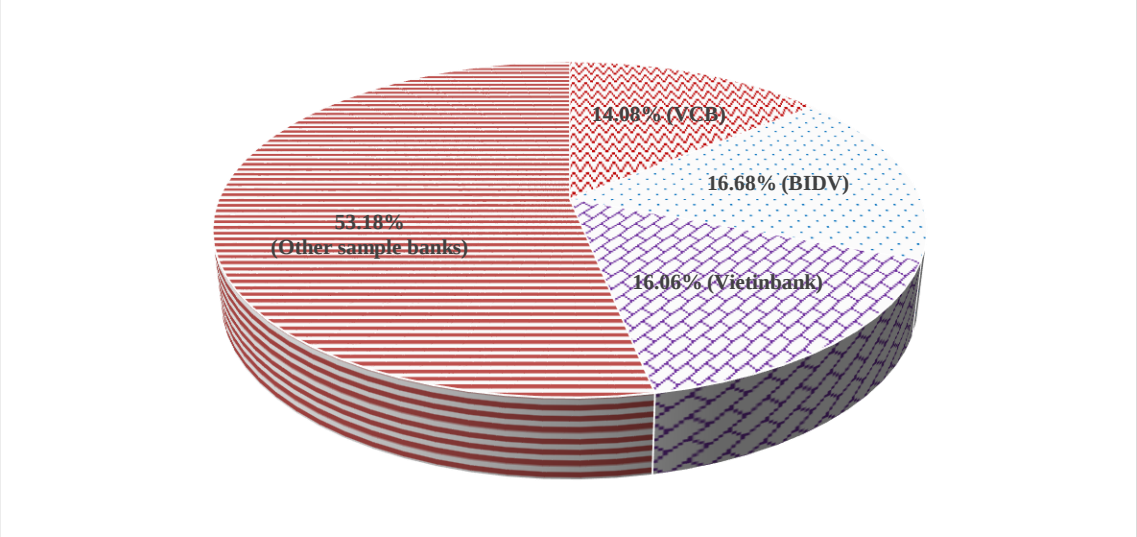

Figure 2-2 The average share of the three largest Vietnamese commercial banks in the sample over the period between 2008 and 2017[1]

Source: Fitch database and Author's calculation

[1] Due to limited data, Agribank is excluded and data from 22 Vietnamese commercial banks is used as our sample.

With a large number of branches covering all the whole country, the Vietnamese commercial banks have played a vital role in the economic development of the country. Nonetheless, the loan growth rate rose dramatically with the speed of the country's economic development over the last decade. One of the reasons being that many of the banks significantly increased their credit growths through real estate loans as a result of the expansion of the real estate market within the country. The credit growth rate of the banking system grew at nearly 38 % in 2007 and peaked at an alarming rate of 63% in the first quarter of 2008, the highest recorded within the past decade. In addition, the 2008 financial crisis deeply affected the Vietnamese economy and as a consequence, there has been an increase in NPL in the banking system. For instance, reports showed that during this period, the commercial banks lent loans to both the central and provincial governments for infrastructural developments and projects with the loans for state-owned enterprises accounting for more than half of the total credit. The evidence also reports of some instances were the commercial banks made short-term direct loans to provincial governments without the proper collateral or a guarantees. This lead to the current NPL of state-owned enterprises and contributed to about 70% of the overall Vietnamese banking sector's NPL.

An increase in the number of NPL is one of the indicators for the weak performance of the Vietnamese commercial banks. To address this, a restructuring program for the period between 2011 and 2015 was suggested and approved in 2012. Remarkably, the roadmap to implement this restructuring in Vietnam during that period was clearly defined with a plan that focused on two groups consisting of state-owned and joint-stock commercial banks. Additionally, the joint-stock commercial banks were categorized into "healthy", "temporary illiquidity" or "weak" groups with each group treated based on the orientation of the restructuring program. One of the main objectives that the program aims at is to resolve NPL in order to strengthen the credit institutions.

Table 2-1 Mergers and restructures in the Vietnamese banking market

No.	Bank	Merged	Restructured	Year
1.	Habubank	x		2012
2.	DaiABank	x		2013
3.	MHB	x		2015
4.	MDB	x		2015
5.	Southern Bank	x		2015
6.	Ocean bank		x	2015
7.	GPbank		x	2015
8.	Vietnam Construction Bank		x	2015

Source: The State Bank of Vietnam and Author's summary

However, as compared to the roadmap, the process of restructuring has been slow with limited progress reported so far. Although the Vietnamese banking system has focused on tackling its NPL over the past few years, the level of NPL is still fairly high which results in significant impacts on the safety, stability, and efficiency of the financial sector. Hence, the NPL has attracted much attention in recent years in the Vietnamese financial literature.

2.3 Literature Review

The 2008 global financial crisis severely affected the credit quality of loan portfolios in most countries around the world and left in its wake, several analyses of NPL and its drivers across many nations over the past decade. The empirical literature on the interaction of NPL with macroeconomic determinants is based on theoretical models. The theory highlights the economic cycle models with an explicit role for financial intermediation (Ghosh, 2015; Nkusu, 2011). The counter cyclicality of credit risk and business failures is discussed in the study of Williamson (1987). In addition, previous also mentioned the financial accelerator theory that has an impact on the link between NPL and its interaction with macroeconomic environment studies (Kiyotaki and Moore, 1997; Bernanke and Gertler, 1989). Moreover, the life cycle model which is related to the

macroeconomic determinants of NPL was introduced in the findings of Lawrence (1995). This model suggests that low-income borrowers have higher probability of default because they face increased risk of unemployment and are unable to meet their obligations (Lawrence, 1995). Moreover, banks could have more intensions to charge higher lending interest rates on riskier clients. Hence, the rate of default may have an association with unemployment and the lending rates.

Recently, the number of studies highly relevant to NPL is divided into two strands. The first strand of the existing literature focused on examining the determinants of NPL in developed countries. For example, Ghosh (2015) identifies both the bank-level and regional drivers of NPL in the US by employing the dataset of all commercial and savings banks across 50 American states and the District of Columbia from 1984 to 2013. The authors report that higher NPL was associated with larger capitalization, high liquidity risks, poor credit quality, greater cost inefficiency and banking industry size (Ghosh, 2015). Additionally, the study also reveals that the increase in bank profitability could lower NPL. Regarding regional and national economic factors, state real GDP and real personal income growth rates, and changes in state housing price index could lead to a decrease in NPL in the banking system (Ghosh, 2015). Meanwhile, inflation, state unemployment rates, and the US public debt have significantly positive effects on NPL. A study that reviewed NPL in three European countries (Italy, Greece, and Spain) between 2004-2008 reports that NPL is negatively influenced by GDP growth rate and bank profitability (Messai and Jouini, 2013). Contrarily, the study also emphasizes that NPL is positively influenced by unemployment rates, real interest rates, the loan loss reserves to total loans ratio (Messai and Jouini, 2013). In addition, Louzis et al. (2012) examine the NPL among three loan categories (mortgages, consumer loans, business loans) in nine Greek commercial banks. Motivated by the hypothesis that both macroeconomic and bank-level determinants influence NPL, they find that macroeconomic variables (GDP, unemployment, interest rates, public debt) and management quality are the main factors affecting NPL in the Greek banking sector. Focusing a sample of 26 advanced economies between1998 – 2009, Nkusu (2011) explores the relationship between NPL and macroeconomic drivers and suggests adverse macroeconomic developments lead to an increase in NPL. Comparing the drivers

of NPL between commercial banks and savings institutions in Spain, Salas and Saurina (2002) find that credit risk is not only significantly determined by microeconomic factors but also by other macroeconomic determinants consisting of GDP growth rate and the level of indebtedness of firms and households. Their results further implied the differences in the factors affecting NPL between commercial and savings banks.

The second strand of the literature analyses NPL determinants in emerging countries or both advanced and emerging economies. According to Škarica (2014), the slowdown of economy is the primary reason for high NPL levels in seven Central and Eastern European (CEE) countries from 2007 to 2012. Similarly, a study of Central, Eastern and South-eastern European (CESEE) countries also confirmed that the economic growth and stock index are the leading indicators for decreasing NPL but the changes in exchange rate and past credit growth positively relate to NPL (Jakubik and Reininger, 2013). Similarly, Klein (2013) investigates the data of 16 CESEE countries over the period of 1998 – 2011 and provided findings that indicated the influences of both macroeconomic and bank-level factors on NPL. Using a panel data set of 75 countries including advanced and emerging countries, Beck et al. (2015) examine the key macroeconomic factors of NPL and find statistically significant effects of real GDP growth, share prices, the exchange rate, and the lending interest rate on NPL.

2.4 Determinants of Non-Performing Loans

2.4.1 Macroeconomic Factors

The above literature review has identified the relationship between NPL and economic conditions. In line with existing research and following Louzis et al. (2012), the GDP growth, the unemployment rate, and the lending interest rates are employed as the primary macroeconomic factors and used to estimate the baseline model in the present study. Based on Louzis et al. (2012), the chosen primary determinants are motivated by other studies in the literature, the life-cycle consumption

model in Lawrence (1995), and the study of Rinaldi and Sanchis-Arellano (2006) which extend the model of Lawrence (1995) by allowing borrowers to invest in either real or financial assets.

GDP growth

The majority of studies have empirically examined the impact of GDP growth rates on NPL. Also, earlier studies on the determinants of bank NPL report that the GDP growth rate is one of the key factors associated with NPL (Konstantakis et al., 2016; Dimitrios et al., 2016; Ghosh, 2015; Chaibi and Ftiti, 2015; Beck et al., 2015; Castro, 2013; Bonfim, 2009; Salas and Saurina, 2002). However, their findings present mixed results. For example, Bonfim (2009) identifies the determinants of corporate credit default and indicates that there may be a trend towards excessive risk-taking and a rise in default rates. The periodic element of GDP reveals a positive leading correlation with the cycle of credit overdue. According to Jimenez and Saurina (2006), more liberal credit policies with lower credit standards are implemented during economic booms because banks could be overoptimistic about borrowers' investment project and their future prospects.

On the contrary, some studies report that real GDP growth is negatively related to NPL. Using the Arellano - Bond estimator, Salas and Saurina (2002) compare the determinants of problem loans of Spanish commercial and savings banks between the period 1985-1997 while Ghosh (2015) examines banking-industry specific as well as regional economic drivers of NPL for both commercial banks and savings institutions across 50 American states and the District of Columbia between 1984 and 2013. The authors find a negative relationship between real GDP growth and NPL in both types of banks. In much the same way, Louzis et al. (2012) note that the NPL ratio in the Greek banking system from 2003 until 2009 is adversely affected by a decrease in the economic growth for all loan types including consumer, business loans, and mortgages. Among these, the overall effect of the GDP growth rate is found to be stronger for business NPL. Similarly, Castro (2013) employs dynamic panel data analysis approaches to five European countries (Greece, Ireland, Portugal, Spain, and Italy) over the period 1997–2011 to analyze the links between the macroeconomic development and the banking credit risk in the aforementioned countries. The author reports that a reduction in

the growth rate of real GDP leads to an immediate increase in credit risk. In addition, Chaibi and Ftiti (2015) in a recent study compare the indicators of commercial banks' NPL in both market-based economy (e.g. France) and bank-based economy (e.g. Germany) during 2005–2011 and reported that GDP growth variable is highly significant and negatively correlated with the NPL ratio in both economies. Hence, the NPL ratio is negatively affected by a slowdown in the French and German economic growth with an overall effect of the GDP growth found to be greater for French NPL. This result illustrates the relative dependence of the French borrowers' ability to repay their loans on the phases of the economic cycle. Moreover, Beck et al. (2015) also report that real GDP growth significantly affects the NPL ratio which is the main driver of the NPL ratio from 2000 to 2010. Their estimated models also suggest that the real GDP growth has a negative impact on NPL across 75 countries. Thus, the following hypothesis is made:

Hypothesis 2.1: There is a positive relationship between GDP growth and NPL in the Vietnamese banking sector.

Unemployment rate

The unemployment rate has been found to affect the vulnerability of the banking sector (Dimitrios et al., 2016). The rise in unemployment makes more borrowers unable to meet their debt obligations may consequently cause a deterioration in the consumer's ability to generate cash flow and to service debt. Therefore, an expansion in the unemployment rate is a leading indicator of consumer NPL (Louzis et al., 2012). For corporations, an increase in unemployment leads to lower consumption of products and services, and consequently to a decrease in firms' cash flow and a weak position regarding debt. The effect of unemployment on NPL is therefore expected to be positive and therefore, when the unemployment rate falls, the rate of NPL decreases significantly (Castro, 2013). Louzis et al. (2012) find a strong effect of unemployment on the level of NPL and indicated that unemployment has a significant impact on all NPL categories with business NPL being the most sensitive. As expected, the findings of Chaibi and Ftiti (2015) also indicate that when the unemployment rate grew, the NPL ratios for both France and Germany grew substantially with the most sensitive NPL being those of France. Additionally, Ghosh (2015) reports that unemployment

increases the growth of NPL and therefore, unemployment rate is found to have a strong positive relationship with NPL. Premised on the above points, the hypothesis below is made:

Hypothesis 2.2: There is a positive relationship between the unemployment rate and NPL in the Vietnamese banking sector.

Interest rate

The interest rate is one of the important factors affecting credit risk and a considerable number of studies have explored the extent of interest rate influences on credit risk in recent years (Castro, 2013; Louzis et al., 2012). According to Bonfim (2009), an increase in interest rate could lead to a rise in credit overdue with a possible association between the interest rate and periods of stronger economic growth. The long-term interest rate is used as a benchmark in the analysis in the study of Castro (2013) because a large number of loans are usually agreed for a long period of time. The study further demonstrates that higher interest rates tend to increase credit risk remarkably. The above findings are corroborated by Beck et al. (2015) who also report the positive association between lending interest rates and NPL. Therefore, it is supposed:

Hypothesis 2.3: There is a positive relationship between the lending interest rates and NPL in the Vietnamese banking sector.[2]

2.4.2 Bank-Specific Factors

There has been a wide range of analyses that focus on idiosyncratic determinants of NPL. A clearer understanding of NPL drivers may help to predict if and when they would influence the performance of financial institutions. The literature documents bank-industry determinants that

[2] Lending rates used in this analysis are collected by the International Monetary Fund (IMF). Additionally, IMF has applied the different terms and conditions attached to the rates to countries, but limited their comparability (WB – World Development Indicators).

used in the study consisting of Bank size, Return On Equity (ROE), Solvency ratio, and Non-interest income.

Bank size

Many previous studies argue that "too big to fail" has played a vital role in several banking crises all over the world in recent decades. Under the "too big to fail" presumption, large banks take more risks and hence may have more NPL (Louzis et al., 2012). Evidence from the literature also suggests that size proxied by the natural logarithm of total assets is found to be significantly and positively associated with NPL in both market-based (e.g. France) and bank-based economies (e.g. Germany) (Chaibi and Ftiti, 2015). As Ghosh (2015) identifies, a greater capitalization may be beneficial to ensure more profits but also could enhance NPLs. On the other hand, Louzis et al. (2012) report that for the business loan portfolios, a too-big-to-fail effect on the quality of loans cannot be inferred.

Regarding the commercial banking sector, larger banks appear to have fewer problem loans than do smaller banks because they could have more opportunities to invest in different geographical or business segments to reduce credit risk (Salas and Saurina, 2002). Using panel Ordinary least squares (OLS) regressions and two-step GMM regressions, Vithessonthi (2016) find the negative correlation between bank size and NPL in a sample of 82 publicly listed commercial banks in Japan during the period 1993 and 2013. Supporting the too-big-to-fail effect hypothesis, the probability of bank failures is smaller for large banks due to bailout expectations. According to Salas and Saurina (2002), since the size of Spanish commercial banks allows for more diversification opportunities, a less concentrated portfolio may be the reason behind the negative sign of the coefficient for bank size. Nevertheless, an increase in relative size does not help to reduce loan problems; this is perhaps due to the fact that most of Spanish savings banks are concentrated in small regions. Accordingly, the following hypotheses are assumed:

Hypothesis 2.4: There is a positive relationship between banks' size and NPL in the Vietnamese banking sector.

ROE

Generally, ROE is computed as net income divided by total equity. It could be a proxy of bank performance or bank profitability. Under the hypothesis "bad management" suggested by Berger and DeYoung (1997), ROE is negatively related to NPL because banks with high profit would have fewer incentives to involve in high-risk activities such as granting risky loans (Dimitrios et al., 2016). Similarly, aiming to identify the main determinants of NPL for France and Germany, Chaibi and Ftiti (2015) use ROE to proxy the quality of the management of banks. Their results emphasized a negative significant association between the NPL and ROE in France and Germany, thus suggesting that bad management significantly increases the level of NPLs. Louzis et al. (2012) and Chaibi and Ftiti (2015) find that ROE is negatively related to the mortgages and consumer NPL while it is not related to the business NPL. The findings for mortgages and consumer NPL provide evidence in favour of the 'bad management' hypothesis.

Despite the above position, the model of Rajan (1994) identifies that the more liberal the credit policy, the greater the current earnings and the more likely that loans made are substandard. The authors further report that banks may maximize current earnings by a liberal credit policy which could extend their term of loans and lend new monies that leads to more substandard loans. As a result, the 'Procyclical credit policy' hypothesis proposes that performance is positively related to future increases in NPL (Louzis et al., 2012). Consequently, these hypotheses are examined:

Hypothesis 2.5: There is a positive relationship between ROE and NPL in the Vietnamese banking sector.

Non-interest rate income

The ratio of non-interest rate income to total income reflects the diversification of banks' income sources and this variable was employed in prior studies (e.g. Ghosh, 2017; Ghosh, 2015; and Louzis et al., 2012). More diversification in the businesses of banks could help to reduce its own NPL. Thus, the expected sign for this variable is negative and it is assumed that:

Hypothesis 2.6: There is a negative relationship between non-interest income and NPL in the Vietnamese banking sector.

Solvency ratio

According to the hypothesis 'moral hazard' suggested by Berger and DeYoung (1997), banks with low equity capital could have moral hazard incentives by increasing the risky loan portfolios. This implies an adverse association between equity and NPL (Klein, 2013). Solvency ratio is measured by total equity to total assets. Also, the following hypothesis investigated the impact of Solvency ratio on NPL, as follows:

Hypothesis 2.7: There is a negative relationship between solvency ratio and NPL in the Vietnamese banking sector.

2.4.3 Regulatory Change

Vietnamese commercial banks applied *Decision No.493/2005/QD-NHNN which promulgated the regulation on the classification of debts, appropriation, setting up and use of reserves for handling credit risks in banking activities of credit institutions in Vietnam* (henceforth Decision 493) to divide NPL into different categories and set aside the risk provision from 2005 to 2013 (SBV, 2005). Then, SBV issued *Circular 02/2013/TT-NHNN (henceforth Circular 02) on classified assets, levels and methods of setting up of risk provision against credit risks in the banking activity of credit institutions and foreign bank branches* (SBV, 2013). In addition, Circular 09 (henceforth Circular 09) was issued later with the aim of amending, supplementing a number of articles of Circular 02 (SBV, 2014). These regulations have been applied in the Vietnamese banking system since 2014. The new rules regulate the classification of assets, levels, and methods of setting up of risk provision, and the use of these provisions against credit risk in the banking activity of credit institutions and branches of foreign bank. Circular 02 and Circular 09 have replaced Decision 493. As compared to Decision No.493, these rules reveal some significant changes in the loan classification and risk provision that are expected to have great impacts on Vietnamese commercial banks. The most remarkable modification have been identified in these new regulations as follows: first, there are more bank

assets required to set up risk provisions such as credit cards, interbank deposits; second, the maximum deduction rate applied for real estate collateral is up to 50%, as a result, the value of these collateral decreases together with the increase in loan provisions; third, an error in classifying debt groups for the same customer between financial institutions may lead to incorrect data, therefore, Circular 2 requires that to the same customer, financial institutions must adjust the debt and off-balance sheet commitments by cross-referring the data of the financial system; fourth, financial institutions have responsibility for reporting the results of debt classification and off-balance sheet commitments to the Vietnamese credit information center (CIC); fifth, if institutions apply a qualitative method to classify NPL, it would require them combine it with a quantitative method and the method that suggests the results with high-risk level would be choosen (SBV, 2013). These tighter changes require banks to identify the loan groups and their provisions in the high expectation that Vietnamese commercial banks would identify and manage NPL more efficiently. It is predicted to increase the NPL of Vietnamese commercial banks in short-term. However, Circular 02 is highly expected to identify NPL correctly, reduce the number of NPL effectively in long-term and to give an overview of the better performance of each each bank as well as the banking system. In addition, Circular 02 could take part in gradually orienting banks to implement international standards fully and based on that, the difficulties in banking operations could be resolved and the safety and stability of banking system could be improved.

Table 2-2 The correlation matrix of NPL among sample banks in Vietnam from 2008 to 2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
(1)	1																					
(2)	0.85	1																				
(3)	-0.74	-0.49	1																			
(4)	0.59	-0.16	0.81	1																		
(5)	0.96	0.94	-0.34	0.10	1																	
(6)	0.63	0.90	-0.48	-0.38	0.75	1																
(7)	0.69	0.85	-0.42	-0.05	0.81	0.96	1															
(8)	0.64	0.77	-0.59	-0.31	0.68	0.81	0.87	1														
(9)	0.96	0.87	-0.24	0.20	0.97	0.62	0.69	0.49	1													
(10)	0.16	0.66	-0.25	-0.35	0.41	0.85	0.69	0.60	0.27	1												
(11)	0.69	0.30	0.29	0.52	0.57	0.16	0.45	0.01	0.68	-0.23	1											
(12)	0.50	0.88	-0.41	-0.32	0.69	0.92	0.75	0.66	0.59	0.92	-0.03	1										
(13)	0.32	0.49	-0.79	-0.89	0.24	0.73	0.89	0.65	0.09	0.64	-0.30	0.61	1									
(14)	-0.51	-0.20	-0.44	-0.62	-0.43	0.04	-0.10	0.36	-0.61	0.23	-0.82	0	0.54	1								
(15)	0.98	0.82	-0.65	-0.20	0.87	0.58	0.56	0.57	0.87	0.15	0.44	0.51	0.36	-0.32	1							
(16)	0.24	0.71	-0.26	-0.35	0.48	0.86	0.67	0.51	0.38	0.97	-0.12	0.95	0.62	0.06	0.26	1						
(17)	0.72	0.54	-0.52	-0.31	0.59	0.60	0.74	0.67	0.52	0.13	0.51	0.25	0.56	0.00	0.65	0.13	1					
(18)	0.36	0.82	0.04	-0.12	0.63	0.94	0.80	0.85	0.57	0.94	0.18	0.98	0.83	-0.45	0.31	0.98	0.05					
(19)	0.15	-0.15	0.71	0.94	0.05	-0.41	-0.35	-0.27	0.12	-0.30	0.25	-0.26	-0.88	-0.45	-0.22	-0.32	-0.50	-0.12	1			
(20)	0.74	0.79	-0.46	-0.22	0.77	0.86	0.97	0.91	0.63	0.54	0.36	0.62	0.61	0.07	0.63	0.50	0.86	0.59	-0.32	1		
(21)	0.38	0.36	0.56	0.70	0.41	0.28	0.79	0.22	0.39	0.41	0.29	0.38	-0.37	-0.36	-0.06	0.37	-0.18	0.99	0.71	0.23	1	
(22)	0.80	0.58	0.40	0.68	0.71	0.41	0.87	0.30	0.72	0.33	0.61	0.44	-0.31	-0.62	0.31	0.36	0.10	0.87	0.62	0.41	0.91	1

Where (1)-(22) denote each Vietnamese commercial bank in the sample as follows: (1): Anbinh, (2): ACB, (3): BIDV, (4): Eximbank; (5): HDBank, (6): Indovina, (7): Lienvietpostbank, (8): Maritime, (9): MB, (10): PGBank, (11): OCB, (12): Sacombank, (13): Saigonbank, (14): SCB, (15): Seabank, (16): SHB, (17): Techcombank, (18): Tienphongbank, (19): VCB, (20): VIB, (21): Vietinbank, (22): VPbank.

Table 2-3 The correlation matrix of NPL among sample banks in Vietnam from 2014 to 2017

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
(1)	1																					
(2)	0.71	1																				
(3)	0.95	0.60	1																			
(4)	0.61	-0.13	0.62	1																		
(5)	0.68	0.96	0.49	-0.09	1																	
(6)	-0.55	-0.25	-0.30	-0.58	-0.47	1																
(7)	0.89	0.80	0.71	0.40	0.87	-0.76	1															
(8)	0.67	1.00	0.55	-0.18	0.97	-0.25	0.78	1														
(9)	0.75	0.99	0.61	-0.03	0.99	-0.39	0.87	0.99	1													
(10)	-0.86	-0.60	-0.97	-0.47	-0.43	0.06	-0.57	-0.55	-0.58	1												
(11)	0.67	0.99	0.54	-0.15	0.98	-0.30	0.81	1.00	0.99	-0.53	1											
(12)	-0.52	-0.82	-0.26	0.12	-0.94	0.62	-0.83	-0.84	-0.87	0.15	-0.87	1										
(13)	-0.30	-0.73	-0.40	0.46	-0.53	-0.47	-0.21	-0.73	-0.62	0.57	-0.69	0.28	1									
(14)	0.44	-0.32	0.45	0.98	-0.26	-0.55	0.24	-0.36	-0.22	-0.30	-0.34	0.25	0.61	1								
(15)	0.94	0.91	0.87	0.29	0.86	-0.41	0.90	0.88	0.92	-0.83	0.88	-0.68	-0.57	0.10	1							
(16)	-0.19	-0.23	-0.46	0.11	0.05	-0.71	0.17	-0.19	-0.11	0.66	-0.14	-0.37	0.75	0.19	-0.28	1						
(17)	0.74	0.95	0.55	0.01	0.99	-0.54	0.92	0.95	0.98	-0.47	0.97	-0.94	-0.48	-0.16	0.88	0.08	1					
(18)	0.05	0.15	-0.26	0.02	0.42	-0.80	0.47	0.19	0.27	0.46	0.25	-0.69	0.47	0.04	0.06	0.93	0.44	1				
(19)	0.71	0.97	0.68	-0.11	0.86	-0.07	0.70	0.96	0.93	-0.73	0.94	-0.65	-0.85	-0.31	0.91	-0.46	0.85	-0.09	1			
(20)	0.51	-0.08	0.37	0.87	0.09	-0.89	0.54	-0.10	0.06	-0.14	-0.05	-0.20	0.66	0.87	0.23	0.57	0.19	0.51	-0.19	1		
(21)	0.29	0.04	0.02	0.47	0.30	-0.96	0.56	0.05	0.18	0.22	0.11	-0.53	0.65	0.48	0.14	0.88	0.36	0.89	-0.17	0.84	1	
(22)	-0.67	-0.84	-0.74	0.06	-0.66	-0.16	-0.51	-0.81	-0.77	0.84	-0.78	0.38	0.91	0.25	-0.83	0.71	-0.64	0.40	-0.95	0.30	0.42	1

Where (1)-(22) denote each Vietnamese commercial banks in the sample as follows: (1): Anbinh, (2): ACB, (3): BIDV, (4): Eximbank; (5): HDBank, (6): Indovina, (7): Lienvietpostbank, (8): Maritime, (9): MB, (10): PGBank, (11): OCB, (12): Sacombank, (13): Saigonbank, (14): SCB, (15): Seabank, (16): SHB, (17): Techcombank, (18): Tienphongbank, (19): VCB, (20): VIB, (21): Vietinbank, (22): VPbank.

Table 2-4 The correlation matrix of NPL among sample banks in Vietnam from 2014 to 2017

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
(1)	1																					
(2)	0.8	1																				
(3)	-0.04	-0.14	1																			
(4)	0.09	-0.15	0.35	1																		
(5)	0.95	0.91	-0.01	0.07	1																	
(6)	0.36	0.54	-0.52	-0.31	0.43	1																
(7)	0.71	0.8	0.14	-0.21	0.81	0.54	1															
(8)	0.25	0.58	-0.54	-0.1	0.35	0.42	0.32	1														
(9)	0.63	0.8	0.08	0.1	0.73	0.09	0.49	0.63	1													
(10)	0.16	0.57	-0.13	-0.35	0.39	0.63	0.66	0.23	0.11	1												
(11)	0.33	0.48	0.34	0.11	0.41	-0.19	0.29	0.47	0.88	-0.12	1											
(12)	-0.11	-0.08	-0.72	0.06	-0.12	0.62	-0.15	0.19	-0.38	0.16	-0.64	1										
(13)	0.17	0.26	-0.66	-0.66	0.11	0.5	0.57	0.29	-0.15	0.57	-0.39	0.41	1									
(14)	-0.22	-0.13	0.27	-0.55	-0.25	-0.19	0.13	-0.19	-0.28	0.2	-0.12	-0.44	0.21	1								
(15)	0.89	0.74	0.19	-0.19	0.82	0.1	0.61	0.12	0.67	0.11	0.48	-0.44	0.02	0.08	1							
(16)	0.3	0.61	0.16	-0.36	0.49	0.45	0.69	0.02	0.22	0.92	0.03	-0.13	0.4	0.25	0.37	1						
(17)	0.68	0.46	0.26	-0.31	0.58	0.13	0.73	-0.01	0.35	0.12	0.34	-0.46	0.2	0.33	0.74	0.31	1					
(18)	0.43	0.75	0.29	-0.3	0.66	0.52	0.81	0.05	0.36	0.93	0.13	-0.13	0.55	0.01	0.42	0.97	0.29	1				
(19)	0.26	0.05	0.83	0.56	0.19	-0.46	0.13	-0.27	0.31	-0.22	0.46	-0.64	-0.85	0.09	0.27	0.01	0.1	0.2	1			
(20)	0.65	0.65	-0.42	-0.1	0.65	0.58	0.82	0.55	0.35	0.48	0.05	0.29	0.64	-0.09	0.36	0.34	0.5	0.54	-0.39	1		
(21)	0.28	0.32	0.29	0.68	0.4	0.13	0.62	0.12	0.25	0.4	0.11	0.03	-0.27	-0.29	-0.05	0.35	-0.15	0.84	0.49	0.25	1	
(22)	0.38	0.33	-0.22	0.62	0.47	0.39	0.38	0.22	0.17	0.29	-0.12	0.48	0	-0.68	-0.08	0.14	-0.2	0.42	0.02	0.47	0.79	1

Where (1)-(22) denote each Vietnamese commercial banks in the sample as follows: (1): Anbinh, (2): ACB, (3): BIDV, (4): Eximbank; (5): HDBank, (6): Indovina, (7): Lienvietpostbank, (8): Maritime, (9): MB, (10): PGBank, (11): OCB, (12): Sacombank, (13): Saigonbank, (14): SCB, (15): Seabank, (16): SHB, (17): Techcombank, (18): Tienphongbank, (19): VCB, (20): VIB, (21): Vietinbank, (22): VPbank.

A pairwise t—test is conducted on the study sample to identify whether there is a statistically difference in NPL correlations among bank samples when these Vietnamese commercial banks have applied new NPL regulations (Circular 02 and Circular 09). Firstly, the pairwise correlation is calculated by measuring the relationship between the NPL of Vietnamese commercial banks during the period 2008 – 2013 (before the application of Circular 02 and Circular 09) and the 2014 – 2017 (after the application of Circular 02 and Circular 09).

Table 2-5 Descriptive statistics for the pairwise t-test of correlation of NPL among the sample banks between the period 2008-2013 and the period 2014-2017

Variable	Obs	Mean	Std.Err.	Std.Dev.	[95% Conf.Interval]	
Before (2008-2013)	231	.278271	.0295529	.4491659	.2200419	.3365001
After (2014-2017)	231	-.0359229	.0469357	.7133606	-.1284018	.0565559
diff		.3141939	.0550042	.835991	.2058175	.4225704
mean (diff) = mean (Before-After)				t = 5.7122		
Ho: mean(diff) = 0				degree of freedom = 230		
Ha: mean(diff) # 0						

Note: The significance at 5% level.

Source: Author's own calculation.

Secondly, the same test is carried out to discover more the impact of new NPL rules but by comparing the NPL correlation of Vietnamese commercial banks at two different time point (the period 2008 – 2013 and the whole 10 years period 2008 -2017).

Table 2-6 Descriptive statistics for the pairwise t-test of correlation of NPL among the sample banks between the period 2008-2013 and the period 2008-2017

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
Before (2008-2013)	231	.3266333	.0317034	.4818502	.2641671	.3890996
Whole (2008-2017)	231	.2202494	.0251329	.3819866	.1707292	.2697695
diff		.106384	.0213671	.3247512	.0642838	.1484842
mean(diff) = mean(Before - Whole)					t = 4.9789	
Ho: mean(diff) = 0				degrees of freedom =	230	
Ha: mean(diff) # 0						

Note: The significance at 5% level.

Source: Author's own calculation.

The results of the pairwise t-test are shown in Table 2-5 and Table 2-6. The summary statistics for the pairwise t-test reveals that the decrease in the mean value of the correlation of NPL between the banks in both the After and the Whole period as opposed to the Before period. There are statistically significant differences in the correlations of NPL between the compared periods (Before and After; Before and Whole) with t-statistics values at 5.712 and 4.9789 respectively. Table 2-5 and Table 2-6 provide evidence that the mean of the correlation among banks become lower after 2013. In other words, by applying the tighter regulations in the Vietnamese banking sector, they have influenced the correlation in the NPL's changes in the whole 10-year period. Consequently, a dummy variable so-called "REG" will be included in the regression analysis and:

Hypothesis 2.8: There is a negative relationship between REG and NPL in the Vietnamese banking sector.

2.5 Data and Methodology

2.5.1 Data and Variables

Following prior studies (Ghosh, 2015 and Louzis et al., 2012), the NPL ratio is employed in the present study as the dependent variable. This chapter explores factors that are associated with or have impacts on the NPL ratio. Table 2-7 lists the explanatory variables investigated in the framework and their expected signs which have been discussed in Section 2.4.

Table 2-7 Definition of variables

Variable	**Definition**	**Expected sign**
Dependent variable		
$\text{Non} - \text{performing loans ratio}_{it}$ (NPL_{it})	$\frac{\text{Non} - \text{performing loans}_{it}}{\text{Gross loans}_{it}}$	
Independent variables		
Bank – specific variables		
Bank size_{it} (Size_{it})	$\frac{\text{Total assets}_{it}}{\sum_{i=1}^{22} \text{Total assets}_{it}}$	+
$\text{Return on Equity}_{it}$ (ROE_{it})	$\frac{\text{Net income}_{it}}{\text{Equity}_{it}}$	+
$\text{Non} - \text{interest income ratio}_{it}$ (NII_{it})	$\frac{\text{Non} - \text{interest income}_{it}}{\text{Total income}_{it}}$	-
$\text{Solvency ratio}_{it}$ (SOLR_{it})	$\frac{\text{Equity}_{it}}{\text{Total assets}_{it}}$	-
Macroeconomic variables		
Gross Domestic Product_t (GDP_t)	Annual percentage growth rate of GDP_t	+
UN_t	$\text{Unemployment rate}_t$	+
LIR_t	$\text{Lending interest rates}_t$	+
Dummy variable		
REG_t	Vietnamese commercial banks implemented the new regulations (Circular 02 and Circular 09 relating to the classification of loans) in 2014 equal to 1 if the new regulations applied equal to 0 otherwise	-

Source: Author's own list

In Vietnam, the SBV classifies late or non-repayment loans into five categories including current debts, special mention debts, sub-standard debts, doubtful debts, loss debts. (These categories, the loan types and the standards of loan classification are shown in Appendix A). NPL, according to Circular 02 and Circular 09, consits of Sub-standard debts, Doubtful debts, and Loss debts (Categories 3-5 in Appendix A). Therefore, the NPL ratio in this study is calculated as a ratio of the sum of these three loan categories to the total amount of loans.To examine the determinants of NPL in Vietnam, the panel data for the 22 largest Vietnamese commercial banks were employed in the present study. The panel data set covers the period between 2008 – 2017 with data collected from several sources. Firstly, the bank-level data is obtained from the Fitch database and annual reports of banks. Secondly, data in the analysis on unemployment rates are collected from the World Bank and finally, the GDP and lending interest rate data are retrieved from the International Monetary Fund. The bulk of bank-specific data are retrieved from Fitch database but only six banks in our sample are provided with both annual data and quarterly data in this data source during the sampling period from 2008 to 2017. The rest of Vietnamese commercial banks are included in the database with no quarterly data or only eight recent interim periods. In addition, these banks have either non-listed or listed for a few years (See Appendix B for the details of the listing dates). This results in a lack of data being publicly available on a quarterly basis. As a consequence, the annual data are used in this analysis instead of the quarterly data. (See Table 2-8 for details on data sources).

Table 2-8 Data sources

Indicator	Source
NPL_{it}	Fitch database Banks' annual reports
Bank - specific	
$SIZE_{it}$	Fitch database
ROE_{it}	Fitch database
NII_{it}	Fitch database
$SOLR_{it}$	Fitch database
Macroeconomic	
GDP_t	International Monetary Fund – World Economic Outlook Database
UN_t	World Bank – World Development Indicators
LIR_t	International Monetary Fund – World Economic Outlook Database
Dummy	
REG_t	State Bank of Vietnam Banks' annual reports

Source: Author's own summary

Table 2-9 reveals descriptive statistics of all variables used in the analysis. To avoid the impacts of outliers, the bank-specific data is winsorized at 5% and 95% percentiles.

Table 2-9 Description of variables

Variable	Obs	Mean	Median	Std. Dev.	Min	Max
NPL	216	2.17	2	1.25	0.5	5.8
GDP	10	6	6.1	0.53	5.2	6.8
Unemployment (UN)	10	2.16	2.1	0.27	1.8	2.6
Lending interest rate (LIR)	10	10.87	9.85	3.55	7	17
Bank size (SIZE)	220	7.40	3.55	10.44	0.5	42.4
ROE	220	10.85	10.4	6.85	0.85	25.35
Solvency ratio (SOLR)	220	10.01	8.55	4.52	5.2	21.25
Non-interest income (NII)	220	17.73	16.7	12.12	-3.7	44
REG	10	0.40	0	0.49	0	1

Note: All variables are expressed in percentage points except for the dummy variable.
Source: Author's calculation

With regards to NPL, its mean value of 0.5% and the highest value of 5.8% is recorded among the sample commercial Vietnamese banks from 2008 to 2017. As compared to GDP and unemployment rate, the value of lending interest rates is quite higher and ranged between 7% and 17%. The mean of SIZE that represented by the banks' assets is 7.4% and its degree of variation is large across banks. In this period, the average ROE is 10.85% and ranged from 0.85% to 23.35%. While solvency ratio reaches an average of 10.01%, Table 2-8 indicates a higher mean value for NII. Additionally, the min of NII is -3.7% during the period 2008-2017 which is suggestive that the proportion of non-interest income in total income decreases in some years.

2.5.2 Research Philosophy, Approach and Methods

A research philosophy is relevant to a set of beliefs and assumptions of the knowledge being examined in the research project, in which the philosophical assumptions justify how the research question will be answered (Saunders, Lewis and Thornhill, 2016; Flick, 2015; Bryman, 2012). The five main research paradigms are *positivism*, *critical realism*, *interpretivism, postmodernism,* and *pragmatism* (Saunders, Lewis and Thornhill, 2016). This study applied the positivism paradigm since its hypotheses concerns with the impact of determinants on NPL within the Vietnamese banking sector. In addition, these hypotheses are developed by using existing theory and can be empirically investigated using researchers' analysis tools rather than their values (Saunders, Lewis and Thornhill, 2016).

The choice of a specific philosophy helps to select the best-suited of three research approaches including deduction, induction and abduction (Saunders, Lewis and Thornhill, 2016). The deductive approach starts from pre-existing theory to develop hypotheses, and test those assumptions and, thus, it goes from general to the specific (Saunders, Lewis and Thornhill, 2016; Silverman, 2010). In contrast, the inductive approach moves from the particular to general, as researchers start from observations, and then look for patterns in the data, which can help generate new theories (Bryman and Bell, 2015; Flick, 2015). Following Saunders, Lewis and Thornhill (2016), instead of moving from theory to data as in a deductive approach or data to theory as an inductive

approach, abduction moves back and forth, or it is likely to combine deduction and induction. This study implements the deductive approach as it was concerned with the need to investigate the casual relationships among variables in order to test hypotheses and, thus, generalise results rather than generate new theories (Saunders, Lewis and Thornhill, 2016).

Research methods take three main forms, namely, quantitative, qualitative, and mixed methods. With quantitative methods, numeric data can be effectively collected from a large number of respondents, measures using various quantitative techniques, such as questionnaires and apply a variety of statistical analysis tools in order to test the established hypotheses (Bryman, 2012; May, 2011). Qualitative methods, on the other hand, collect information using a descriptive and non-numerical approach such as interviews in order to examine the meaning of social phenomena, rather than causal relationships between variables (Feilzer, 2010; Berg, 2004). Researchers have the choice to use either mono or multi- quantitative methods, or mono or multi-qualitative methods. The quantitative data required for empirical analysis can be categorised into three groups, cross sectional data, time series data, and Longitudinal or panel data. In cross-sectional data, variables from several entities are collected at the same point of time, while in time series data, variables from one entity are observed over a period of time. In panel data, on the other hand, variables from several entities are gathered over a period of time (Saunders, Lewis and Thornhill, 2016; Flick, 2015; Bryman, 2012; Greene, 2012; Gujarati, 2003). Mixed methods research is considered as the combination of quantitative and qualitative data collection techniques and analytical procedures (Saunders, Lewis and Thornhill, 2016). This study uses quantitative methods to collect panel data in order to investigate the impact of macroeconomic and bank-level determinants on NPL over a period of 10 years. Thereafter, the causal relationship between macroeconomic and bank-level factors are examined using the GMM estimation that has been widely used in prior studies (Louzis et al.,2012; Salas and Saurina, 2002).

Generalized Method of Moments (GMM)

The main purpose of the study is to explore the factors affecting NPL in the Vietnamese banking system by employing a panel set of data. Following standard procedures in the NPL literature, GMM estimation is used in the analysis.

In order to capture the persistence of the NPL growth, a dynamic estimation technique is adopted using the lagged difference of the dependent variable in the econometric model (Ullah et al., 2018; Beck et al., 2015). It may lead to a rise to autocorrelation problems, but the least square estimator of the fixed effects model becomes biased and inconsistent in the presence of the lagged dependent variable. Additionally, the macroeconomic factors (GDP growth, unemployment rates and lending interest rates) are treated as endogenous, since the causality may run in both directions, and these variables might be correlated with the error term. Furthermore, NPL may not only be a result of economic activity slow down, but they can also have a negative impact on economic growth. Similar relationships may exist between NPL and unemployment rates as well as between NPL and lending interest rates. These may result in the endogeneity issues arising from reserve causality (Ullah et al., 2018). Therefore, to tackle problems of correlation amongst errors and to obtain additional efficiency gains a generalized method of moments (GMM) with instrumental variables is needed for our analysis (Beck et al., 2015).

All the issues discussed above are addressed by the Arellano-Bond two-step difference GMM estimation, with robust standard errors (Arellano and Bond, 1991). The inclusion of the lagged dependent variable also assumes that the number of groups is greater than the total number of regressors included in the model. The specifications used for the Arellano Bond analysis are the same that have been presented in the fixed effects estimation section. The Arellano Bond estimation uses the available lags of the dependent variables and the lagged values of the exogenous regressors as instruments. The variables considered as endogenous are instrumented with GMM-style instruments, more specifically the lagged values of the variables (Beck et al., 2015; Arellano and Bond, 1991).

GMM estimation controls for endogeneity by internally transforming the data and including lagged values of the dependent variable (Ullah et al., 2018). Likewise, two kinds of transformation methods of GMM are known as first-difference transformation (one-step GMM) and second-order transformation (two-step GMM). However, one-step GMM has some limitations. For example, the first-difference transformation could lead to the loss of too many observations in the case of missing the recent value of a variable (Ullah et al., 2018; Roodman, 2009). Therefore, we apply two-step GMM in this analysis to avoid potential data loss caused by the internal transformation problem with the one-step GMM.

The GMM estimation could be applied to get rid of the first autocorrelation problem. Indeed, by construction, $NPL_{i,t-1}$ is correlated with the unobserved individual-level effect (Chaibi and Ftiti, 2015). Therefore, in order to eliminate $\eta_{i,}$ the first difference equation is proposed as follows:

$$\Delta NPL_{it} = \alpha + \gamma \Delta NPL_{i,t-1} + \beta(L)\Delta X_{it} + \varepsilon_{it} \quad (2.1)$$

Where NPL_{it} denotes bank non-performing loans; ΔX_{it} is a vector of explanatory variables. The sub-indices *i* and *t* denote banks and time, respectively. Δ is the first difference operator; the parameters to be estimated are α, γ, and β. ε_{it} is an error term.

Following Louzis et al. (2012), in Equation (2.2), by construction, the lagged depended variable $\Delta NPL_{i,t-1}$ correlates with the error term ε_{it}. In spite of that, $NPL_{i,t-2}$, which is expected to be correlated with $\Delta NPL_{i,t-1}$ and not correlated with ε_{it} for t =3,... ,T, given that ε_{it} are not serially correlated. This suggests that lags of order two, and more, of the dependent variable, satisfy the following moment conditions:

$$E[NPL_{i,t-s}, \varepsilon_{it}] = 0 \text{ for } t = 3,\ldots,T \text{ and } s \geq 2 \quad (2.2)$$

The GMM model proposed by Arellano and Bond (1991) and developed by Arellano and Bover (1995) and Blundell and Bond (1998) is employed to estimate the factors that may determine NPL over time in the present study (Ghosh, 2015; Louzis et al., 2012; Salas and Saurina, 2002).

Econometric specification

Following the approach by Louzis et al. (2012), a baseline model is built using the variables that may determine the change in the NPL ratio of the Vietnamese banking system (see equation below):

$$\Delta NPL_{it} = \alpha_1 + \beta_1 \Delta NPL_{i,t-1} + \beta_2 \Delta GDP_{t-1} + \beta_3 \Delta LIR_{t-1} + \beta_4 \Delta UN_{t-1} + \eta_i + \varepsilon_{it} \quad (2.3)$$

with $|\alpha| < 1$, i = 1,...,22 and t = 1,...,10.

where NPL_{it} denotes the NPL ratio, GDP_t denotes the GDP growth rate, LIR_t denotes the lending interest rate and UN_t denotes in the unemployment rate. Δ is the first difference operator; the parameters to be estimated are α_1; β_1; β_2; β_3 and β_4. η_i are the unobserved bank specific effects and ε_{it} is an error term.

In order to test the impact of bank-specific determinants on NPL, each of the above variables is added to the baseline model. The number of instruments used in the estimation is limited to ensure that the total instruments do not exceed the number of cross-sections. As a consequence, one bank-specific factor is added at a time to reduce the need for instruments. The baseline model is extended as follows:

$$\Delta NPL_{it} = \alpha_2 + \beta_1 \Delta NPL_{i,t-1} + \beta_2 \Delta GDP_{t-1} + \beta_3 \Delta LIR_{t-1} + \beta_4 \Delta UN_{t-1} + \beta_5 X_{it-1} + \eta_i + \varepsilon_{it} \quad (2.4)$$

Where NPL_{it} denotes the NPL ratio, GDP_t denotes the GDP growth rate, LIR_t denotes the lending interest rate and UN_t denotes in the unemployment rate; X_{it} represents a vector of the bank-specific variables and dummy variable (See Table 2.7). Δ is the first difference operator; the parameters to be estimated are α_2; β_1; β_2; β_3; β_4 and β_5. η_i are the unobserved bank specific effects and ε_{it} is an error term.

In the estimation, one-lag for the bank-level factors are employed to capture the explanatory power of these variables over the previous year. The estimation is based on the assumption that the current level of bank-specific variables does not influence the current level of NPL (Louzis et al., 2012). According to the authors, this can be explained by the nature of accounting data and the

time delay between changes in management's decision and changes in the balance sheet data of banks. However, in the case of Bank size, the study only examines the impact of its current value on NPL because of its permanent feature in the banking system compared to other bank-specific variables used in the estimation (Louzis et al., 2012, and Salas and Saurina, 2002).

Endogeneity and Instrument variables

As suggested by Louzis et al. (2012), all macroeconomic variables in the present study are assumed to be strictly exogenous. However, this assumption for the bank-level determinants are too strong. Hence, bank-specific variables are assumed to be the weak forms of exogeneity. It suggests an endogeneity issue concerning the current and past realizations of the error term. For the weakly exogenous explanatory variable, its lagged value is a valid instrument for the GMM estimation in the study.

Differences-in-differences (DID)

To provide a clear picture of the impact of the new regulations on the changes in NPL when these have been implemented since 2014 in the Vietnamese commercial bank, this chapter apply a Differences-in-differences (DID) approach. We, therefore, conduct the test to compare the NPL growth before and after the application of the new NPL rules in the Vietnamese banking sector. Traditionally, DID estimation suggests a comparison of the difference between the change in potential outcomes before and after a treatment in a treatment versus control group (Sant'Anna and Zhao, 2020; Abadie, 2005). However, in our analysis, all Vietnamese commercial banks have applied the new NPL regulations since 2014 (or all sample banks have received the treatment) and it leads to a difference in employing a DID method. We adopt a continuous DID estimation suggested by Duchin et al. (2010).

We run the regressions by including the macroeconomic factors, the dummy variable REG, each bank specific variable and the interaction variable between the dummy variable and the bank specific variable. The equation is shown as follows:

$$\Delta NPL_{it} = \alpha_3 + \beta_1 \Delta NPL_{i,t-1} + \beta_2 \Delta GDP_{t-1} + \beta_3 \Delta LIR_{t-1} + \beta_4 \Delta UN_{t-1} + \beta_5 REG_t + \beta_6 X_{it-1} + \beta_7 (REG_t \times X_{it-1}) + \eta_i + \varepsilon_{it}$$ [3] (2.5)

Where NPL_{it} denotes the NPL ratio, GDP_t denotes the GDP growth rate, LIR_t denotes the lending interest rate and UN_t denotes in the unemployment rate; REG_t is a binary variable that takes the value 1 if the bank has implemented the new regulations and zero otherwise. X_{it} represents a vector of the bank-specific variables. Δ is the first difference operator; the parameters to be estimated are $\alpha_3; \beta_1; \beta_2; \beta_3; \beta_4; \beta_5; \beta_6$ and β_7. η_i are the unobserved bank specific effects and ε_{it} is an error term.

2.6 Results

2.6.1 Empirical Result

This section discusses the relationship between NPL and the determinants of change in NPL at Vietnamese commercial banks between 2008 – 2017 time periods. Table 2-10 and Table 2-12 provide the main empirical results of the analysis over the last decade.

The effects of macroeconomic determinants as the primary variables are shown in Baseline model in Table 2-10. The basline model is estimated for two sub-periods: the first is 2008 – 2013 which represents the period that the new NPL rules not applied in the Vietnamese banking sector, and the second is 2008 – 2017. Model 1 investigates the impact of bank size on the change in NPL while Model 2 examines the influence of ROE. In addition, Non-interest income and Solvency ratio are step by step added into the Baseline model to explore their relationship with the change in NPL and the results are presented in Model 3 and Model 4 respectively. Furthermore, Model 5 includes the dummy variable “REG” which denotes the changes in the NPL regulations in Vietnam.

[3] To the case of Bank size, its current value is used in the model instead of the lagged value

Table 2-10 GMM estimation results

	Baseline model (Before 2008-2013)[4]	**Baseline model (Whole 2008-2017)**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
ΔNPL_{it-1}	**0.637****	**0.509*****	**0.474*****	**0.538*****	**0.468*****	**0.404****	**0.481*****
	(0.020)	*(0.000)*	*(0.001)*	*(0.001)*	*(0.005)*	*(0.019)*	*(0.000)*
ΔGDP_{t-1}	**1.538*****	**0.372****	**0.481****	**0.410*****	0.091	0.103	**0.527*****
	(0.000)	*(0.021)*	*(0.041)*	*(0.005)*	*(0.693)*	*(0.573)*	*(0.000)*
ΔLIR_{t-1}	**-0.206*****	**0.066****	**0.076*****	0.001	**0.054***	**0.092*****	-0.029
	(0.001)	*(0.019)*	*(0.001)*	*(0.980)*	*(0.082)*	*(0.002)*	*(0.470)*
ΔUN_{t-1}	**-2.021****	-0.233	-0.685	**-1.344****	0.385	-0.136	-0.956
	(0.016)	*(0.668)*	*(0.118)*	*(0.017)*	*(0.459)*	*(0.791)*	*(0.103)*
$SIZE_{it}$			0.014				
			(0.329)				
ROE_{it-1}				**0.093*****			
				(0.003)			
NII_{it-1}					**-0.047****		
					(0.013)		
$SOLR_{it-1}$						**-0.132****	
						(0.030)	
REG_t							**-0.897****
							(0.028)
Constant	-0.389	-1.355	-1.171	0.481	0.018	1.291	0.819
	(0.899)	*(0.400)*	*(0.540)*	*(0.756)*	*(0.993)*	*(0.508)*	*(0.631)*
Number of observations	*84*	*172*	*172*	*172*	*172*	*172*	*172*
Number of groups	*22*	*22*	*22*	*22*	*22*	*22*	*22*
Number of instruments	*13*	*19*	*20*	*19*	*19*	*19*	*14*
AR(1), p-value	*0.0224*	*0.006*	*0.004*	*0.006*	*0.004*	*0.016*	*0.003*
AR(2), p-value	*0.2484*	*0.704*	*0.713*	*0.702*	*0.739*	*0.727*	*0.776*

Notes: p-values of coefficients in parentheses

*, **, *** denote significance at 10%, 5%, 1% respectively

Baseline model: $\Delta NPL_{it} = \alpha_1 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \eta_i + \varepsilon_{it}$

Model 1: $\Delta NPL_{it} = \alpha_2 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \beta_5 SIZE_{it} + \eta_i + \varepsilon_{it}$

Model 2: $\Delta NPL_{it} = \alpha_3 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \beta_5 ROE_{it-1} + \eta_i + \varepsilon_{it}$

Model 3: $\Delta NPL_{it} = \alpha_4 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \beta_5 NII_{it-1} + \eta_i + \varepsilon_{it}$

Model 4: $\Delta NPL_{it} = \alpha_5 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \beta_5 SOLR_{it-1} + \eta_i + \varepsilon_{it}$

Model 5: $\Delta NPL_{it} = \alpha_6 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \beta_5 REG_t + \eta_i + \varepsilon_{it}$

[4] There was multicollinearity between Lending interest rates and unemployment rates in the 2014- 2017 period. Thus, the regression by employing the sub-period After (2014-2017) is not included in this analysis.

AR (1) of Arellano-Bond test denotes the null hypothesis of no first-order serial correlation should be rejected but AR (2) with the null hypothesis of no second-order serial correlation of the residuals should not be rejected. The p-values of the AR (1) and AR (2) suggest that the GMM estimation results of the changes in NPL ratio meet the requirements.

Looking at the Baseline model in Table 2-10, the positive and statistically significant coefficient of the lagged NPL implies that NPL is likely to rise when it has increased in the previous year. Comparing this result with previous studies, the finding of the present study is in line with Ghosh (2015) and Salas and Saurina (2002). However, it contrasts the negative impact of this variable on NPL found by Louzis et al. (2012).

Baseline model also reveals the results of the macroeconomic determinants. The estimated coefficients of GDP and lending interest rate are statistically significant but there is no evidence of the impact of unemployment rate on NPL which differs from previous studies (Ghosh, 2015; Louzis et al., 2012). The NPL ratio is positively influenced by a rise in economic growth in the previous year. and this result supports findings of Beck et al. (2015). The relationship between GDP growth and NPL is consistent for two sub-periods. The implication is that in the boom period, there is a rise in the GDP growth and banks could lower their lending standards for customers. In addition, the revenue of firms also increases leading to more incentives to borrow from banks in order to make more investment. Therefore, there could be an increase in NPL in the current year in the banking system. Additionally, in an emerging economy like Vietnam, the GDP growth is higher as compared to developed countries such as the US or Greece and its impact on NPL may be very strong. On the other hand, the level of public debt in both Greece and US are considerably higher than Vietnam. Turning to the lending interest rate, its coefficient is positive as expected over the whole sampling period (2008 – 2017) and matches the findings of previous authors (Beck et al., 2015 and Louzis et al., 2012). It seems to be more difficult for consumer loans to be refinanced and for firms to renegotiate a debt restructuring. As a result, NPL will increase when lending interest rates rise. The impact of lending interest rate on NPL for the short-run period from 2008 to 2013, however, is found negative. Due to the impact of the 2008 global financial crisis, the level of NPL

remains high when banks either increase or decrease their lending interest rates. Besides, the result of Baseline mode for the Before period (2008 – 2013) shows that unemploymen rate negatively affects NPL. In fact, the unemployment rate in Vietnam decrease slightly from 2.4% in 2008 to 2% in 2013 but as discussed above, the economic downturns may lead to a higher number of NPL during this sub-period. The impact of the employment rate on NPL for the long-run period (2008 – 2017) is found insignificant.

Model 1 – Model 5 presents the GMM estimation results when each bank-specific variables is included. Regarding bank size's effect on NPL, the coefficient is not statistically significant and whilst this result contrasts the findings of Vithessonthi (2016), Ghosh (2015), and Salas and Saurina (2002). However, it is consistent with Louzis et al. (2012) when bank size is employed to proxy bank diversification.

As expected, the ROE indicator is positive and statistically significant and as documented in literature, a higher ROE is associated with higher NPL. The above finding emphasizes the "Procyclical credit policy" which states that banks could maintain a liberal credit policy and lend more money to insolvent borrowers. Consequently, the increase in their profitability in the current year could be generated at the expense of future problem loans. The result disagrees with the earlier studies (e.g. Vithessonthi, 2016; Ghosh, 2015; Klein, 2013; and Louzis et al., 2012) when they use ROE or ROA as a proxy of bank management quality.

The proportion of non-interest income as a share of total income is also a proxy of diversification in the studies of Ghosh (2015) and Louzis et al. (2012) but both lack its significance on NPL in the Greek and US banking industry. However, in the present study analysis, this variable is negatively significant. As a consequence, except for interest income from loans, Vietnamese commercial banks could get benefit from the diversified sources of income which can help lower NPL.

Similarly, the results of Model 4 show the significant impact of solvency ratio on NPL in the Vietnamese banking sector. This implies that the decrease in the equity of Vietnamese banks could

raise the number of risky loans, and therefore, banks with relatively low capital may have more incentives with the potential of increasing the riskiness of their loan portfolios or reducing loan quality with resultant increase in NPL in the future. Additionally, the coefficient parameter of the dummy variable (REG) is the largest compared to other variables' parameters in the analysis and as expected, this shows significance in the present study. In order to meet the new requirement of the NPL regulations which is indicated in Circular 02 and Cirular 09 and to maintain good performance, Vietnamese banks must focus on the credit risk management process. In other word, tightening NPL regulations may require that banks pay more attention to the credit standard and lending quality as well as loan provision.

Table 2-11 Comparison the regression results of NPL determinants in Vietnam, Greece, and the US

Study	**Present study**	**Louzis et al. (2012)**			**Ghosh (2015)**	
Country	**Vietnam**	**Greece**			**The US**	
Types of loans/banks	*All loans/Sign*	*Mortgage/ Sign*	*Business/ Sign*	*Consumer/ Sign*	*Commercial banks/Sign*	*Savings banks/Sign*
NPL	✓/+	x	✓/-	✓/-	✓/+	✓/+
GDP	✓/+	✓/-	✓/-	✓/-	✓/-	✓/-
LIR	✓/+	✓/+	✓/+	✓/+	x	x
UN	x	✓/+	✓/+	✓/+	✓/+	✓/+
SIZE	x	x	x	x	✓/+	x
ROE / ROA	✓/+	✓/-	x	✓/-	✓/-	✓/-
NII	✓/-	x	x	x	x	x
SOLR	✓/-	x	x	x	N/A	N/A
REG	✓	N/A	N/A	N/A	N/A	N/A
Time span	2008 – 2017	2003Q1 - 2009Q3			1984 - 2013	1990 - 2013
Sample banks	22	9			All banks across 50 states and the District of Columbia	All banks across 50 states and the District of Columbia

Note: ✓ denotes significance

x denotes insignificance

\+ denotes positive impact

\- denotes negative impact

This work is also related to a line of research in NPL. However, the GMM estimation results of the analysis in this chapter have some obvious differences as compared the other studies in the literature of Ghosh (2015) and Louzis et al. (2012). As be shown in Table 2-11, the positive impact of GDP on NPL in the Vietnamese banking sector contrasts with this relation in the US (Ghosh, 2015) and Greece (Louzis et al., 2012). Clearly, Vietnam is one of the emerging countries with the speedy development in every economic field. As a consequence, the GDP of Vietnam is quite higher than this indicator in the developed countries. The rapid GDP growth and skyrocketing industrialization Vietnam may lead entrepreneurs to take out more loans. In addition, to meet the requirements of the boom in economy, Vietnamese commercial banks have a vital role in loan supply and the credit policy could be loosen to enhance investment. Based on these issues, an increase in GDP is accompanied by a rise in NPL in Vietnam. Moreover, the finding of this chapter indicates that the positive effect of ROE on NPL is not in line with the earlier studies of Ghosh, (2015) and Louzis et al. (2012). As discussed, Vietnamese commercial banks could increase their ROE by lending more customers. Nevertheless, adverse selection and moral hazard could happened when these banks lower their credit standard to lower-quality debtors. Consequently, it results in an increase in NPL when borrowers may not fulfil their obligations.

Table 2-12 DID regression results

	(1)	(2	(3)	(4)	(5)
ΔNPL_{it-1}	**0.402*****	**0.429*****	**0.403*****	**0.407*****	**0.436*****
	(4.43)	*(4.58)*	*(4.52)*	*(4.77)*	*(4.41)*
ΔGDP_{t-1}	**0.502*****	**0.517*****	**0.496*****	**0.498****	**0.528****
	(2.90)	*(3.05)*	*(2.94)*	*(2.78)*	*(2.60)*
ΔLIR_{t-1}	-0.0200	-0.0236	-0.0271	-0.0221	-0.0345
	(-0.54)	*(-0.62)*	*(-0.73)*	*(-0.61)*	*(-0.86)*
ΔUN_{t-1}	**-1.148****	**-1.203****	**-1.133****	**-1.095****	**-1.306*****
	(-2.76)	*(-2.65)*	*(-2.73)*	*(-2.73)*	*(-3.67)*
REG_t	**-0.931****	**-0.796****	**-0.939****	**-0.926****	**-0.776****
	(-2.67)	*(-2.53)*	*(-2.77)*	*(-2.65)*	*(-2.25)*
$SIZE_{it}$	-0.113				-0.222*
	(-0.89)				*(-1.94)*
ROE_{it-1}		0.0111			0.0170
		(0.56)			*(0.72)*
$SOLR_{it-1}$			-0.0362*		-0.0798**
			(-1.81)		*(-2.22)*
NII_{it-1}				-0.00317	0.00847
				(-0.32)	*(0.82)*
REG_t*$SIZE_{it}$	0.0195				0.0697*
	(0.89)				*(2.02)*
REG_t*ROE_{it-1}		0.0298			0.0461
		(0.85)			*(1.29)*
REG_t*$SOLR_{it-1}$			0.0772**		0.137***
			(2.10)		*(3.20)*
REG_t*NII_{it-1}				0.00320	0.00333
				(0.23)	*(0.27)*
Constant	1.992	1.351	1.956	1.452	3.296**
	(1.57)	*(0.96)*	*(1.38)*	*(1.03)*	*(2.46)*
Firm fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Number of observations		*194*	*194*	*194*	*194*
R^2	*0.4014*	*0.6263*	*0.8479*	*0.8798*	*0.3058*

Notes: p-values of coefficients in parentheses

*, **, *** denote significance at 10%, 5%, 1% respectively

(1) $$\Delta NPL_{it} = \alpha_1 + \beta_1 \Delta NPL_{i,t-1} + \beta_2 \Delta GDP_{t-1} + \beta_3 \Delta LIR_{t-1} + \beta_4 \Delta UN_{t-1} + \beta_5 REG_t + \beta_6 Size_{it} + \beta_7 (REG_t \times Size_{it}) + \eta_i + \varepsilon_{it}$$

(2) $$\Delta NPL_{it} = \alpha_1 + \beta_1 \Delta NPL_{i,t-1} + \beta_2 \Delta GDP_{t-1} + \beta_3 \Delta LIR_{t-1} + \beta_4 \Delta UN_{t-1} + \beta_5 REG_t + \beta_6 ROE_{it-1} + \beta_7 (REG_t \times ROE_{it-1}) + \eta_i + \varepsilon_{it}$$

(3) $$\Delta NPL_{it} = \alpha_1 + \beta_1 \Delta NPL_{i,t-1} + \beta_2 \Delta GDP_{t-1} + \beta_3 \Delta LIR_{t-1} + \beta_4 \Delta UN_{t-1} + \beta_5 REG_t + \beta_6 SOLR_{it-1} + \beta_7 (REG_t \times SOLR_{it-1}) + \eta_i + \varepsilon_{it}$$

(4) $$\Delta NPL_{it} = \alpha_1 + \beta_1 \Delta NPL_{i,t-1} + \beta_2 \Delta GDP_{t-1} + \beta_3 \Delta LIR_{t-1} + \beta_4 \Delta UN_{t-1} + \beta_5 REG_t + \beta_6 NII_{it-1} + \beta_7 (REG_t \times NII_{it-1}) + \eta_i + \varepsilon_{it}$$

(5) $$\Delta NPL_{it} = \alpha_1 + \beta_1 \Delta NPL_{i,t-1} + \beta_2 \Delta GDP_{t-1} + \beta_3 \Delta LIR_{t-1} + \beta_4 \Delta UN_{t-1} + \beta_5 REG_t + \beta_6 X_{it-1} + \beta_7 (REG_t \times X_{it-1}) + \eta_i + \varepsilon_{it}$$

As discussed in the sub-section 2.52, DID regressions are carried out to clarify the impact of the new NPL rules in the Vietnamese banking system apart from GMM estimation. Table 2-12 provides the results of estimating the model specified in Equation 2.5. Firstly, Column (1) to (4) report the results of the analysis when the dummy variable, each bank-level indicator and the interaction between the dummy variable and this bank – level factor are added in the baseline model. NPL of banks change in a specific year in response to changes in each of bank-specific determinants, depending on the banks' exposure to the new NPL regulations. The results reveal the statistically significant influence of these new rules on the change of bank NPL over the sampling period. Secondly, another DID regression is estimated when the dummy variable, bank-level indicators and all interactions between dummy variable and a bank –level factor are included (See Column 5 of Table 2 -12). The similar result is obtained when comprising these interactions in one regression. Column (5) shows the negative impact of 'REG' on NPL. Consequently, NPL tend to decrease when new NPL regulations applied in the Vietnamse banking sector since 2014. The statistically significant negative sign for 'REG' is found and consistent. This implies the contribution of the changes in NPL regulations to NPL. Therefore, it confirms the robustness of our finding as initial empirical evidence to support the view that tighter NPL rules lead to lower NPL.

2.6.2 Robustness Checks

In addition to the above empirical analyses, a number of additional tests are conducted to confirm the robustness of the empirical results. Firstly, the GMM estimations are re-analysed by using the identified data with the winsorization at 10% and 90% percentiles to remove outliers. As can be seen from Table 2-13, there are no changes in all the original results. The impacts of macroeconomic indicators including GDP, lending interest rate and unemployment rate on NPL hold for the two subperiods as shown in both Baseline model column of Table 2-13. In addition, the significant relationship between bank-level factors (consisting of ROE, non-interest income, solvency ratio and 'REG') remains unchanged compared to the main results.

Secondly, inflation rate is also used as an important macroeconomic factor of NPL in the recent studies of Ghosh (2017) and Ghosh (2015). However, there is multicollinearity between inflation rate and lending interest rate in the sample data. Inflation rate, therefore is not included in the main empirical analysis. To examine the influence of the inflation rate on NPL, an additional test is carried out by using this macroeconomic determinant instead of lending interest rate. The results of the second robustness test are shown in Table 2-14. Most of the original determinants keep the significant sign as compared to the empirical test, except for the solvency ratio. The result illustrates that the solvency ratio holds the negative sign but turns no significant impact on NPL when the inflation rate is employed to replace the lending interest rate as a baseline indicator.

Furthermore, there are concerns that some of the largest commercial banks in the Vietnamese banking sector, which are also the state-owned commercial banks, may have influenced the direction of the results (Cornett et al., 2010; Sapienza, 2004). Therefore, the data of the three largest banks in the study sample (VCB, Vietinbank, BIDV) are removed to re-run the regression analysis and it is worthy of note that, the results of the variables remained unchanged (see Table 2-15).

Table 2-13 Robustness check with winsorizing at 10% and 90%

	Baseline model (Before 2008 - 2013)	**Baseline model (Whole 2008 - 2017)**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
ΔNPL_{it-1}	**0.698*****	**0.653*****	**0.595*****	**0.727*****	**0.531*****	**0.417****	**0.641*****
	(0.000)	*(0.001)*	*(0.000)*	*(0.000)*	*(0.001)*	*(0.016)*	*(0.000)*
ΔGDP_{t-1}	**1.247*****	**0.356*****	**0.351*****	**0.391*****	0.0217	0.0197	**0.457*****
	(0.000)	*(0.001)*	*(0.010)*	*(0.000)*	*(0.893)*	*(0.872)*	*(0.000)*
ΔLIR_{t-1}	**-0.157*****	**0.0493****	**0.0564****	0.00533	**0.0459****	**0.0881****	-0.0123
	(0.000)	*(0.011)*	*(0.000)*	*(0.861)*	*(0.040)*	*(0.000)*	*(0.545)*
ΔUN_{t-1}	**-1.567*****	-0.268	-0.343	**-0.878****	0.496	0.00916	**-0.669****
	(0.000)	*(0.425)*	*(0.270)*	*(0.013)*	*(0.189)*	*(0.980)*	*(0.047)*
$SIZE_{it}$			0.00617				
			(0.700)				
ROE_{it-1}				**0.0836****			
				(0.013)			
NII_{it-1}					**-0.0552*****		
					(0.001)		
$SOLR_{it-1}$						**-0.176*****	
						(0.007)	
REG_t							**-0.622*****
							(0.000)
Constant	-0.686	-1.364	-1.165	-0.799	0.211	1.807	-0.0982
	(0.602)	*(0.260)*	*(0.356)*	*(0.394)*	*(0.884)*	*(0.261)*	*(0.926)*
Number of observations	*84*	*172*	*172*	*172*	*172*	*172*	*172*
Number of groups	*22*	*22*	*22*	*22*	*22*	*22*	*22*
Number of instruments	*13*	*12*	*20*	*19*	*19*	*19*	*14*
AR(1), p-value	*0.0046*	*0.0109*	*0.0080*	*0.0031*	*0.0075*	*0.0224*	*0.0011*
AR(2), p-value	*0.2709*	*0.2674*	*0.2195*	*0.1526*	*0.6131*	*0.0593*	*0.2363*

Notes: p-values of coefficients in parentheses

*, **, *** denote significance at 10%, 5%, 1% respectively

Baseline model: $\Delta NPL_{it} = \alpha_1 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \eta_i + \varepsilon_{it}$

Model 1: $\Delta NPL_{it} = \alpha_2 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \beta_5 SIZE_{it} + \eta_i + \varepsilon_{it}$

Model 2: $\Delta NPL_{it} = \alpha_3 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \beta_5 ROE_{it-1} + \eta_i + \varepsilon_{it}$

Model 3: $\Delta NPL_{it} = \alpha_4 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \beta_5 NII_{it-1} + \eta_i + \varepsilon_{it}$

Model 4: $\Delta NPL_{it} = \alpha_5 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \beta_5 SOLR_{it-1} + \eta_i + \varepsilon_{it}$

Model 5: $\Delta NPL_{it} = \alpha_6 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \beta_5 REG_t + \eta_i + \varepsilon_{it}$

Table 2-14 Robustness check – Replacing Lending interest rates by Inflation rates

	Baseline model (Before 2008-2013)	**Baseline model (Whole 2008 - 2017)**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
ΔNPL_{it-1}	**0.442***	**0.666*****	**0.613*****	**0.605*****	**0.591*****	**0.478*****	**0.483*****
	(0.061)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.001)*	*(0.004)*	*(0.002)*
ΔGDP_{t-1}	**1.032*****	**0.440*****	**0.473***	**0.448*****	0.0989	0.187	**0.522*****
	(0.000)	*(0.003)*	*(0.084)*	*(0.004)*	*(0.663)*	*(0.275)*	*(0.000)*
ΔINF_{t-1}	**-0.0473*****	0.00935	0.0123	-0.0204	0.00562	0.0234	**-0.0228***
	(0.004)	*(0.476)*	*(0.362)*	*(0.156)*	*(0.759)*	*(0.128)*	*(0.095)*
ΔUN_{t-1}	**-1.518****	-0.170	-0.507	**-1.556*****	0.570	-0.224	**-0.966***
	(0.019)	*(0.739)*	*(0.267)*	*(0.007)*	*(0.287)*	*(0.651)*	*(0.091)*
$SIZE_{it}$			0.00725				
			(0.677)				
ROE_{it-1}				**0.119*****			
				(0.000)			
NII_{it-1}					**-0.0550*****		
					(0.008)		
$SOLR_{it-1}$						-0.0794	
						(0.182)	
REG_t							**-0.951*****
							(0.004)
Constant	-0.423	-1.580	-1.015	0.466	-0.00202	1.121	0.770
	(0.841)	*(0.279)*	*(0.611)*	*(0.786)*	*(0.999)*	*(0.561)*	*(0.670)*
Number of observations	*84*	*172*	*172*	*172*	*172*	*172*	*172*
Number of groups	*22*	*22*	*22*	*22*	*22*	*22*	*22*
Number of instruments	*14*	*19*	*20*	*19*	*19*	*19*	*14*
AR(1), p-value	*0.0083*	*0.0016*	*0.0035*	*0.0034*	*0.0024*	*0.0120*	*0.0049*
AR(2), p-value	*0.2580*	*0.5548*	*0.5797*	*0.6342*	*0.5751*	*0.9880*	*0.7615*

Notes: p-values of coefficients in parentheses

*, **, *** denote significance at 10%, 5%, 1% respectively

Baseline model: $\Delta NPL_{it} = \alpha_1 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 INF_{t-1} + \beta_4 UN_{t-1} + \eta_i + \varepsilon_{it}$

Model 1: $\Delta NPL_{it} = \alpha_2 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 INF_{t-1} + \beta_4 UN_{t-1} + \beta_5 SIZE_{it} + \eta_i + \varepsilon_{it}$

Model 2: $\Delta NPL_{it} = \alpha_3 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 INF_{t-1} + \beta_4 UN_{t-1} + \beta_5 ROE_{it-1} + \eta_i + \varepsilon_{it}$

Model 3: $\Delta NPL_{it} = \alpha_4 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 INF_{t-1} + \beta_4 UN_{t-1} + \beta_5 NII_{it-1} + \eta_i + \varepsilon_{it}$

Model 4: $\Delta NPL_{it} = \alpha_5 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 INF_{t-1} + \beta_4 UN_{t-1} + \beta_5 SOLR_{it-1} + \eta_i + \varepsilon_{it}$

Model 5: $\Delta NPL_{it} = \alpha_6 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 INF_{t-1} + \beta_4 UN_{t-1} + \beta_5 REG_t + \eta_i + \varepsilon_{it}$

Table 2-15 Robustness check – Removing the data of the three largest banks in the sample

	Baseline model (Before 2008-2013)	**Baseline model (Whole 2008 - 2017)**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
ΔNPL_{it-1}	0.489	**0.479*****	**0.474*****	**0.525*****	**0.456*****	**0.421****	**0.452*****
	(0.198)	*(0.001)*	*(0.002)*	*(0.001)*	*(0.006)*	*(0.015)*	*(0.000)*
ΔGDP_{t-1}	**1.7*****	**0.442****	**0.555****	**0.475*****	0.212	0.163	**0.643*****
	(0.000)	*(0.022)*	*(0.049)*	*(0.004)*	*(0.409)*	*(0.448)*	*(0.000)*
ΔLIR_{t-1}	**-0.227*****	**0.0759****	**0.0846*****	0.00116	**0.0623***	**0.0984*****	-0.0422
	(0.004)	*(0.018)*	*(0.004)*	*(0.974)*	*(0.065)*	*(0.003)*	*(0.440)*
ΔUN_{t-1}	**-2.527****	-0.396	-0.869	**-1.531****	0.154	-0.161	**-1.162***
	(0.048)	*(0.557)*	*(0.112)*	*(0.038)*	*(0.775)*	*(0.798)*	*(0.090)*
$SIZE_{it}$			0.0131				
			(0.450)				
ROE_{it-1}				**0.101*****			
				(0.004)			
NII_{it-1}					**-0.0363***		
					(0.065)		
$SOLR_{it-1}$						**-0.123****	
						(0.028)	
REG_t							**-1.204****
							(0.031)
Constant	0.508	-1.390	-1.204	0.582	-0.387	0.930	0.998
	(0.898)	*(0.460)*	*(0.600)*	*(0.768)*	*(0.867)*	*(0.663)*	*(0.605)*
Number of observations	72	*148*	*148*	*148*	*148*	*148*	*148*
Number of groups		*19*	*19*	*19*	*19*	*19*	*19*
Number of instruments		*19*	*20*	*19*	*19*	*19*	*14*
AR(1), p-value		*0.0061*	*0.0035*	*0.0071*	*0.0036*	*0.0124*	*0.0033*
AR(2), p-value		*0.5902*	*0.5675*	*0.5665*	*0.6244*	*0.9822*	*0.6069*

Notes: p-values of coefficients in parentheses
*, **, *** denote significance at 10%, 5%, 1% respectively

Baseline model: $\Delta NPL_{it} = \alpha_1 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \eta_i + \varepsilon_{it}$

Model 1: $\Delta NPL_{it} = \alpha_2 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \beta_5 SIZE_{it} + \eta_i + \varepsilon_{it}$

Model 2: $\Delta NPL_{it} = \alpha_3 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \beta_5 ROE_{it-1} + \eta_i + \varepsilon_{it}$

Model 3: $\Delta NPL_{it} = \alpha_4 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \beta_5 NII_{it-1} + \eta_i + \varepsilon_{it}$

Model 4: $\Delta NPL_{it} = \alpha_5 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \beta_5 SOLR_{it-1} + \eta_i + \varepsilon_{it}$

Model 5: $\Delta NPL_{it} = \alpha_6 + \beta_1 NPL_{it-1} + \beta_2 GDP_{t-1} + \beta_3 LIR_{t-1} + \beta_4 UN_{t-1} + \beta_5 REG_t + \eta_i + \varepsilon_{it}$

2.7 Conclusion

Using data on the 22 largest commercial banks in Vietnam and employing the GMM estimation, this chapter has provided detailed insights into the key drivers of NPL in the Vietnamese banking sector from the year 2008 to 2017. Applying the GMM estimation, a number of potential determinants of NPL are found to have influences on NPL in Vietnam and more importantly, the impact of the changes in the NPL regulation on NPL during that period were also identified. The estimation results provided evidence of the strong impacts of GDP growth and lending interest rates on NPL as macroeconomic factors. Furthermore, bank-specific variables such as ROE, non-interest income and solvency ratio are found to significantly affect NPL when they are added into the baseline model with the primary determinants. Remarkably, the empirical results presented in this study indicates the crucial role of the new NPL regulation on NPL.

Additionally, the findings of this analysis also suggested several implications in terms of banking regulations and policies. Regarding the macroeconomic condition of the Vietnamese banking sector, the economic health of banks should be improved to reduce NPL due to the trade-off between GDP growth and problem loans in the developing country. Macroeconomic policies without too rapid growth, therefore, should be highly considered to keep a low level of problem loans. Furthermore, optimal monetary decisions take into account interest rates based on the positive link between NPL and lending interest rates. Moreover, the significant impacts of profitability, capital level or non-interest income share can be used as early warning indicators of future NPL to help regulators implement prompt corrective action. More importantly, it is also necessary to consider the trade-offs between the profits of banks and future NPL. In addition, the appraisal procedures of banks should be used to adequately assess all the risks associated with financing projects, especially infrastructure projects in order to reach a balance between long-term assets and long-term liabilities. Again, regulators should focus on credit rating tools and credit risk control matrix and consider integrating them into the credit risk management and decision-making process for better loan portfolio monitoring and management. Finally, banks should emphasize on diversifying their services to reduce NPL.

Chapter 3 Does the Ratio of Non-Performing Loans to Loan Loss Reserves Provide a Signal about Bank Future Profitability? Evidence from Vietnam

Chapter 3: Does the Ratio of Non-Performing Loans to Loan Loss Reserves Provide a Signal about Bank Future Profitability? Evidence from Vietnam

Abstract

The purpose of this chapter is to examine the association between the non-performing loans (NPL) to loan loss reserves (LLR) ratio and the future profitability of Vietnamese commercial banks. Applying the two-stage least squares (2SLS) methodology, this first analysis shows that a lower NPL_{it} to LLR_{it-1} ratio has a statistically significant negative impact on a bank's future profitability. In addition, our results reveal a stronger negative relationship in boom periods as compared to downturns. Moreover, the empirical results provide evidence to show that the ratio gives a reliable signal for a bank's future profitability in Vietnam for the period 2008 to 2017. Our results hold when both macroeconomic and bank-specific variables are controlled for and are robust to different macroeconomic factor, different proxy of profitability and alternative methodology.

3.1 Introduction

Profitability is one of the vital factors which not only does banks need to sustain their ongoing activity but also for investors to achieve fair returns (ECB, 2010). The sustainable development of a bank's profitability plays an important role in determining the stability of both the bank and the whole financial system. Most importantly, the banking structure and profitability have been driven by a large number of factors such as economic conditions and ownership structure (Athanasoglou et al., 2008). As a consequence, obtaining advanced information affecting a bank's profitability is of the utmost importance to bank regulators, policy makers and investors. In other word, developing baseline indicators that provide early warnings of bank profitability is a crucial step in improving countries' financial sectors. Within the extant literature, numerous studies have mostly focused on explaining the impacts of both internal and external factors affect on banks' profitability (Shaban and James, 2018; Athanasoglou et al., 2008; Goddard et al., 2004). Additionally, several analyses are carried out to identify informative indicators to predict bank future profitability (Mollah et al., 2019; Balasubramnian et al., 2019; Brian et al., 2016). However, to date, there has been no empirical study investigating the ratio non-performing loans to loan loss reserves as a signal for bank future earnings prediction.

The trade-off between profits and risks has been subject to controversial dispute among bank managers, shareholders and policymakers in recent years. Many articles make the assertion that higher profitability dissuades bank risk-taking incentives because shareholders of banks stand to lose more if downside risks realize (e.g. Repullo, 2004; Demsetz et al., 1996; Keeley, 1990). Furthermore, if shareholders are highly risk-averse, they will want to ensure their bank perform counter-cyclically and then take decisions that may be suboptimal for the bank (Bikker and Bos, 2008). By contrast, with the purpose of satisfying capital requirements, banks may have incentives to take risks to generate profits (e.g. Hellmann et al., 2000; Matutes and Vives, 2000; Blum, 1999). Moreover, profitable banks can build up capital enabling banks to absorb occasional losses and

permitting risk-taking (Perotti et al., 2011; Calem and Rob, 1999). A more profitable banks, therefore, may boost their leverage and take risk in side activities (Martynova et al., 2019). Theoretically, when banks are confronted with increasing competition, they could have intentions of taking on more risk (Boyd and De Nicoló, 2005). Rationally, banks could involve risky lending portfolios to earn more. On one hand, bank managers pursue their private benefits through insufficient monitoring of loans whilst on the other hand, moral hazard problem arises from a conflict of interest between shareholders and creditors. Shareholders may want to make riskier loans but eventually shift the risk to the depositors. The literature suggests that moral hazard problems lead to a higher loan growth rate and a larger number of NPLs. One of the main indicators of moral hazard problem is excessive risk-taking in lending. Therefore, when banks extend credit to low-quality customers, loan growth could represent a key driver of the riskiness of banks and lead to an increase in loan losses causing a decline in interest income and profits. Additionally, bank managers tend to have incentives to adjust loan loss provisions and loan loss reserves to manage earnings or signal private information about future bank prospects (Ahmed et al., 1999). Over the last decade (2008-2017), regulatory changes and the evolution of financial instruments have dramatically affected the global banking sector. Furthermore, the Great Recession of 2007 to 2009 strongly influenced the performance of banks globally and susequenlty caused many of them to fail. Consequently, risks and risk management of banks are taken into further consideration with their profits. Specially, previous studies imply either the link between credit risk (proxied by NPL) and banks' profitability (Berger et al. (1997) or the relationship between the cushion to absorb expected loss on banks' loan portfolio (captured by Loan Loss Reserves - LLR) and their earnings (Bouvatier and Lepetit, 2008).

Motivated by the ongoing debate concerning an early warning system for bank performance, this chapter assesses whether or not the ratio between non-performing loans in the current year (NPL_{it}) and loan loss reserves in the previous year (LLR_{it-1}) effectively signal banks' future profitability in Vietnam. This analysis aims to contribute to the preceding literature on bank performance and the early warning systems of bank performance in the following ways. Firstly, the empirical analysis

examines the relationship between the ratio of NPL_{it} to LLR_{it-1} and a bank's future profitability rather than NPL or LLR separately. In terms of accounting principles, NPL are loans on which borrowers have failed to make contractual payments for a predetermined time or loans which have not been repaid either partly or in full. NPL are associated with the traditional lending activity of banks. Hence, NPL_{it} capturing the actual loan losses at time (t) are regarded as a proxy of credit risk in numerous studies (e.g. Ghosh, 2015; Louzis et al., 2012). Meanwhile, LLR (or loan loss allowances) are set up to absorb the loan losses. LLR are also used to prevent credit risk from happening and to deal with the expected losses imbedded in the loan portfolios in the next period. In other words, LLR is considered as a forward-looking measure of credit risk or the actual buffer for loan losses (Fang and Van Lelyveld, 2014). Accordingly, LLR_{it-1} could denote the expected future loan losses (loan losses expected at time t) in existing loan portfolios (Anandarajan et al., 2005). Consequently, the ratio of NPL_{it} to LLR_{it-1} is likely to capture the association between the actual loan losses and the expected value of the actuall loan losses. Secondly, despite significant studies that have been conducted to investigate the impacts of NPL or the influences of LLR on bank profitability, to date, there have been no studies examining the ratio of NPL_{it} to LLR_{it-1} as a sign to predict a bank's profitability. This chapter, therefore, is the first study that attempts to shed new light on positing the NPL_{it}/LLR_{it-1} ratio as an indicator for an early warning signal of banks' future earnings. Using both return on equity (ROE) and return on assets (ROA) to proxy a bank's earnings in this analysis, the NPL_{it}/LLR_{it-1} ratio has a statistically negative association with the future profitability of a bank. Particularly the influence of the NPL_{it}/LLR_{it-1} ratio on a bank's future profitability becomes stronger in an upswing period. Thus, the finding is likely regarded as a useful component adding into the early warning model to forecast a bank's profit.

In Vietnam, the Doi Moi (Renovation) policy was launched by the government in 1986 with the aim of reforming the country's economy. Remarkably, the Vietnamese economy successfully transferred from a closed command economy (or a centrally planned economy) to a market-

oriented one and the country becomes one of the most rapidly emerging countries with speedy economic growth in South East Asia.

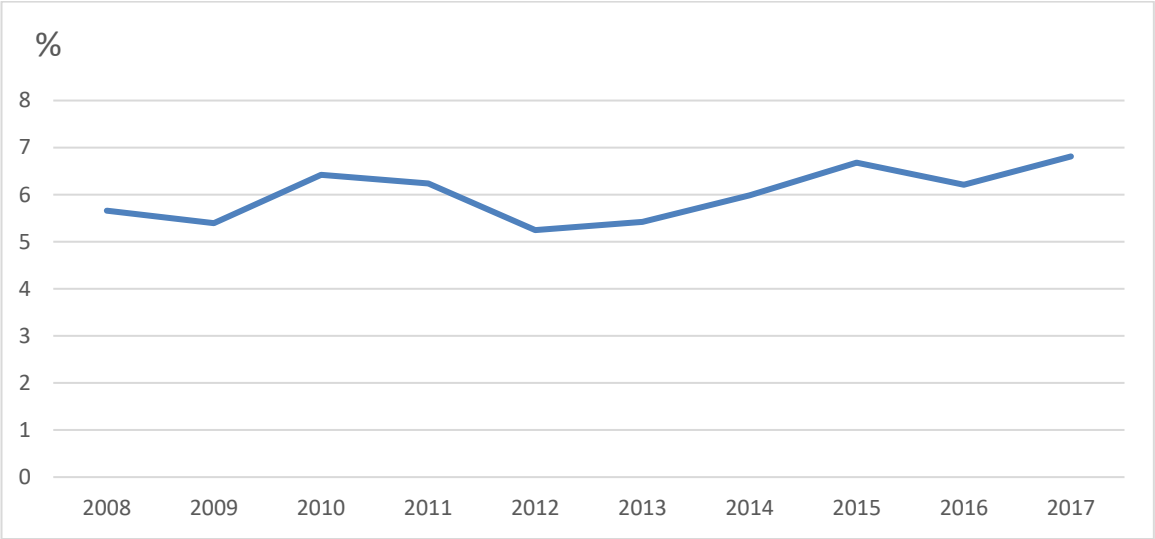

Figure 3-1 Annual GDP growth in Vietnam from 2008 to 2017

Source: World Develop Indicators - World Bank

Vietnam has been transforming from one of the world's poorest nations into a lower middle-income country. Between 2008 and 2017, both GDP and GDP per capita increased sharply (See Figure 3-1 and Table 3-1).

Table 3-1 GDP and GDP per capita in Vietnam over the period 2008 to 2017

Year	GDP (million US$)	GDP per capita (US$)
2008	99,130	1,149
2009	106,014	1,217
2010	115,931	1,317
2011	135,539	1,525
2012	155,820	1,735
2013	171,222	1,886
2014	186,204	2,030
2015	193,241	2,085
2016	205,276	2,192
2017	223,779	2,365

Source: World Develop Indicators - World Bank and Author's summary

In accordance with these developments of the economy, the Vietnamese banking system has experienced numerous substantial changes since the early 1990s. During the last decades (2008 - 2017), the banking sector in Vietnam has made improvements in the quantity of the banking institutions available, the size of banks, and the amount of other banking services offered as well. Lending, however, is considered as the main activity of Vietnamese commercial banks and the loans supplied by the banking sector still dominate the financial market and plays vital roles in the revenue and profits of banks.

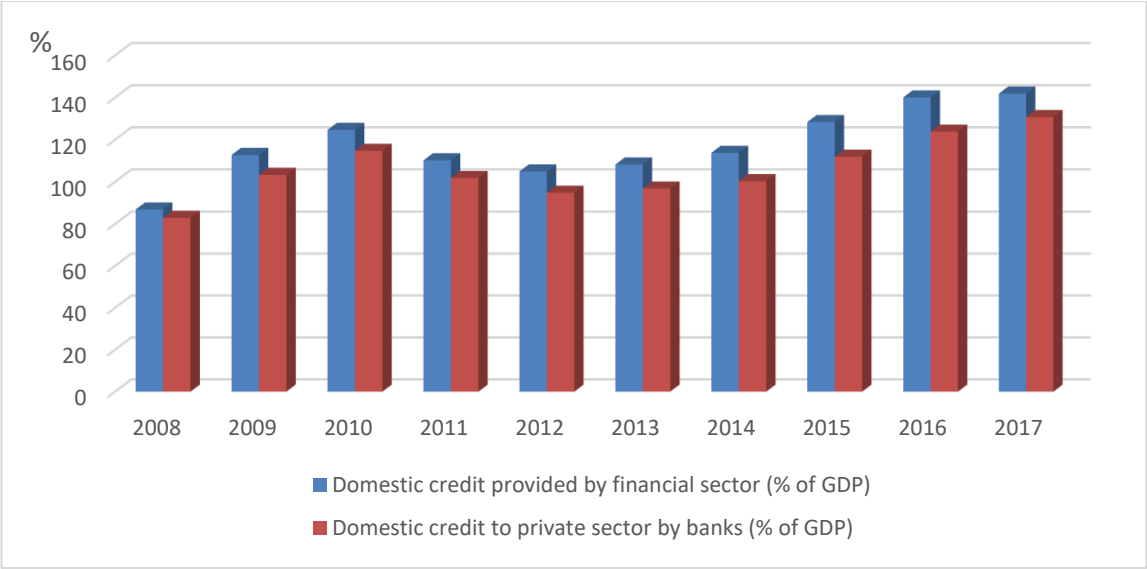

Figure 3-2 The average of domestic credit in Vietnam from 2008 to 2017

Source: World Develop Indicators - World Bank

The set-up of this chapter is as follows: Section 3.2 gives a brief overview of the literature; Section 3.3 presents all variables, data and methodology used in the estimation; Section 3.4 provides the results and finally, Section 3.5 summarizes and concludes with our main findings.

3.2 Literature Review

A growing body of recent empirical research points towards signals to predict bank earnings (e.g. Mollah et al., 2019; Balasubramnian et al., 2019; Brian et al., 2016). For example, the latest study of Mollah et al. (2019) investigates how corporate governance predicts bank earnings. The study focus on different sub-samples of banks varying country legal status (common versus civil law), stages of economic development (developed versus emerging countries) and bank sizes (large, medium and small bank sizes) over the period 2007 to 2016. The authors state that board structure and CEO power have significant impacts on future cash flows which is used to capture a forward-looking measure of bank earnings in this study. The consistent results, however, highlight the differences in these influences according to countries and sized banks. In particular, board structure is found to be more effective in predicting future bank profits in civil law and developed countries than in common law and emerging economies. CEO power provides a negative signal to future

earnings predictability in common law and emerging countries . The impacts of risk governance also vary between civil and common law countries as well as across developed and emerging economies. Moreover, there is a differential influence of governance on earnings prediction for banks depending on their sizes (Mollah et al., 2019). Following Balasubramnian et al. (2019), the book-to-market (B/M) ratio is identified as an effective indicator to predict bank future earnings. A high B/M ratio, therefore, may lead to weaker and more volatile bank future earnings. The findings of this study also indicate a significantly negative relationship between the B/M ratio and ROA for up to seven quarters. Covering the sample period from 2003 to 2014, the results are robust and consistent before, during and after the 2008 financial crisis period (Balasubramnian et al., 2019). Using a sample of bank holding companies, Brian et al. (2016) contribute to the ongoing debate about the early warning system for bank performance by investigating how fair value could predict bank future profitability. The findings suggest that fair value can predict future bank earnings both one and two years ahead. The results are robust to various tests and alternative measures of performance (Brian et al., 2016).

Over the years, regulators, supervisors and investors of banks have been more interested in the profitability of banks than others equally important aspects of the banking system and this is strongly reflected within the literature as many studies acknowledge the various determinants of bank profitability (e.g. Shaban and James, 2018; Athanasoglou et al., 2008; Molyneux and Thornton, 1992; Bourke, 1989). Whilst some studies focus on the global banking system, others report on the banking system of individual countries. The drivers of bank profitability are separated into internal and external groups.

With respect to internal determinants, a considerable amount of literature pays a great deal of attention to the effects of NPL and LLR on a bank's profitability. An increase in NPL negatively impacts on a bank's assets, and subsequently influences its return directly. According to Berger et al. (1997), there is a link between problem loans and cost efficiency in commercial banks, which in

turn affects profitability. Remarkably, not only NPL but LLR also have a direct influence on bank profit (Bouvatier and Lepetit, 2008). A rise in LLR reduces both reported net income and the transfer to retained earnings (Wall and Koch, 2000). Furthermore, LLR are negatively related to future earnings and signal information about the prospects of future earnings (Ahmed et al., 1999). Consequently, provisions for loan losses are considered as the most crucial determinants affecting bank profitability (Walter, 1991).

There has a link between LLR and LLP in terms of accounting policies. Loan loss reserves - LLR (also known as reserves for loan losses) are set up through loan loss provisions (LLP) to deal with the expected losses imbedded in the loan portfolios (Pérez et al., 2008). At the end of accounting period, the probable value of the loan losses in banks' existing loan portfolios is identified and LLP reflect the amount. In addition, LLP are supposed as an expense category that show up on the income statement, then recorded on the balance sheet as LLR additions. Existing studies in the literature indicate that banks make LLP with the aim of covering expected future losses on loans in their portfolio (Bouvatier and Lepetit, 2008; Anandarajan et al., 2005; Ahmed et al., 1999). According to Hasan and Wall (2004), in accounting terms, LLR appear on the asset side of the balance sheet as a decline in the value of the outstanding loans. LLR, therefore, rises by an amount equivalent to LLP (Hasan and Wall, 2004; Walter, 1991). In Vietnam, there are specific and general provisions with requirements set by the SBV in terms of assets classification and provisioning rules. The detailed regulatory framework for asset classification and loan loss provisions distinguishes between specific and general provisions. A fifth category of provisions has been regulated indicating the provisioning rates for each group as follows: Group 1 – 5%; Group 2 – 5%; Group 3 – 20%; Group 4 – 50% and Group 5 – 100%. Vietnamese commercial banks are required to maintain a general provision of 0.75% of total outstanding balance of loans and advances to customers (which are classified into Group 1 to 4 in Appendix A).

Apart from NPL and LRR, several existing studies report that other bank-specific factors such as banks' size, capital, credit risk, liquidity and ownership can affect bank profitability. For example, banks' size is used to capture the existence of economies of scale (Shaban and James, 2018;

Athanasoglou et al., 2008; Goddard et al., 2004; Short, 1979) and the results are mixed. First of all, a positive and significant association between banks' size and profitability is documented in the study of Smirlock (1985) and similarly, the finding of Shaban and James (2018) denotes that larger banks are related to higher ROE or more profitability. In addition, Flamini et al. (2009) study the determinants of bank profitability in Sub-Saharan Africa (SSA) and find that there is a positive association between ROA and banks' size. Conversely, García-Meca et al. (2015) employ an international sample of 159 banks in nine countries (Canada, France, Germany, Italy, the Netherlands, Spain, Sweden, the UK, and the US) covering the period between 2004 and 2010 and indicate the negative relationship between banks' size and the return on assets (ROA). Unexpectedly, both Athanasoglou et al. (2008) and Goddard et al. (2004) provide no evidence of the relationship between size and performance of banks with respect to economies of scale in the banking sector.

A considerable amount of research identifies capital as an important determinant of profitability based on the data from cross-countries as well as a single economy. Following Berger and Bouwman (2013), capital is captured by the ratio of equity capital to total assets. They explore the link between capital and bank performance in the US during the financial crisis as well as. The banking and market crises, and normal banking times with no crisis are included in the sample period from 1984 to 2010. Generally, the finding from their analysis shows that capital increases bank profitability. However, its effect on the profitability of small banks differs from medium and large banks. Firstly, capital improves small bank performance at all times. Secondly, regarding the performance of medium and large banks in the US, capital only shows significant impact during banking crises. According to Goddard et al. (2004), cross-sectional, pooled cross-sectional time-series and dynamic panel models are applied to identify the determinants of profitability. Their empirical analysis reports that there is a significantly positive effect of the capital-assets ratio on profit in European banks. In a similar way, Athanasoglou et al. (2008) also report the significantly positive influence of capital on profitability in Greek banks and according to the authors, this could

be indicative of the sound financial condition in the country. Likewise, the earlier empirical result of Berger (1995) also confirms a statistically positive relationship between capital and earnings in the US banking system and further proposes that an increase in capital could therefore be followed by a rise in earnings.

Recently, many articles have drawn much attention to examining the relationship between bank ownership and performance. Focusing on the impact of ownership change on bank performance in Indonesia from 2005 to 2012, Shaban and James (2018) mention that the profit of state-owned banks tends to be less than private and foreign banks in this developing economy. To a transition country like China, Jiang et al. (2013) firstly argue that the ownership of banks matter to the performance of banks. Following their regression, the performance of private commercial banks has also been shown to be significantly higher than state-owned commercial banks. Secondly, bank performance in the transitional economy is improved by privatization in both short and long terms. Adopting a large sample of 16 Far East countries observed from 1989 to 2004, the study of Cornett et al. (2010) explores how state ownership involves the change in bank performance around the Asian financial crisis. They clarify that stated-owned banks make less profit compared to privately-owned banks. Additionally, there are significant differences in performance in countries with more government involvement and political corruption in the banking system. Similarly, Micco et al. (2007) examine how bank ownership influences bank performance and consider the impact of politics on the relationship between bank ownership and performance in 179 countries including developing and industrial countries. Their findings imply a strong link between ownership and performance for banks in developing countries. Moreover, the profitability of state-owned banks in these countries tends to be lower. Whilst the aforementioned findings constrast the finding of Bourke (1989), Molyneux and Thornton (1992) find a statistically significant positive link between state-owned banks and performance. That mentioned, Athanasoglou et al. (2008) clarify that the ownership status is irrelevant for explaining banks' performance.

Bank expenses are documented in the study of Athanasoglou et al. (2008); Molyneux and Thornton (1992) and Bourke (1989) as crucial factors of bank profitability. To the Greek banking

system case, the findings of Athanasoglou et al. (2008) suggests a negative impact of operating expenses on performance because of the lack of ability in expenses management. In contrast, Molyneux and Thornton (1992) state the strong positive relationship between expenses and profitability.

Liquidity ratio is a variable included in a profit function of most early research into the factors affecting bank performance. The bank profit study of Goddard et al. (2004) uses liquidity ratio as a proxy for risk that could influence a bank's overall performance. The negative coefficient of liquidity ratio in their estimation result suggests that banks involved in riskier activities tend to get higher profits. In line with Goddard et al. (2004), Bourke (1989) denotes the positive association between liquidity level and profitability. On the contrary, the loans to deposits ratio considered as a measure of bank liquidity in the study of Molyneux and Thornton (1992) becomes statistical negative and as expected, the ratio also represents an expense to banks and could make banks less profitable.

Turning to external determinants of bank profitability, an extensive literature has directed the attention toward macroeconomic conditions. The variables normally employed as control factors in empirical studies are the inflation rate, interest rate, growth rate of money supply, and the GDP growth. Interest rates is a proxy of capital scarcity in order to investigate the determinants of bank profitability (Molyneux and Thornton, 1992; Bourke, 1989; Short, 1979). There is clear evidence of its positive impact on bank performance and interest rates (Molyneux and Thornton, 1992; Bourke, 1989).

The relationship between inflation rate and profitability is discussed in a vast range of studies. Applying a Generalized Method of moments (GMM) technique to a panel of Greek banks spanning from 1985 to 2001, Athanasoglou et al. (2008) confirm the positive and significant effect of inflation on the profits in the banking sector. In line with this result, the positive association between inflation and profitability is shown in the previous analysis of Molyneux and Thornton (1992) and Bourke (1989). In contrast, the coefficient of inflation is positive but insignificant in the analysis of

Albertazzi and Gambacorta (2009) who use data for 10 industrialized countries covering the period between 1981 and 2003 (Austria, Belgium, France, Germany, Italy, the Netherlands, Portugal, Spain, United Kingdom and United States).

Recently, the GDP growth rate has become an important element in most studies of bank performance and according to Albertazzi and Gambacorta (2009), it positively affects ROE. The annual growth rate of GDP is used as a macroeconomic indicator in previous studies which report its positive relationship with bank profitability (Demirguc-Kunt and Huizing, 2002).

Using a simple linear equation to estimate the impacts of determinants on bank profitability, both Molyneux and Thornton (1992) and Bourke (1989) employ annual growth in money supply to capture market growth in their models. Accordingly, the result of Bourke (1989) suggests the positive influence of money supply growth rate on profit however, there are no evidence of this relationship in the study of Molyneux and Thornton (1992).

Overall, the empirical studies in the existing literature identity several determinants of bank profitability. The clear evidence provided supports the significant impacts of both bank-specific and macroeconomic characteristics on bank profitability. Therefore, our study differs from previous research in that it is the first analysis to investigate the link between NPL and expected NPL as a factor affecting bank profitability. It also examines whether the NPL_{it} to LLR_{it-1} ratio can serve as early warning indicators for bank future earnings.

3.3 Data and Methodology

3.3.1 Variables and Data

Variables

The variables used in this analysis and their measure are listed in Table 3-2 as follows:

Table 3-2 Definition of variables

Variable	**Definition**
Dependent variable	
Profitability	$\mathrm{ROE}_{it+1} = \frac{\text{Net income}_{it+1}}{\text{Total equity}_{it+1}}$
	$\mathrm{ROA}_{it+1} = \frac{\text{Net income}_{it+1}}{\text{Total assets}_{it+1}}$
Main variable	
$\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$	$\frac{\text{Non} - \text{performing loans}_{it}}{\text{Loan loss reserves}_{it-1}}$
Control variables	
Capital	$\frac{\text{Total equity}_{it}}{\text{Total assets}_{it}}$
Size	$\frac{\text{Total assets}_{it}}{\sum_{i=1}^{22} \text{Total assets}_{it}}$
Expenses management	$\frac{\text{Operating expenses}_{it}}{\text{Total assets}_{it}}$
Liquidity	$\frac{\text{Loans}_{it}}{\text{Deposits}_{it}}$
Ownership	equal to 1 if state-owned commercial banks equal to 0 otherwise
D_{GDP}	Market condition equals to 1 if an economic boom equals to 0 otherwise
D_{Ratio}	equals to 1 if $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}} \geq 1$ equals to 0 otherwise
Real interest rate	$\text{Lending interest rate adjusted for inflation}_t$
Inflation	$\text{Inflation as measured by the consumer price index}_t$
Money supply	$\text{Annual broad money growth}_t\ (\mathrm{M}_2)$
GDP	$\text{Annual GDP growth}_t$

Source: Author's own list

Dependent variable

Following existing literature, a bank's profitability in this chapter could be represented by the return on equity (ROE) (Berger and Bouwman, 2013; Berger et al., 2005). ROE, therefore, reflects the return to shareholders on their equity. It is a direct evaluation of the financial return of a shareholder's investment and the sign of the ability that a bank's profit could be generated from its equity (ECB, 2010). Also, ROE neglects the risks linked with financial leverage and this is likely considered as the most pivotal indicator of a bank's profitability. In addition, the alternative measure used to obtain estimation result is the return on assets (ROA) (e.g. Shaban and James, 2018; Micco et al., 2007).

Main independent variable

As previously mentioned in section 3.1, the ratio of NPL_{it} to LLR_{it-1} is considered as the main variable in the model and to predict the future earnings of Vietnamese banks, this chapter employs the aggregated value of NPL at the current year (at time t) and LLR at the previous year (at time t-1).

Control variables

Additionally, apart from the main determinant suggested in the model, there could be other factors affecting a bank's future profitability. Therefore, to avoid a potential omitted variables problem, the predicted profitability regression consists a set of control variables.

Firstly, a bank must fulfil minimum capital requirements in accordance with its activities and consequently could influence a bank's earnings. Thus, capital is included and measured by the ratio of total equity to total assets (Berger and Bouwman, 2013). A bank with a higher capital ratio is more likely to enhance its profitability in the next period (Athanasoglou et al., 2008; Goddard et al., 2004). Furthermore, the size of a bank is proxied by the ratio between its total assets and all sample banks' total assets (Louzis et al., 2012). A bank size is expected to have a significant effect on the profitability (Shaban and James, 2018; García-Meca et al., 2015). The expenses management, liquidity and ownership are also accounted for in the model. Accordingly, a bank's expenses management is captured by the ratio of operating expenses over total assets (Athanasoglou et al., 2008). The liquidity is represented by loans over deposits and the binary value is used to denote the ownership status (Molyneux and Thornton, 1992).

Secondly, a bank's future profitability is potentially related to the macroeconomic situation and to account for the effects, inflation, money supply and GDP growth are controlled (Athanasoglou et al., 2008; Demirguc-Kunt and Huizing, 2002; Molyneux and Thornton, 1992; Bourke, 1989).

Finally, two other dummy variables are used in the empirical analysis to interact with the main independent variable. D_{GDP} captures the change in the growth of GDP in Vietnam denoting the market condition. A positive value of D_{GDP} implies an economic boom or otherwise. The current market condition is expected to have a marginal effect on the prediction of a bank's profitability by its interaction with the main independent variable. In addition, the value of main independent variable (D_{Ratio}) is included in the equations where it is clearly seen that there is an interaction between NPL_{it} and its expected value (LLR_{it-1}).[5] If a bank's LLR_{it-1} exceed its NPL_{it}, the value of the ratio of NPL_{it} to LLR_{it-1} will less than 1. In this case, the bank can absorb more losses than expected or the bank can provide a larger cushion for loan losses. The lower ratio likely reflects a bank's management desire to maintain a buffer in case a growth in loan losses occurs during the next period. A high level of LLR, however could lower the reported profitability of a bank (Lars and Anamaria, 2013). Conversely, if LLR_{it-1} are less than (or equals to) NPL_{it}, the bank's equity capital will reduce because low LLR_{it-1} are not able to cover large losses caused by NPL_{it}, then banks must use their capital to absorb the losses. More precisely, the value of the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$ affects both NPL and LLR. Also, this ratio fluctuates according to its actual value when banks modify LLR based on NPL. Thus, the analysis investigates the influence of D_{Ratio} on a bank's future profitability by interacting it with the main variable.

[5] Upon NPL_{it} and LLR_{it-1}, this value may be more than 1 or less than 1 or equal to 1.

Table 3-3 Scenarios for the expected sign of interactions

State	**Value**	$\frac{\text{NPL}_{\text{it}}}{\text{LLR}_{\text{it}-1}}$	**Expected sign of Interaction**	**Expected sign of future profitability**
D_{GDP}	greater than 0	↑	+	-
		↓	-	+
	equal or less than 0	↑	-	+
		↓	+	-
D_{Ratio}	equal or greater than 1	↑	+	-
		↓	-	+
	less than 1	↑	-	+
		↓	+	-

Source: Author's summary

Table 3-3 illustrates the possible scenarios when the main variable ($\frac{\text{NPL}_{it}}{\text{LLR}_{it-1}}$) interacts with the dummy variables identified detailed above. Firstly, in the case of the booming periods, banks' optimism about the prospects and investment projects of their customers may lead to lower credit standards. Consequently, the outbreak of NPL at time t will exceed its expected value denoting by LLR at time t-1 and result in an increase in the ratio $\frac{\text{NPL}_{it}}{\text{LLR}_{it-1}}$. The interaction between D_{GDP} and the ratio $\frac{\text{NPL}_{it}}{\text{LLR}_{it-1}}$ will be positive and the impact of this interaction on banks' future profit is expected to be negative. On the contrary, with the expansion of GDP, both firms and consumers could have a stream of revenues and income to fulfill the payments for their loans. NPL, therefore, could decrease and be considerably lower than its expected amount. Subsequently, the coefficient of the interaction between D_{GDP} and the ratio $\frac{\text{NPL}_{it}}{\text{LLR}_{it-1}}$ would be negative and the sign of bank future

profitability is expected to be positive. Hence, the effect of the ratio of NPL_{it} to LLR_{it-1} on banks' future profitability becomes stronger with the increase in the change of GDP growth. Secondly, in the downswing, in order to boost the economy, banks may have more incentives to loosen the standards of lending to borrowers. It could be followed with higher NPL in the current year (at time t) compared to LLR in the previous year (at time t-1) which indicate the expected losses. The increase in the ratio of NPL_{it} to LLR_{it-1} leads to the negative coefficient of the interaction between D_{GDP} and the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$ and the positive sign of bank future earnings. On the other hand, lending policies may be tighten with banks' prudent management during the economic downturn. In this case, the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$ could reduce. Hence, the profit of banks is predicted to drop in the next year (at time t+1).

In term of the interaction between D_{Ratio} and the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$, the scenarios are also clarified in Table 3-3. For example, if there is a rise in the ratio of NPL_{it} to LLR_{it-1} , the interaction would be positive. Banks' future profitability is expected to decline as the ratio of NPL_{it} to LLR_{it-1} increases. In other word, the negative influence of the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$ on banks' future profitability is predicted and it would be more powerful if the value of the ratio between NPL_{it} and LLR_{it-1} is greater than 1.[6]

[6] Other cases in Table 3-3 left are explained in a similar way.

Data

The data set is collected by combining the information from confidential various sources. It covers the sample of the 22 largest Vietnamese commercial banks over the 10-year period from 2008 to 2017. The further details of the data sources are given in Table 3-4 as follows:

Table 3-4 Data sources

Indicator	**Source**
Profitability	Fitch database Banks' annual reports
Bank - specific	
$\frac{\mathrm{NPL_t}}{\mathrm{LLR_{t-1}}}$	Fitch database Banks' annual reports
Capital	Fitch database Banks' annual reports
Size	Fitch database Banks' annual reports
Expenses management	Fitch database Banks' annual reports
Liquidity	Fitch database Banks' annual reports
Ownership	Banks' annual reports
Macroeconomic	
Real interest rate	World Bank – World Development Indicators
Inflation	World Bank – World Development Indicators
Money supply	World Bank – World Development Indicators
GDP	World Bank – World Development Indicators
Dummy	
D_{GDP}	World Bank – World Development Indicators
D_{Ratio}	Fitch database Banks' annual reports

Source: Author's own summary

The panel data for the 22 largest Vietnamese commercial banks are adopted in this empirical estimation to investigate whether bank future profitability is affected by the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$. Data covers the period from 2008 to 2017 and is gathered from several sources. The bank-specific data is obtained from both the Fitch database and hand-collected from annual reports of banks. Additionally, the real interest rates, inflation, money supply, and GDP growth data are retrieved from the World Bank.

Table 3-5 Descriptive statistics

Variables	**Obs.**	**Mean**	**Median**	**Std.Dev.**	**Min**	**Max**
Dependent variable						
Profitability* - $\mathrm{ROE}_{\mathrm{it+1}}$	219	10.98	10.5	6.99	0.9	25.2
Profitability*- $\mathrm{ROA}_{\mathrm{it+1}}$	219	0.98	0.88	0.60	0.06	2.11
Independent variables						
Main variable						
$\frac{\mathrm{NPL}_{\mathrm{it}}}{\mathrm{LLR}_{\mathrm{it-1}}}$	216	2.37	1.88	1.68	0.77	7.88
Control variables						
Capital*	220	10.01	8.55	4.52	5.2	21.25
Size*	220	4.49	2.72	4.63	0.51	16.06
Expenses management*	219	1.60	1.57	0.46	0.87	2.58
Liquidity	212	0.86	0.85	0.18	0.56	1.17
Ownership	220	0.14	0	0.34	0	1
D_{GDP}	220	0.5	0.5	0.50	0	1
D_{Ratio}	220	0.89	1	0.32	0	1
Real interest rate*	10	2.39	3.25	3.93	-5.62	7.32
Inflation*	10	8.57	6.82	6.71	0.88	23.12
Money supply*	10	20.13	20.22	5.34	11.94	29.71
GDP*	10	6.01	6.10	0.53	5.25	6.81

Note: Variables with an asterisk are in percentages.
Source: Author's calculation

The summary statistics of all variables for the analysis is presented in Table 3-5. The key variable in the estimation – the ratio $\frac{\text{NPL}_{it}}{\text{LLR}_{it-1}}$ has a mean of 2.37 and ranges from 0.77 to 7.88 denoting a large variation in this ratio. It is clearly seen that the average bank has the value of NPL in the current year is greater than the LLR in the previous year or its expected losses (see Figure 3-3). Similarly, ROE in the next year has a mean of 10.98 with a wide range of 0.9 to 25.2.

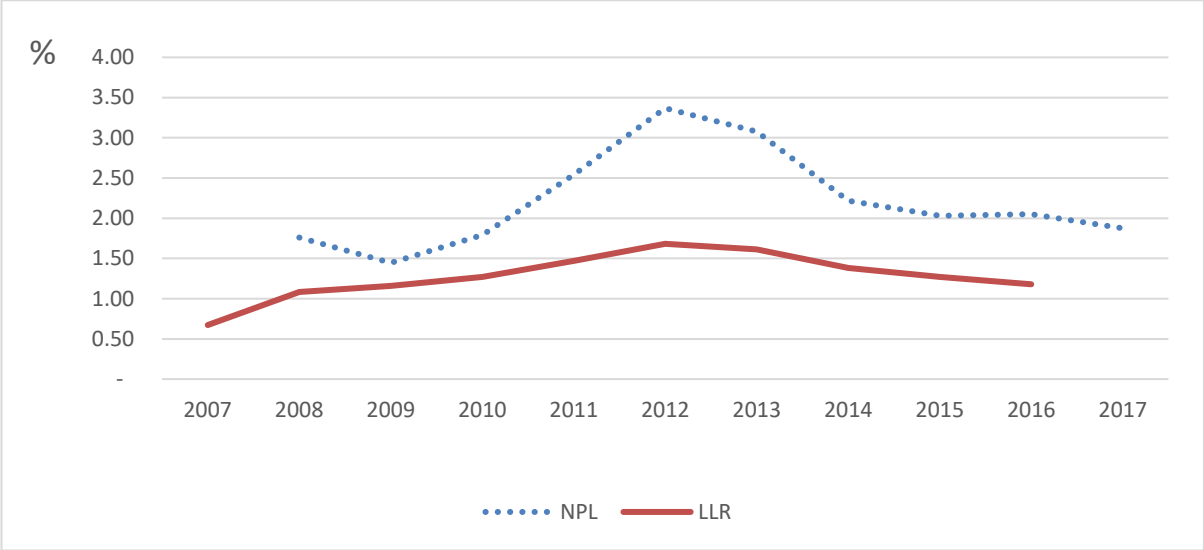

Figure 3-3 The average NPL and LLR in Vietnam for the periods 2008 – 2017 and 2007-2016 respectively

Source: Fitch database

3.3.2 Research Philosophy, Approach and Methods

A research philosophy comprises views and assumptions about how research should be conducted (Bryman and Bell, 2015). There are a number of types of assumptions including *epistemological assumptions, ontological assumptions and axiological assumptions* (Saunders, Lewis and Thornhill, 2016). These views and assumptions aslo shape the understanding of research questions, methodologies used and how to interpret the reseach findings (Saunders, Lewis and Thornhill, 2016; Bryman and Bell, 2015). In addition, the five major philosophies adpoted in business and management are *positivism*, *critical realism*, *interpretivism, postmodernism,* and *pragmatism* (Saunders, Lewis and Thornhill, 2016). In this chapter, positivism paradigm is applied by using existing theory to develop hypotheses and can be empirically investigated using researchers'

analysis tools rather than their values(Saunders, Lewis and Thornhill, 2016). The analysis focuses on assessing whether the ratio non-performing loans to loan loss reserves could provide a signal to bank future earnings within the Vietnamese banking sector.

To develop theory and conduct a research project, there are three main research approaches used including deduction, induction and abduction. It depends on the emphasis of a research to choose the best-suited approach (Saunders, Lewis and Thornhill, 2016). Deduction involves the development of a theory through the academic literature and a research strategy to test the theory (Saunders, Lewis and Thornhill, 2016). The deductive approach starts from pre-existing theory to develop hypotheses, and test those assumptions and, thus, it goes from general to the specific (Saunders, Lewis and Thornhill, 2016; Silverman, 2010). Conversely, the inductive approach moves from the particular to general, as researchers start from observations, and then look for patterns in the data, which can help generate new theories (Bryman and Bell, 2015; Flick, 2015). Using induction, the research starts by collecting data to investigate phenomenon, then generats a theory (Saunders, Lewis and Thornhill, 2016). Following Saunders, Lewis and Thornhill (2016), instead of moving from theory to data as in a deductive approach or data to theory as an inductive approach, abduction moves back and forth, or it is likely to combine deduction and induction. The abduction approach generates a new theory or modifies an existing one by using the interactions between the specific and the general (Saunders, Lewis and Thornhill, 2016). Based on the aims of these three approaches and their implications for research, this study implements the deductive approach. It is concerned with the need to investigate the casual relationships among variables in order to test hypotheses and, thus, generalise results rather than generate new theories (Saunders, Lewis and Thornhill, 2016).

Research strategies take three main forms, namely, quantitative, qualitative, and mixed methods. According to Bryman and Bell (2015), a quantitative research strategy highlights quantification in the collection and analysis of data. With quantitative methods, numeric data can

be effectively collected from a large number of respondents, measures using various quantitative techniques, such as questionnaires and apply a variety of statistical analysis tools in order to test the established hypotheses (Bryman, 2012; May, 2011). Qualitative methods, on the other hand, collect information using a descriptive and non-numerical approach such as interviews in order to examine the meaning of social phenomena, rather than causal relationships between variables (Feilzer, 2010; Berg, 2004). A qualitative research strategy mainly focuses on words rather than the data collection and data analysis (Bryman and Bell, 2015). Researchers have the choice to use either mono or multi-quantitative methods, or mono or multi-qualitative methods. The quantitative data required for empirical analysis can be categorised into three groups, cross sectional data, time series data, and Longitudinal or panel data. In cross-sectional data, variables from several entities are collected at the same point of time, while in time series data, variables from one entity are observed over a period of time. In panel data, on the other hand, variables from several entities are gathered over a period of time (Saunders, Lewis and Thornhill, 2016; Flick, 2015; Bryman, 2012; Greene, 2012; Gujarati, 2003). This study uses quantitative methods to collect panel data in order to investigate how the ratio of NPL_{it} to LLR_{it-1} could provide information to bank future profitability over a period of 10 years.

Endogeneity bias could lead to inconsistent and incorrect inferences resulting in misleading conclusions and inappropriate interpretations or the wrong sign of coefficients (Ullah eat al., 2018). The use of instrumental variables (IV) techniques is regarded as a common approach to address endogeneity issues. 2SLS estimation with instrumental variables includes two steps. In the first step, the endogenous explanatory variable is regressed on the instrumental variables and all exogenous variables in the main model. In the second step, the dependent variable is regressed on the predicted values of the endogenous independent variables from the first step (Gretz and Malshe, 2019; Wooldridge, 2010). Following Cornett et al. (2010), the two-stage least squares (2SLS) is employed for regression to address endogeneity identified in this chapter.

According to existing literature, there has been a tendency for bank profit to persist over time (Flamini et al., 2009; Athanasoglou et al., 2008; Goddard et al., 2004). Also, the study of

Goddard et al. (2004) confirms the significant persistence of bank profitability from one year to the next year. Consequently, a dynamic model is adopted by adding a lagged profitability as a regressor into the equations.

In order to capture the impact of market condition on future earnings, the interaction between the ratio $\frac{\text{NPL}_{it}}{\text{LLR}_{it-1}}$ and the dummy variable 'D_{GDP}' is included in the equation (3.1). The general model in this chapter is estimated as the following form:

$$Profitability_{it+1} = \alpha_1 + \alpha_2 Profitability_{it} + \alpha_3 \frac{NPL_{it}}{LLR_{it-1}} + \alpha_4 (\frac{NPL_{it}}{LLR_{it-1}} \times D_{GDP}) + \alpha_j X_{it} + \alpha_k X_t + \varepsilon_{it} \quad (3.1)$$

In equation (3.1), $Profitability_{it+1}$ denotes banks' future earnings measured by ROE; $Profitability_{it}$ is the profitability at time t; $\frac{\text{NPL}_{it}}{\text{LLR}_{it-1}}$ is the main variable; X_{it} is the large set of bank specific controls at time t (including Capital, Size, Expenses-management, Liquidity, Ownership) and X_t is the set of macroeconomic controls at time t (including Inflation, Money supply, GDP). The parameters to be estimated are $\alpha_1;\ \alpha_2;\ \alpha_3;\ \alpha_4;\ \alpha_j$ and α_k. ε_{it} is an error term.

Hypothesis 3.1: There is a negative impact of the NPL_{it} to LLR_{it-1} ratio on bank future profitability with the condition of this ratio on GDP growth.

Furthermore, to examine whether the value of the ratio $\frac{\text{NPL}_{it}}{\text{LLR}_{it-1}}$ affects bank performance in the next period, the interaction between the ratio $\frac{\text{NPL}_{it}}{\text{LLR}_{it-1}}$ and the dummy variable 'D_{Ratio}' is added in the equation (3.2) :

$$Profitability_{it+1} = \beta_1 + \beta_2 Profitability_{it} + \beta_3 \frac{NPL_{it}}{LLR_{it-1}} + \beta_4 (\frac{NPL_{it}}{LLR_{it-1}} \times D_{Ratio}) + \beta_j X_{it} + \beta_k X_t + \varepsilon_{it} \quad (3.2)$$

Where: $Profitability_{it+1}$ denotes banks' future earnings measured by ROE; $Profitability_{it}$ is the profitability in the current year; $\frac{\text{NPL}_{it}}{\text{LLR}_{it-1}}$ is the main variable; X_{it} is the large set of bank specific

controls at time t (including Capital, Size, Expenses-management, Liquidity, Ownership) and X_t is the set of macroeconomic controls at time t (including Inflation, Money supply, GDP). The parameters to be estimated are $\beta_1;\ \beta_2;\ \beta;\ \beta_4;\ \beta$ and β_k. ε_{it} is an error term.

Hypothesis 3.2: There is a negative impact of the NPL_{it} to LLR_{it-1} ratio on bank future profitability with the condition of this ratio on its value.

Endogeneity and Instrument variables

Following Athanasoglou et al. (2008), capital is better modelled as an endogenous variable. They argue that capital refers to the available amount a bank owns to support its business, as a consequence, an increase in capital could be able to raise expected earnings. On the other hand, a rise in earnings would help a bank increase the capital ratio. In other words, a bank's profitability could reversely cause its capital and have the impacts on capital. In this chapter, the lagged value of capital is employed as a valid instrument for the 2SLS estimation.

3.4 Results

3.4.1 Empirical Results

This subsection presents the 2SLS results to assess how the $\mathrm{NPL_{it}}$ to $\mathrm{LLR_{it-1}}$ ratio signal the future profitability of banks from 2008 to 2017. The main estimation results are based on the R^2 and log likelihood values demonstrating the goodness of fit.

We present the main results in Table 3-6 for the 2SLS regression of future eanings of banks on its lagged value, the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$, the interaction between the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$ and a dummy variable, and bank-specific and macroeconomic control variables. As highlighted in Section 3.3.1, the interaction between the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$ and D_{GDP} is included in Setup (1) of Table 3-6 while Setup (2) of Table 3-6 consists of the interaction between the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$ and D_{Ratio}.

Table 3-6 Empirical results

Explanatory variable	**2SLS**[7]	
	Dependent variable ROE_{it+1}	
	(1)	**(2)**
$\frac{\mathrm{NPL_{it}}}{\mathrm{LLR_{it-1}}}$	**-0.697****	**-0.373***
	(-2.21)	*(-1.83)*
$\frac{\mathrm{NPL_{it}}}{\mathrm{LLR_{it-1}}}$ x D_{GDP}	0.709	
	(1.42)	
$\frac{\mathrm{NPL_{it}}}{\mathrm{LLR_{it-1}}}$ x D_{Ratio}		0.273
		(0.29)
$\mathrm{ROE_{it}}$	**0.831*****	**0.825*****
	(19.92)	*(18.93)*
$\mathrm{Capital_{it}}$	-0.0742	-0.076
	(-0.42)	*(-0.42)*
$\mathrm{Size_{it}}$	-0.134	-0.124
	(-1.51)	*(-1.35)*
$\mathrm{Expenses-management_{it}}$	1.108	1.144
	(1.57)	*(1.59)*
$\mathrm{Liquidity_{it}}$	2.359	2.658
	(1.13)	*(1.24)*
$\mathrm{Ownership_{it}}$	1.231	1.072
	(1.29)	*(1.02)*
$\mathrm{Inflation_{t}}$	**-0.246*****	**-0.254****
	(-2.64)	*(-2.41)*
$\mathrm{Money\ supply_{t}}$	0.257	0.227
	(1.51)	*(1.31)*
$\mathrm{GDP_{t}}$	**2.503****	**2.216****
	(2.44)	*(1.99)*
Constant	**-17.52****	**-16.33***
	(-2.02)	*(-1.83)*
No. of Obs.	*190*	*190*
R^2	*0.6739*	*0.6692*
Wald χ^2	*1009.06*	*831.32*
Log likelihood	*-504.53*	*-415.66*

Note: t statistics in parentheses

*, **, *** denote significance at 10%, 5%, 1% respectively

[7] The results of first-stage estimations are shown in Appendix C

Column (1) of Table 3-6 shows the statistical association between the $\mathrm{NPL}_{\mathrm{it}}$ to $\mathrm{LLR}_{\mathrm{it}-1}$ ratio and banks' future earnings and as expected, this ratio is negatively linked with $\mathrm{ROE}_{\mathrm{it}+1}$. This connotes that a decrease in the $\mathrm{NPL}_{\mathrm{it}}$ to $\mathrm{LLR}_{\mathrm{it}-1}$ ratio could increase banks' future profitability.

Table 3-7 Scenarios for the changes in the $\mathrm{NPL}_{\mathrm{it}}$ to $\mathrm{LLR}_{\mathrm{it}-1}$ ratio

No.	Change in NPL_{it} (ΔNPL)	Change in LLR_{it-1} (ΔLLR)	Assumption	Direction of the change in the ratio $\Delta(\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}})$
1.	≥ 0	> 0	$\lvert\Delta NPL\rvert < \lvert\Delta LLR\rvert$	↓
2.	< 0	≤ 0	$\lvert\Delta NPL\rvert > \lvert\Delta LLR\rvert$	↓
3.	< 0	> 0	$\lvert\Delta NPL\rvert = \lvert\Delta LLR\rvert$	↓
			$\lvert\Delta NPL\rvert > \lvert\Delta LLR\rvert$	
			$\lvert\Delta NPL\rvert < \lvert\Delta LLR\rvert$	
4.	≤ 0	< 0	$\lvert\Delta NPL\rvert < \lvert\Delta LLR\rvert$	↑
5.	> 0	≥ 0	$\lvert\Delta NPL\rvert > \lvert\Delta LLR\rvert$	↑
6.	> 0	< 0	$\lvert\Delta NPL\rvert = \lvert\Delta LLR\rvert$	↑
			$\lvert\Delta NPL\rvert > \lvert\Delta LLR\rvert$	
			$\lvert\Delta NPL\rvert < \lvert\Delta LLR\rvert$	
7.	> 0	> 0	$\lvert\Delta NPL\rvert = \lvert\Delta LLR\rvert$	unchanged
8.	< 0	< 0	$\lvert\Delta NPL\rvert = \lvert\Delta LLR\rvert$	unchanged

Source: The summary created specifically for this chapter by the author[8]

[8] This study has not discussed in detail about mathematical formula

As discussed in Section 3.1, there have been no studies employing the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$ to predict banks' earnings so far. This analysis, therefore, gives a clear explanation of how this ratio changes and all scenarios are illustrated in Table 3-7. As can be seen from Table 3-7, a decrease (rise) in the the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$ caused by changes in both $\mathrm{NPL_{it}}$ and $\mathrm{LLR_{it-1}}$. For example, to the first case of Table 3-7, if there is an increase in both NPL at time t and LLP at the previous year (t-1) and the absolute value of the change in $\mathrm{NPL_{it}}$ is less than this value of $\mathrm{LLR_{it-1}}$, the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$ will decrease. The directions of the change in the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$ in the rest of Table 3-7 are similarly explained.

Interestingly, the impact of the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$ on a bank's future earnings tends to be higher if the economic condition is improved or there is an increase in the GDP growth. Overall, the finding shows that the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$, which is conditional on a large set of controls and the market condition, is informative about the future profitability of banks. It supports the hypothesis 3.1 suggested in Section 3.3.2. The result indicates that the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$ is effective as a signal indicator for banks to predict their profitability in the next period in the strong economy. With the negative relationship between the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$ and the future earnings of banks found in the analysis, bank managers and investors would prefer the scenarios 1-3 illustrated in Table 3-7 which indicate the decrease in the $\mathrm{NPL_{it}}$ to $\mathrm{LLR_{it-1}}$ ratio. Hence, to boost bank's profitability in the future, both $\mathrm{NPL_{it}}$ and $\mathrm{LLR_{it-1}}$ are expected as follows: i). $\mathrm{NPL_{it}}$ remains either unchanged or increases and $\mathrm{LLR_{it-1}}$ rises but the change in $\mathrm{NPL_{it}}$ is less than the change in $\mathrm{LLR_{it-1}}$; ii). $\mathrm{NPL_{it}}$ declines and $\mathrm{LLR_{it-1}}$ remains unchanged or decreases but the change in $\mathrm{NPL_{it}}$ is more than the change in $\mathrm{LLR_{it-1}}$; iii). Both $\mathrm{NPL_{it}}$ decreases and $\mathrm{LLR_{it-1}}$ increases. To offset future losses on outstanding loans (also known as credit risk), a bank identifies a loss on the loan ahead of time and estimates the expected future loss on the loan and sets aside a corresponding reserve. Periodically, the bank's managers decide how much to add to the LLR account, and charge this amount against the bank's current earnings. LLL are recorded as an expense item on the bank's income statement (Balla et al., 2012). Based on

these cases (see No.1-3 in Table 3), to lower the ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$, banks are likely to adopt a cautious approach to build more reserves prior to future losses. There is a temporary trade-off between LLR and profit of banks since more LLR potentially create a greater reduction of bank earnings. From a prudential perspective, however, LLR enable banks to sustain loan losses for ensuring safety, soundness, thereby improving their future profitability.

Furthermore, among the bank level control factors, the previous value of the profitability has a significantly positive influence on its future value. Generally, it is commonly known that higher profits in the previous encourage a rise in the future performance of banks. This result is compatible with the findings documented in existing literature (e.g. Flamini et al., 2009; Athanasoglou et al., 2008; Goddard et al., 2004). The highly significant coefficient of the lagged profitability variable is presented in the study of Athanasoglou et al. (2008) to confirm that profits seem to persist in the Greek banking sector. Also, the earlier findings of Goddard et al. (2004) gives a demonstration of the way in which the statistical evidence for the persistence of profits of European banks from one year to the next. Regarding the impacts of macroeconomic determinants, inflation and GDP growth perform the significant results. The negative coefficient of inflation rate signifies that the macroeconomic instability could have a contrary impact on banks' profitability in the next period. Conversely, economic growth proxied by GDP growth positively affects banks future earnings. In a developing ecomomy with a high GDP growth, Vietnamese commercical banks tend to lend more and this enables them to achieve a better profit margin. This finding is in line with the studies of Albertazzi and Gambacorta (2009) and Demirguc-Kunt and Huizing (2002) that state the positive association between bank profitability and GDP.

Referring to the result in the Setup (2) of Table 3-6, the effects of current profitability, inflation and GDP growth accord with the findings in the first estimation. Turning to the impact of the main variable, there is a weak evidence that the $\mathrm{NPL}_{\mathrm{it}}$ to $\mathrm{LLR}_{\mathrm{it}-1}$ ratio provides information about future earnings for Vietnamese commercial banks on the condition of the ratio value.

3.4.2 Robustness Checks

A few additional tests have been conducted to confirm the robustness and consistency of the above empirical results. The first test to confirm the robustness and consistency of the results has been done by using real interest rate as a macroeconomic control variable in the analysis. The real inteterst rates are measured by lending interest rate adjusted for inflation. It leads to the multicollinearity between real interest rate and inflation rate in term of macroeconomic effects. Therefore, using the same methodology presented in the previous section, other estimations that control for the real interest rate instead of the inflation rate are carried out. The ratio $\frac{\mathrm{NPL}_{it}}{\mathrm{LLR}_{it-1}}$ is found to be have a robust link with the future earnings. The results also perform the strong association in the upswing period but it is weak on the condition of the ratio value. As can be seen from Table 3-8, the results are consistent for all control variables, except for the size of banks.

Table 3-8 Robustness check (Replace Inflation by Real interest rate)

Explanatory variable	**2SLS**	
	Dependent variable ROE_{it+1}	
	(3)	**(4)**
$\frac{\text{NPL}_{\text{it}}}{\text{LLR}_{\text{it}-1}}$	**-0.684****	**-0.366***
	(-2.15)	*(-1.78)*
$\frac{\text{NPL}_{\text{it}}}{\text{LLR}_{\text{it}-1}}$ x D_{GDP}	0.696	
	(1.40)	
$\frac{\text{NPL}_{\text{it}}}{\text{LLR}_{\text{it}-1}}$ x D_{Ratio}		0.210
		(0.22)
ROE_{it}	**0.829*****	**0.824*****
	(19.13)	*(18.63)*
$\text{Capital}_{\text{it}}$	-0.106	-0.108
	(-0.63)	*(-0.63)*
Size_{it}	**-0.173****	**-0.165****
	(-2.23)	*(-2.05)*
$\text{Expenses} - \text{management}_{\text{it}}$	1.161	1.199
	(1.60)	*(1.62)*
$\text{Liquidity}_{\text{it}}$	2.449	2.727
	(1.20)	*(1.29)*
$\text{Ownership}_{\text{it}}$	1.599	1.463
	(1.64)	*(1.41)*
$\text{Real interest rate}_{\text{t}}$	**0.318*****	**0.329****
	(2.73)	*(2.51)*
$\text{Money supply}_{\text{t}}$	**0.358****	**0.333****
	(2.54)	*(2.33)*
GDP_{t}	**3.733*****	**3.497*****
	(4.68)	*(4.40)*
Constant	**-29.35*****	**-28.59*****
	(-4.35)	*(-4.43)*
No. of Obs.	*190*	*190*
R^2	*0.6735*	*0.6689*
Wald χ^2	*1047.65*	*892.12*
Log likelihood	*-523.825*	*-446.06*

Note: t statistics in parentheses

*, **, *** denote significance at 10%, 5%, 1% respectively

Next, the results of the second robustness test are shown in Table 3-9. Using ROE to capture a bank's profitability could give the misleading results. Hence, in this analysis, the different bank future profitability measure is employed by ROA instead of ROE. Overall, the Table 3-9 gives consistent evidence that the NPL_{it} to LLR_{it-1} ratio has a negative impact on ROA in the next period. This influence becomes statistically and significantly strong in the economic growth period.

Table 3-9 Robustness check by using ROA as a proxy of profitability

Explanatory variable	**2SLS**			
	Dependent variable ROA_{it+1}			
	(1)	**(2)**	**(3)**	**(4)**
$\frac{NPL_{it}}{LLR_{it-1}}$	**-0.0644****	**-0.0638****	-0.0285	-0.0282
	(-2.04)	*(-2.01)*	*(-1.37)*	*(-1.35)*
$\frac{NPL_{it}}{LLR_{it-1}}$ x D_{GDP}	0.0788	0.0781		
	(1.61)	*(1.60)*		
$\frac{NPL_{it}}{LLR_{it-1}}$ x D_{Ratio}			-0.00292	-0.00653
			(-0.05)	*(-0.11)*
ROA_{it}	**0.814*****	**0.812*****	**0.799*****	**0.798*****
	(15.43)	*(14.70)*	*(15.57)*	*(15.09)*
$Capital_{it}$	-0.0144	-0.0160	-0.0137	-0.0153
	(-1.13)	*(-1.29)*	*(-1.05)*	*(-1.20)*
$Size_{it}$	**-0.0117***	**-0.0140****	**-0.0111***	**-0.0132****
	(-1.85)	*(-2.54)*	*(-1.68)*	*(-2.34)*
$Expenses - management_{it}$	**0.182****	**0.185****	**0.186****	**0.189****
	(2.14)	*(2.14)*	*(2.09)*	*(2.09)*
$Liquidity_{it}$	0.173	0.177	0.199	0.201
	(1.12)	*(1.14)*	*(1.26)*	*(1.26)*
$Ownership_{it}$	0.0831	0.105	0.0758	0.0971
	(0.96)	*(1.23)*	*(0.81)*	*(1.07)*
Real interest $rate_t$		0.0156		0.0153
		(1.57)		*(1.38)*
Money $supply_t$	**0.0202***	**0.0258*****	0.0184	**0.0239****
	(1.67)	*(2.60)*	*(1.44)*	*(2.33)*
GDP_t	**0.255*****	**0.321*****	**0.238****	**0.302*****
	(2.92)	*(4.66)*	*(2.44)*	*(4.24)*
$Inflation_t$	-0.0127		-0.0123	
	(-1.64)		*(-1.43)*	
Constant	**-1.811*****	**-2.440*****	**-1.791****	**-2.404*****
	(-2.76)	*(-4.95)*	*(-2.48)*	*(-4.72)*
No. of Obs.	*190*	*190*	*190*	*190*
R^2	*0.6453*	*0.6436*	*0.6365*	*0.6351*
Wald χ^2	*1122.83*	*1183.90*	*975.30*	*1085.01*
Log likelihood	*-561.42*	*-591.95*	*-487.65*	*-542.51*

Note: t statistics in parentheses

*, **, *** denote significance at 10%, 5%, 1% respectively

Lastly, relying on the only one methodology the results could not perform strong enough. Thus, following the recent study of Balasubramnian et al. (2019), a Multivariate regression is used in the additional test as the second method to support the robustness of our main findings.

Table 3-10 Robustness check by using multivariate regression

Explanatory variable	**MULTIVARIATE REGRESSION**							
	Dependent variable ROE_{it+1}		**Dependent variable** ROA_{it+1}		**Dependent variable** ROE_{it+1}		**Dependent variable** ROA_{it+1}	
	(5)	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
$\frac{NPL_{it}}{LLR_{it-1}}$	**-0.671****	**-0.681****	**-0.0637****	**-0.0644****	-0.356	-0.362	-0.0284	-0.0286
	(-2.28)	*(-2.32)*	*(-2.48)*	*(-2.51)*	*(-1.60)*	*(-1.63)*	*(-1.46)*	*(-1.47)*
$\frac{NPL_{it}}{LLR_{it-1}}$ x D_{GDP}	0.689	0.700	**0.0775****	**0.0784****				
	(1.62)	*(1.65)*	*(2.08)*	*(2.11)*				
$\frac{NPL_{it}}{LLR_{it-1}}$ x D_{Ratio}					0.228	0.276	-0.00758	-0.00340
					(0.35)	*(0.43)*	*(-0.13)*	*(-0.06)*
ROE_{it}	**0.814*****	**0.812*****			**0.808*****	**0.806*****		
	(15.07)	*(15.21)*			*(14.89)*	*(15.02)*		
ROA_{it}			**0.807*****	**0.811*****			**0.794*****	**0.797*****
			(14.59)	*(14.75)*			*(14.27)*	*(14.42)*
$Capital_{it}$	**-0.214****	**-0.196****	-0.0114	-0.0101	**-0.218****	**-0.200****	-0.0110	-0.00980
	(-2.37)	*(-2.14)*	*(-1.48)*	*(-1.30)*	*(-2.40)*	*(-2.16)*	*(-1.42)*	*(-1.25)*
$Size_{it}$	**-0.199*****	**-0.170****	**-0.0128****	**-0.0105***	**-0.191*****	**-0.161****	**-0.0122****	-0.00994
	(-2.98)	*(-2.34)*	*(-2.20)*	*(-1.65)*	*(-2.84)*	*(-2.19)*	*(-2.06)*	*(-1.54)*
Expenses $-$ $management_{it}$	**1.329***	**1.300***	**0.179*****	**0.177*****	**1.368***	**1.339***	**0.184*****	**0.181*****
	(1.88)	*(1.84)*	*(2.93)*	*(2.90)*	*(1.93)*	*(1.88)*	*(2.96)*	*(2.93)*
$Liquidity_{it}$	3.168	3.131	0.150	0.150	**3.460***	**3.440***	0.175	0.177
	(1.60)	*(1.59)*	*(0.86)*	*(0.86)*	*(1.73)*	*(1.72)*	*(0.99)*	*(1.00)*
$Ownership_{it}$	1.547	1.260	0.110	0.0853	1.406	1.101	0.102	0.0780
	(1.24)	*(0.98)*	*(1.02)*	*(0.77)*	*(1.11)*	*(0.84)*	*(0.93)*	*(0.68)*
Real interest $rate_t$	**0.279****		0.0162		**0.289****		0.0158	
	(2.21)		*(1.45)*		*(2.24)*		*(1.38)*	
Money $supply_t$	**0.414*****	**0.337****	**0.0238****	0.0178	**0.389*****	**0.309****	**0.0221***	0.0163
	(3.12)	*(2.25)*	*(2.04)*	*(1.35)*	*(2.91)*	*(2.03)*	*(1.86)*	*(1.20)*
GDP_t	**3.976*****	**2.984****	**0.313*****	**0.242****	**3.742*****	**2.705****	**0.295*****	**0.226***
	(3.70)	*(2.30)*	*(3.34)*	*(2.13)*	*(3.44)*	*(2.04)*	*(3.10)*	*(1.94)*
$Inflation_t$		**-0.207****		**-0.0134***		**-0.215****		-0.0130
		(-2.33)		*(-1.70)*		*(-2.36)*		*(-1.60)*
Constant	**-31.31*****	**-21.65****	**-2.369*****	**-1.701***	**-30.56*****	**-20.52***	**-2.340*****	**-1.693***
	(-3.80)	*(-2.09)*	*(-3.28)*	*(-1.86)*	*(-3.66)*	*(-1.94)*	*(-3.19)*	*(-1.81)*
No. of Obs.	*190*	*190*	*190*	*190*	*190*	*190*	*190*	*190*
R^2	*0.6769*	*0.6779*	*0.6442*	*0.6457*	*0.6723*	*0.6733*	*0.6356*	*0.6369*
RMSE	*4.0196*	*4.0132*	*0.3509*	*0.3501*	*4.0478*	*4.0418*	*0.3551*	*0.3544*

Note: t statistics in parentheses

*, **, *** denote significance at 10%, 5%, 1% respectively

3.5 Conclusion

In this chapter, an empirical framework is carried out to investigate the effect of the ratio between NPL and LLR on the profitability of Vietnamese commercial banks. Using a data set covering the period from 2008 to 2017, the analysis clarifies whether the ratio between NPL in the current year (NPL_{it}) and (LLR_{it-1}) in the previous year could signal information about a bank's profitability in the future. Overall, these empirical results provide evidence that Vietnamese commercial banks with a low NPL_{it} to LLR_{it-1} ratio have stronger future earnings. The impact of the ratio on a bank's potential profitability becomes more statistically significant and sensitive in periods of strong economic performance. Accordingly, the empirical analysis supports hypothesis 3.1 which is discussed in Section 3.3.2 (i.e. *There is a negative impact of the NPL_{it} to LLR_{it-1} ratio on bank future profitability with the condition of this ratio on GDP growth*). The results of the analysis are robust when we control various bank-level and macroeconomic variables and the models are re-run with a Multivariate regression. The present finding provides bank regulators, policy-makers and investors with useful insights. With the assumption, for the Vietnamese commercial banking sector, the interaction between NPL in the current year and LLR in the previous year captured by the NPL_{it} to LLR_{it-1} ratio could indicate a forward-looking signal for the prediction of bank profits. Based on the finding, the credit risk management by using a LLR strategy to absorb the expected loan losses should enhance to ensure profitability and maintain financial stability. Additionally, an improvement in the economic environment influences the prospect of a bank's future earnings. Importantly, the NPL_{it} to LLR_{it-1} ratio may likely helps to predict problems in the banking sector. This ratio, therefore, can provide sound useful information to include in the advance warning model of a bank's future performance. However, to have a better understanding of the NPL_{it} to LLR_{it-1} ratio impact on predicting a bank's future profitability, further studies should be carried out. For example, analyses should be conducted by using quarterly observations over the entire sample period (where available) or examining whether the NPL_{it} to LLR_{it-1} ratio is associated with future earnings over three sub periods (pre-2008 financial crisis, during the crisis and post-crisis).

Chapter 4 Does Diversification Affect Loan Growth? Evidence from the Vietnamese Banking Sector

Chapter 4: Does Diversifcation Affect Loan Growth?

Evidence from the Vietnamese Banking Sector[9]

Abstract

This study employs a sample of Vietnamese commercial banks from 2008 to 2019 to evaluate whether diversification influences the growth of banks' gross loans as well as the growth of individual loan categories. Geographic diversification is likely to reduce the amount of money available for loans, however over time it may lead to loan growth via new customer relationships. Deposit diversification is likely to increase total funding available for loans. Our findings show that geographic diversification is statistically significant with the expansion of gross loans, consumer loans and corporate loans. In contrast, the empirical results provide evidence of the impact of deposit diversification on the growth of consumer loans only. In the case of other loans, the results do not reveal any significant diversification impact on growth. To an emerging country with loan domination of the banking system, the strategic implications of our findings could be beneficial for both bank managers and regulators.

[9] Nguyen, T.T. and Wolfe, S., 2020. Does Diversification Affect Loan Growth? Evidence from the Vietnamese Banking Sector. *Journal of International Money, Banking and Finance*, *1*(1).

4.1 Introduction

This chapter evaluates whether diversification is beneficial for banks in an emerging economy. The chapter is motivated by the ongoing debate about the impact of diversification on bank operations. Moreover, the empirical analysis aims to investigate how deposit diversification and geographic diversification influence loan growth in the banking sector by using data on Vietnamese commercial banks during the 2008 – 2019 period.

With financial deregulation and increased competition, commercial banks have an incentive to expand their activities and develop new lines of businesses alongside their traditional interest earning activities. Vietnamese commercial banks have begun to engage in more non-interest generating activities such as cash Automated Teller Machine (ATM) withdrawal charges and letters of credit. However, their operations have mostly relied on traditional intermediation activities (deposits funding loans). Thus, loan dominance in banking activities directly affects the performance and risk of these banks. Income from loans continues to be the main component of revenue for Vietnamese commercial banks. In addition, the marginal cost induced by the supply of additional loans is limited to interest expenses when a lending relationship is established (Lepetit et al., 2008). As a result, the banks' strategies involve solutions that aim to improve their share of lending in this competitive market.

To eliminate a firm's idiosyncratic risk or enhance its performance, managers are likely to diversify by offering new products (such as deposits and fee-generating activities) or enter into new geographic markets (Meslier et al., 2016; Baele et al., 2007). As a response to the diversification trend, the Vietnamese banking system has experienced a dramatic increase in both bank services and number of branches. Moreover, the changes have had a dramatic influence on lending activity. Nevertheless, there have been many obstacles for Vietnamese commercial banks to launch new products or expand their network. Firstly, the national economy is heavily dependent on agriculture; therefore, a significant number of customers are in the habit of storing and paying in

cash. Additionally, technology has neither been widely adopted by industries nor is it available in every region. In other words, there is still a lack of infrastructure and facilities. Consequently, these barriers prevent banks from offering a range of new products or opening more branches. In other words, it has been challenging for Vietnamese commercial banks to diversify.

There is an extensive literature that questions the implications of diversification on banks in terms of either risk or performance. A vast range of studies contributes to the diversification literature, but there is less discussion about how diversification effects loan or lending growth. To the best of our knowledge, no empirical study has documented the influence of diversification on loan growth in emerging economies such as Vietnam. This paper, hence, aims to contribute to the literature in the following ways. First, it fills a gap in the literature by exploring diversification benefits for lending activity in the banking system using a dataset originating from the banking industry in an emerging country. Second, the analysis not only focuses attention on how diversification relates to the growth of banks' overall loan portfolios but also compares the different effects of diversification across individual loan categories.

The rest of this chapter is organized as follows. Section 4.2 discusses overview of existing literature. Section 4.3 defines the variables, describes the data sample and presents the methodology. Section 4.4 details the main results of the analysis. Section 4.5 includes several robustness tests and Section 4. 6 concludes.

4.2 Literature Review

Empirical studies in the literature that investigate the role of diversification in the banking sector, mainly focus on the influence upon bank risk and return. The bank diversification literature consists of the following three strands: portfolio diversification, product-market diversification, and geographic diversification.

Firstly, a bank could benefit from diversifying its investment portfolio (e.g. Amihud and Lev, 1981; Lewellen, 1971; Markowitz, 1952). In the pioneering study of Markowitz (1952), focuses on

diversification in securities portfolios for a financial institution. Applying the Markowitz optimal portfolio theory to combining enterprises, Lewellen (1971), and Amihud and Lev (1981) find that the multiple lines of business could enable a bank to reduce risk as long as there is no perfect correlation in the prospective profitability. Additionally, the previous studies of Levy and Sarnat (1970) and Grubel (1968) extend the literature to international portfolio diversification. Their findings suggest that international diversification for securities portfolios might result in risk reduction. Related to work on the portfolio approach to banking, Buch et al. (2010) investigates banks' cross-border asset positions. They employ the data of banks located in five developed countries: France, Germany, Italy, the UK and the US. A mean–variance portfolio model is applied to estimate the benefits of international diversification in the banking sector of these major economies. The results indicate that banks are likely to improve their risk–return trade-offs considerably by holding more international assets.

In reaction to declining market share of loans and deposits, banks have tended to diversify into fee-based services. A variety of products can influence the valuation of a financial institution considerably through return and risk. The second strand of literature, therefore, draws attention to product-market diversification. For example, Deyoung and Roland (2001) assess the influence of product mix on earning volatility at 472 large and medium sized commercial banks in the US from 1988 to 1995. They find that an increase in the share of fee-based activities is associated with the higher profitability volatility. The benefits of mixed banking activities is explored in Stiroh (2004b). Using the Herfindahl Hirschman Index (HHI) to proxy diversification, the empirical analysis provides evidence of a negative link between non-interest-income generating activities and risk-adjusted performance. This result is consistent with the findings of Stiroh (2004a) that the greater reliance on non-interest income, the lower risk-adjusted profits. Similarly, Stiroh and Rumble (2006) investigate whether shifting toward activities that generate fees, trading revenue, and other non-interest income could improve the performance of US financial holding companies. The findings

reveal the existence of diversification benefits between Financial Holding Companies; however, the increased exposure to non-interest activities outweighs the diversification benefits.

Also, the issue of focus versus product diversification receives a considerable amount of attention in the literature with contradicting results. Acharya et al. (2006), for instance, addresses this problem by using a sample of 105 Italian banks during the period 1993 to 1999. They suggest that the impacts of loan diversification are different between high-risk banks and low-risk banks. This finding suggests that a bank's risk-taking level, therefore, could determine the effects of diversification. Thus, diversification in lending leads to decreased bank returns and produces riskier loans for high-risk banks. However, for low-risk banks, the trade-off between risk and return generated by loan diversification is inefficient. Following Hayden et al. (2007), an empirical analysis is carried out to support the argument developed by Acharya et al. (2006). To do so, they apply a Value at Risk approach and employ a dataset of the individual bank loan portfolios of 983 German banks. A negative link between diversification and returns is found for almost all German banks, and especially for the low- and moderate-risk banks. It contradicts the conclusion of Acharya et al. (2006), thus, the effect of diversification on returns seems to differ among European countries. In addition, based on a dataset of European banks for the period 1996–2002, Lepetit et al. (2008) shed new light on the association between bank risk and product diversification in the changing structure of the European banking industry. According to their conclusion, the level of risk to banks expanding into non-interest income activities is higher than to banks mainly specializing in loans. Remarkably, this link is the strongest for small banks and for those involved with fee activities.

Focusing on an emerging market such as China, Berger et al. (2010) document the effects of strategic diversification on performance by capturing product diversification in the following dimensions: loans, deposits and assets. A sample of 88 Chinese banks accounting for 90% of commercial banking assets from 1996–2006 is used in their empirical analysis. They find diversification is associated with a decline in a bank's profit and an increase in costs. The findings are consistent regardless of alternative proxies of diversification and performance. A recent study of Meslier et al. (2014) highlights the effects of revenue diversification on the performance in the

Philippines. Interestingly, their results are the converse of the aforementioned studies on Western economies. That is, an increase in non-interest income can enable banks to improve their profitability. However, the diversification effect is more beneficial for foreign banks rather than their domestic counterparts.

Apart from the product diversification strategy, there is a growing body of literature that examines the influence of geographic diversification during recent decades and report mixed results. First, Berger and Deyoung (2001) examine how geographic expansion affects bank efficiency in the U.S. from 1993 to 1998. Their findings notify that the impacts of geographic scope on bank efficiency vary from bank to bank. For example, banks with branches that expanded into nearby states and regions are likely to enhance performance. By contrast, banks' affiliates located further away from parent organizations tend to reduce their efficiency. An increase in the parent-affiliate distance diminishes the efficiency of the affiliates. According to Berger et al. (2010), after controlling for risks, geographic diversification reduces a bank's profit and increases its costs. Meanwhile, the findings of Meslier et al. (2016) conclude that the impacts of geographic diversification depend on bank size. Small banks benefit from geographic expansion in terms of both risk-adjusted returns and default risk. For large institutions, diversified geography only reduces default risk.

The advantages of geographic diversification are evidenced by other studies. To bank holding companies in the US banking industry, diversified geography is associated with both firm value enhancement and risk reduction (Deng and Elyasiani, 2008). As regards international diversification, García-Herrero and Vázquez (2013) investigate the benefit a bank gains from the operations of foreign subsidiaries. The data set covers the 38 largest international banks in the G-7 (Canada, France, Germany, Italy, Japan, UK and US) plus Spain. Similar Hayden et al. (2007), find that the risk-adjusted returns are improved for a bank with a larger allocation of assets overseas. Additionally, overseas subsidiaries are more profitable but riskier. Both returns and the volatility of subsidiaries opened in emerging countries are higher than the average at home or in other industrial countries.

Employing a new approach to measure international diversification in banking, Fang and Van Lelyveld (2014) emphasize the association between geographical diversification and reduced credit risk across the 49 multinational banking groups. The study of Goetz et al. (2016) assess the net impact of the geographic expansion of Bank Holding Companies deposits on their risk and loan quality. Their estimations indicate that geographic expansion significantly reduces risks but does not change the quality of bank loans. The results are in line with the argument that banks diversify their exposure to idiosyncratic local market risks, then lower risks through geographic expansion. In a recent study, Yildirim and Efthyvoulou (2018) employ the system Generalized Method of Moments (system-GMM) estimation technique to investigate the value effect of international diversification. The analysis concentrates on a large number of banks in both developed countries and emerging countries. Results suggest that the impact of international diversification on value is dependent upon a bank's home country. Furthermore, greater diversification has a significant and positive association with changes in valuation for emerging country banks, but not for developed country banks. However, there is a difference in the value changes between intra-diversification (diversification across countries within a region) and inter-regional (diversification across different regions). While higher levels of intra-diversification increase bank value, a rise in inter-diversification leads to a decrease in the valuation of emerging country banks.

4.3 Data and Methodology

4.3.1 Data and Variables

Regarding Vietnamese bank-specific information, financial information data is obtained from the Fitch database. In addition, other data is hand-collected from individual bank annual reports. The final sample contains 22 Vietnamese commercial banks consisting of three state-owned banks (VCB, BIDV and VIETIN Bank) and 19 privately owned banks for the years 2008- 2019. All macroeconomic data is from the World Bank World Development Indicators database. Table 4-1 presents definitions of all the variables included in the analysis.

Diversification measures

The study aims to examine the impacts of diversification including deposit diversification and geographic diversification on loan growth. According to Salas and Saurina (2002), a branch growth rate is employed to capture the impact of branch network expansion or geographic diversity. Opening branches in new areas or entering into a new geographic market could help banks increase loans. The influence of geographic diversification on loan growth, therefore, is expected to be positive.

To measure customer deposit diversification, a Herfindahl-Hirschman Index (HHI) is computed for all banks to account for diversification between the types of bank deposits following Berger et al. (2010).

$$HHI = \left(\frac{Current}{Total}\right)^2 + \left(\frac{Savings}{Total}\right)^2 + \left(\frac{Term}{Total}\right)^2 \qquad (4.1)$$

$$Total = Current + Savings + Term \qquad (4.2)$$

Where Total customer deposits are captured by *Total, Current* is current deposits, *Savings* is savings deposits, and term deposits are denoted by *Term. HHI* varies between zero (a bank with customer deposits spread widely across each deposit category) and one (a bank with all customer deposits concentrated in one type of deposit). Thus, a bank will become less deposit concentrated and more diversified if the HHI decreases or we can say that a lower value of the HHI index indicates increased diversity.

Table 4-1 Definition of variables

Variables	**Definitions**
Dependent variables	
Growth rate of gross loans_{it}	% Annual change in gross loans_{it}
Growth rate of consumer loans_{it}	% Annual change in consumerl loans_{it}
Growth rate of corporate loans_{it}	% Annual change in corporate loans_{it}
Growth rate of other loans_{it}	% Annual change in other loans_{it}
Main variables – Diversification measures	
$\text{HHI}_{\text{it}-1}$	Herfinfahl − Hirschman Index based on types of customers deposits_{it-1}
$\text{Bran}_{\text{it}-1}$	% Annual change in number of branches_{it-1}
Control variables	
$\text{ROA}_{\text{it}-1}$	$\frac{\text{Net income}_{\text{it}-1}}{\text{Total assets}_{\text{it}-1}}$
$\text{NPL}_{\text{it}-1}$	$\frac{\text{Non} - \text{performing loans}_{\text{it}-1}}{\text{Gross loans}_{\text{it}-1}}$
$\text{SIZE}_{\text{it}-1}$	$\frac{\text{Total assets}_{\text{it}-1}}{\sum_{i=1}^{22} \text{Total assets}_{\text{it}-1}}$
$\text{Capital}_{\text{it}-1}$	$\frac{\text{Equity}_{\text{it}-1}}{\text{Total assets}_{\text{it}-1}}$
$\text{Liquidity}_{\text{it}-1}$	$\frac{\text{Loans}_{\text{it}-1}}{\text{Customer deposits}_{\text{it}-1}}$
$\text{Ownership}_{\text{it}-1}$	equals to 1 if state − owned commercial banks equals to 0 if otherwise
GDP_{t-1}	Annual percentage growth rate of GDP_{t-1}
$\text{LIR}_{\text{t}-1}$	Lending interest $\text{rates}_{\text{t}-1}$

Source: Authors' list

Dependent variables

Growth rate of gross loans (or of consumer loans, corporate loans and other loans): The annual changes in the growth of gross loans or each loan category are used to present the dependent variables in the regressions (Kim and Sohn, 2017; Brei et al., 2013; Cull and Martínez Pería, 2013). In the Vietnamese banking sector, consumer loans are the loans to individuals while banks lend corporate loans to corporate and commercial enterprises. These are the main lending types and account for the majority of bank loans. Some Vietnamese commercial banks used to offer residential mortgages but this loan category has been neither popular nor familiar to customers in Vietnam. Consequently, the growth of residential mortgages is not included in our study. Other loans include all loans not classified as either consumer or corporate loan groups.

Control variables

In order to capture the magnitude of bank-specific and macroeconomic conditions on the loan growth, several variables are used in the model.

ROA: The ratio of income after taxes (net income) to total assets is primarily considered in this study to denote banks' profitability (Cull and Martínez Pería, 2013). Banks with high profitability are likely to have strong balance sheets. Therefore, a positive relationship between profitability and bank lending is expected. By contrast, a higher profitability can imply a greater risk on assets. In this respect, banks with higher profitability might supply fewer loans to improve the quality of assets (Kim and Sohn, 2017). In this case, a relationship between profitability and bank lending can be negative.

NPL: NPL is used to measure loan quality. It is calculated by the ratio of NPL to gross loans. Thus, the higher the level of NPL, the worse the loan portfolio quality is (Kim and Sohn, 2017). The tendency of reducing loans increases when loan quality worsens. The expected sign of NPL is negative.

Capital: The ratio of equity capital to total assets is included in the analysis. Well-capitalized banks tend to increase their loans because they can more effectively absorb the negative effects of shocks on bank lending (Kim and Sohn, 2017; Fracis and Osborne, 2012) Also, a rise in capital encourages risk-taking behaviour (Kim and Santomero, 1988; Koehn and Santomero, 1980). However, according to the literature (Berger et al., 1995; Keeley and Furlong, 1990), higher capital links with lower moral hazard problems and better-capitalized banks have greater monitoring incentives. Therefore, managers of these banks could have fewer incentives to lend more to decrease riskiness embedded in their loan portfolios. Consequently, capital is expected to be either positive or negative with loan growth.

Size: Bank size is calculated as the ratio of each bank's assets to total assets for all sample banks. The expected sign of this variable is ambiguous. Following the "too big to fail" hypothesis suggested by Berger and Deyoung (1997), large banks have incentives to take more risk, thereby enabling them to supply more credit. However, large banks can diversify their portfolio by investing in various types of securities and involving themselves in various activities, whereas small banks tend to pursue traditional lending activities. In other word, diversification and size go hand in hand (Demsetz and Strahan, 1997) In addition, small banks tend to supply relatively more lending to their clients (Brei et al., 2013). From this perspective, the effect of bank size on lending can be negative.

Liquidity: In this study, the ratio of loans to customer deposits is used to capture bank liquidity. Liquid banks are likely to supply more (Brei et al, 2013, Kishan and Opiela, 2000) or there could be a decline in bank credit production when banks hold more loans (Cornett et al., 2011; Ivashina and Scharfstein, 2010).

Ownership: The binary value is employed to denote the ownership status of banks. The types of bank ownership have impacts on bank activities, financial development and economic growth (Sapienza, 2004; La Porta et al., 2002; Barth et al., 2001). Additionally, state-owned banks (or government-owned banks) could increase their lending relatively as compared to private banks (Dinç, 2005).

Macroeconomic variables: To account for the effects of the macroeconomic condition, annual growth rates of GDP and lending interest rates are used (Abedifa et al., 2018; Kim and Sohn, 2017; Brei et al., 2013). The expected sign of the growth rate of real GDP is positive because clients require more funds to broaden business and will increase loan demand. On the other hand, in an upswing period, customers could have more income and revenues to invest instead of borrowing from banks. Alternatively, the influence of changes in bank lending interest rate is expected to be negative because an increase in market rates or a rise in prices of loans could lead to a decrease in loan demands.

4.3.2 Research Philosophy, Approach and Methods

A research philosophy consists of systems of beliefs and assumptions of the knowledge which shape every aspect of a research project (Saunders, Lewis and Thornhill, 2016; Flick, 2015; Bryman, 2012). Research philosophies can be differentiated in terms of the types of assumptions. Whilts *ontological* assumptions affect research objects, phenomenon and research approaches, *epistemological* assumptions determine research contributions to knowledge as a result of the research and *axiology* influences how researchers deal with their own values and with those of the research participants within the research process (Saunders, Lewis and Thornhill, 2016). The five main research paradigms in business and management are *positivism*, *critical realism*, *interpretivism, postmodernism,* and *pragmatism* (Saunders, Lewis and Thornhill, 2016). The positivism paradigm is applied in the analysis of this chapter as its hypotheses are related to the impact of diversification on the growth of loans in the banking sector. Moreover, these hypotheses are developed by using existing theory and can be empirically investigated using researchers' analysis tools rather than their values (Saunders, Lewis and Thornhill, 2016).

Concerning the design of a research project, three research approaches are choosen to develop theories including deduction, induction and abduction (Saunders, Lewis and Thornhill, 2016). The deductive approach is used if research starts with pre-existing theory to develop

hypotheses, and test those assumptions and, thus, it goes from general to the specific (Saunders, Lewis and Thornhill, 2016; Silverman, 2010). Conversely, the inductive approach moves from the particular to general, as researchers begin with observations by collecting data to explore a phenomenon, which can help generate new theories (Bryman and Bell, 2015; Flick, 2015). Also, the third approach to theory development commonly applied in research is abduction. The abduction approach generates a new theory or modifies an existing one by using the interactions between the specific and the general instead of moving from theory to data as in a deductive approach or data to theory as an inductive approach (Saunders, Lewis and Thornhill, 2016). Abductive approach is likely to combine deduction and induction. In terms of these three approaches and their implications for research, this study implements the deductive approach. It is concerned with the need to investigate the casual relationships among variables in order to test hypotheses and, thus, generalise results rather than generate new theories (Saunders, Lewis and Thornhill, 2016).

To conduct business research, three main forms of research strategies frequently used, namely, quantitative, qualitative, and mixed methods. With quantitative methods, researchers focus on qualification in the collection and analysis of data (Bryman and Bell, 2015). Additionally, numeric data can be effectively collected from a large number of respondents, measures using various quantitative techniques, such as questionnaires and apply a variety of statistical analysis tools in order to test the established hypotheses (Bryman, 2012; May, 2011). Qualitative methods, on the other hand, tend to emphasize words rather than numbers or quantitative data are not collected or generated (Bryman and Bell, 2015). Qualitative research, therefore, collect information using a descriptive and non-numerical approach such as interviews in order to examine the meaning of social phenomena, rather than causal relationships between variables (Feilzer, 2010; Berg, 2004). Researchers have the suited choice to use either mono or multi- quantitative methods, or mono or multi-qualitative methods. The quantitative data of empirical analysis can be categorised into three groups, cross sectional data, time series data, and Longitudinal or panel data. In cross-sectional data, variables from several entities are collected at the same point of time, while in time series data, variables from one entity are observed over a period of time. In panel data, on the other hand,

variables from several entities are gathered over a period of time (Saunders, Lewis and Thornhill, 2016; Flick, 2015; Bryman, 2012; Greene, 2012; Gujarati, 2003). A quantitative method is employed for panel data collection in order to investigate the impact of diversification on loan growth over a period of 12 years in the Vietnamese banking sector in this chapter.

Following Goetz et al. (2016), a two-stage least squares (2SLS) methodology is applied to evaluate whether deposit diversification and geographic diversification have influence on the growth of gross loans and the growth of individual loan categories. The empirical regression model is given as follows:

$$L_{it} = \alpha_1 + \alpha_2 L_{it-1} + \alpha_3 HHI_{it-1} + \alpha_4 Bran_{it-1} + \alpha_5 X_{it-1} + \alpha_6 X_{t-1} + \varepsilon_{it} \quad (4.3)$$

Where *i* denotes the number of banks, and *t* represents the yearly time dimension.

The dependent variable - L_{it} is the growth of total gross loans (or of consumer loans, corporate loans, or other loans) for bank i at time t; HHI_{it-1} denotes deposit diversification; $Bran_{it-1}$ represents geographic diversification; X_{it-1} is a matrix of bank-specific control variables that can impact loan growth (ROA, NPL, Capital, Liquidity, Size, and Ownership); X_{t-1} is a vector of additional macroeconomic control variables including GDP growth rate and lending interest rate and finally ε_{it} is an error term.

Endogeneity in regression models may result in inconsistent estimates which potentially leads to wrong inferences, misleading conclusions, and incorrect theoretical interpretations (Ullah et al., 2018). Also, endogeneity bias can have different origins such as measurement errors, omitted bias or simultaneity. The need to control for the endogeneity of the diversification decision is, therefore, identified in the studies of Stiroh and Rumble (2006), and Campa and Kedia (2002). To solve the endogeneity problem, we use an instrumental variables (IV) approach and apply the 2SLS estimator. 2SLS is regarded as an instrumental variable (IV) method which requires at least one additional exogenous variable to help identify the effect of the offending endogenous variable has on the

dependent variable (Gretz and Malshe, 2019). On the one hand, an IV is correlated with the endogenous variable but not correlated with the error term. On the other hand, IVs do not directly influence the main dependent variable in the model (Wooldridge, 2010). Two stages of estimations are implemented in 2SLS as follows: the first stage focuses on regressing each endogenous variable on all instruments and exogenous variables in the main models; in the second step, the dependent variable is regressed on all the exogenous variables and the predicted values of endogenous variables from the first stage (Gretz and Malshe, 2019; Wooldridge, 2010). Finally, in our empirical analysis, all macroeconomic variables in the present study are assumed to be strictly exogenous but this assumption for the bank-level determinants are too strong. Therefore, the bank-specific variables including ROA, NPL, Bank size, Capital and Liquidity are considered to be the weak forms of exogeneity. It suggests an endogeneity issue concerning the current and past realizations of the error term (Louzis et al., 2012). Also, the lagged one period of these variables is used as the valid instruments to mitigate any possible endogeneity bias (Kim and Sohn, 2017; Cull and Martínez Pería, 2013).

4.4 Results

Table 4-2 illustrates the summary statistics for all variables in the sample. There are variations in both the growth of gross loans and growth of each loan type. In addition, growth of branches (denoting geographic diversification) significantly varies with a range from zero to 61.11%. *HHI* denoting customer deposit diversification varies from 0.36 to 0.85. The mean of *HHI* (0.621) or the average value of this indicator emphasizes a moderate concentration within the range of deposit categories banks engage in. Over the sampling period 2008 – 2019, current deposits and term deposits mainly take up all customer deposits of sample banks in the Vietnamese banking sector.

Table 4-2 Descriptive statistics

Variable	**Mean**	**Median**	**Std Dev**	**Min**	**Max**
Growth rate of gross $loans_{it}$	0.246	0.195	0.216	-0.045	0.810
Growth rate of consumer $loans_{it}$	0.288	0.239	0.310	-0.189	1.129
Growth rate of corporate $loans_{it}$	0.214	0.157	0.238	-0.100	0.797
Growth rate of other $loans_{it}$	0.069	0	0.498	-0.782	1.392
HHI_{it-1}	0.621	0.63	0.146	0.36	0.85
$Bran_{it-1}^{*}$	11.585	2.985	17.703	0	61.11
ROA_{it-1}^{*}	1.055	0.995	0.627	0.11	2.305
NPL_{it-1}^{*}	2.028	1.9	1.118	0.4	4.8
$SIZE_{it-1}^{*}$	4.484	2.69	4.62	0.48	16.04
$Capital_{it-1}$	0.099	0.086	0.044	0.050	0.206
$Liquidity_{it-1}$	0.872	0.8538	0.184	0.575	1.252
$Ownership_{it-1}$	0.136	0	0.344	0	1
GDP_{t-1}^{*}	6.19	6.225	0.633	5.25	7.13
LIR_{t-1}^{*}	10.682	10.22	3.352	6.96	16.95

Note: Variables with an asterisk are in percentages
Source: Author's calculation.

Table 4-3 Empirical results

	Growth rate of gross loans (1)	**Growth rate of consumer loans (2)**	**Growth rate of corporate loans (3)**	**Growth rate of other loans (4)**
HHI_{it-1}	0.0319	**0.304****	0.272	-0.202
	(0.34)	*(1.96)*	*(1.56)*	*(-0.72)*
$Bran_{it-1}$	**0.0026****	**0.0031****	**0.0024****	0.0023
	(2.09)	*(2.13)*	*(2.07)*	*(0.46)*
ROA_{it-1}	-0.00267	0.106	-0.0353	**-0.261****
	(-0.06)	*(1.45)*	*(-0.38)*	*(-2.18)*
NPL_{it-1}	-0.0064	-0.0311	-0.0320	0.0348
	(-0.18)	*(-0.74)*	*(-0.98)*	*(0.30)*
$Capital_{it-1}$	-1.028	**-2.750***	**-2.056****	2.322
	(-1.04)	*(-1.84)*	*(-2.30)*	*(1.24)*
$Liquidity_{it-1}$	-0.0782	-0.356	0.140	0.184
	(-0.55)	*(-1.46)*	*(0.71)*	*(0.44)*
$Size_{it-1}$	**-0.0220****	**-0.0753*****	**-0.0388****	**0.0725***
	(-2.02)	*(-3.19)*	*(-2.21)*	*(1.72)*
$Ownership_{it-1}$	**0.233****	**0.902*****	0.332	**-0.755***
	(2.12)	*(3.67)*	*(1.60)*	*(-1.69)*
GDP_{t-1}	-0.0495	**-0.127*****	-0.0405	0.0250
	(-1.39)	*(-2.58)*	*(-0.98)*	*(0.20)*
LIR_{t-1}	-0.0056	-0.0176	0.0073	-0.003
	(-0.82)	*(-1.25)*	*(0.69)*	*(-0.20)*
Growth rate of gross $loans_{it-1}$	**0.231****			
	(2.48)			
Growth rate of consumer $loans_{it-1}$		-0.148		
		(-1.63)		
Growth rate of corporate $loans_{it-1}$			**0.226*****	
			(2.64)	
Growth rate of other $loans_{it-1}$				0.0829
				(0.82)
Constant	**0.724***	**1.834*****	0.429	-0.395
	(1.84)	*(3.65)*	*(0.94)*	*(-0.36)*
N	*197*	*179*	*169*	*149*
R^2	*0.7128*	*0.4949*	*0.4584*	*0.4243*
Wald χ^2	*107.87*	*49.44*	*55.31*	*27.42*
Log-likelihood	*-53.935*	*-24.72*	*-27.655*	*-13.71*

t statistics in parentheses

*, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

The growth of gross loans

Column (1) of Table 4-3 presents the estimation results for the growth of gross loans for commercial banks in Vietnam. We find that there is no impact of deposit diversification on the total loan expansion. By contrast, there is a statistically significant relationship between geographic diversification and total loan growth. The positive coefficient of this variable implies that banks tend to expand their credit to borrowers when there are more branches. To an emerging country like Vietnam, small and medium-sized enterprises (SMEs) have dominated the economy with their contribution to the GDP. The number of SMEs accounts for 95 percent of all enterprises in Vietnam and their presence is more geographically spread out. A diversification strategy through branches, therefore, has an important implication for the banks' lending activity and helps banks meet the demand for more customers' finance in many local markets. It can clearly be seen in our sample that there has been a rapid rise in the quantity of bank branches over the last decade. Also, Vietnamese commercial banks have boosted their market share to increase traditional activities and improve performance through more market entry across various regions.

Regarding other bank-level factors, the estimation reveals the significant impacts of bank size and ownership on the total loan growth with expected signs. Concerning the effect of size, its estimated coefficient is negative, signifying that large banks concentrate less on traditional lending activity as compared to small banks. This result is in line with the finding of Kim and Sohn (2017). It is consistent with Cull and Martínez Pería (2013) when they assess the relationship between bank size and loan growth in developing countries in Eastern Europe and Latin America before the 2008-2009 crisis. Recently, taking advantage of large size, Vietnamese commercial banks have varied their portfolio by engaging in different types of activities rather than focusing on lending.

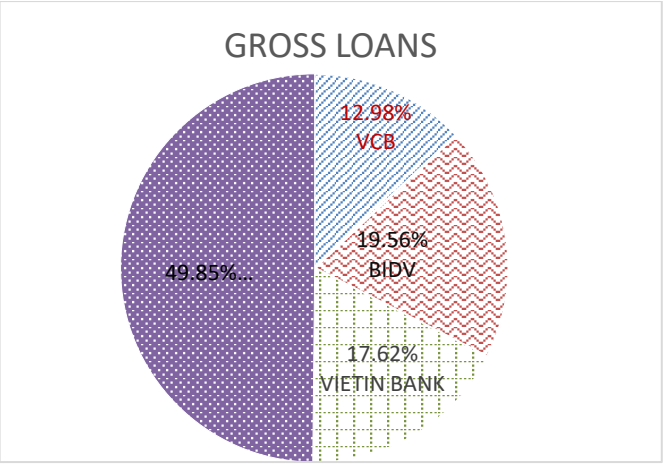

Figure 4-1 The share of gross loans between state-owned banks and private banks from 2008 – 2019

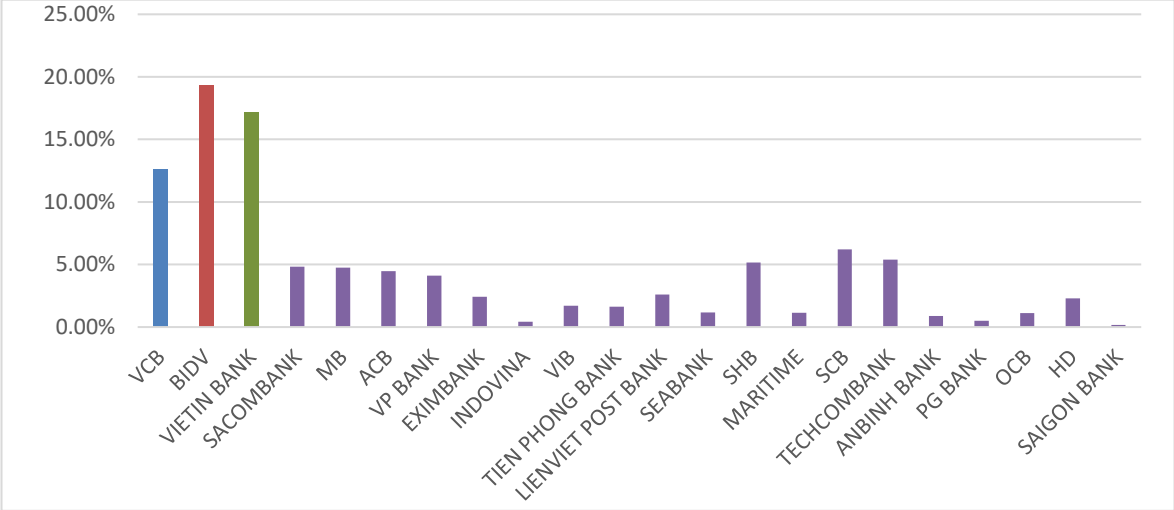

Figure 4-2 The growth of gross loans between state-owned banks and private banks from 2008 – 2019

Generally, gross loans of the three state-owned banks (VCB, BIDV, VIETIN BANK) accounted for more than 50% of all sample banks' gross loans and their growth of gross loans is higher than other privately-owned banks.

In terms of bank ownership, state-owned banks continue to dominate the banking system in Vietnam with the largest number of branches and customers. Moreover, these banks are under the control of the government to launch new lending schemes that aim at supporting domestic production and businesses. Notably, the state-owned banks play crucial roles in supplying credits to the priority sectors such as agriculture, export, SMEs, and enterprises applying advanced technology. A glance at the result at Column (1) of Table 4-3, there is a significantly positive influence of ownership on the total loan growth.

The other bank-specific variables, however, do not influence the change in annual gross loan growth, except for the lag one-order value of gross loan growth. For all macroeconomic variables, the estimated coefficients are also found to be insignificant.

The growth of consumer, corporate and other loans

The growth of each loan type replaces the growth of gross loans to assess the extent to which diversification influences loan growth for the consumer, corporate and other category in the Vietnamese banking sector. Column (2) – (4) of Table 4-3 show the results of regressions for the growth rate of consumer, corporate and other loans, respectively.

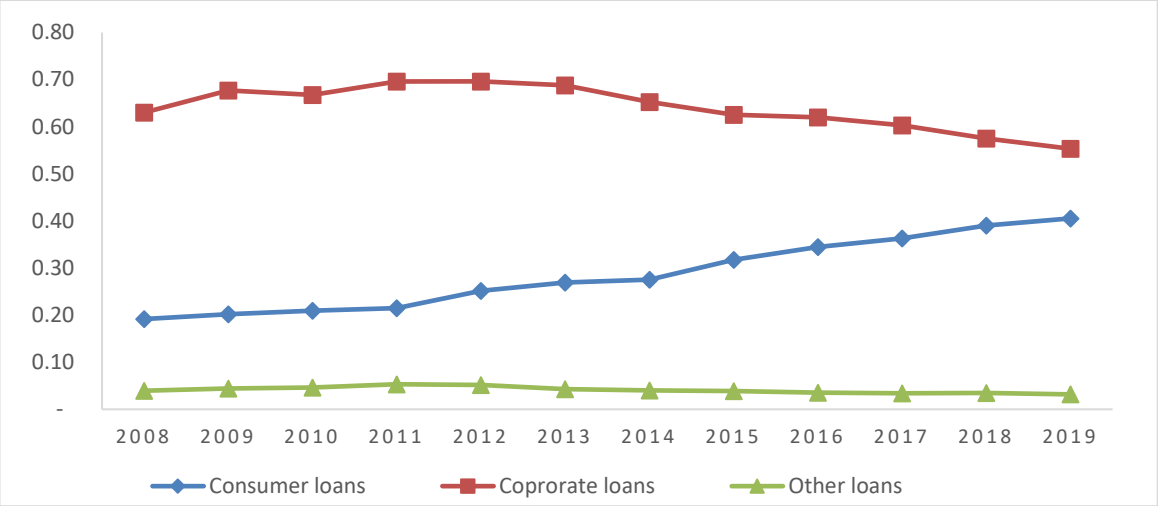

Figure 4-3 The ratio of each loan category to gross loans

Interestingly, the coefficient of HHI is significantly positive only for the consumer loan growth. It implies that more concentrated could lead to a rise in the growth rate of consumer loans or there is the negative relationship between deposit diversification and the growth rate of consumer loans. Despite expanding non-traditional activities, the operation of commercial banks in Vietnam is heavily based on deposit-funded loans (basic intermediation activities). On the one hand, banks could benefit from more deposit products by attracting more depositors from various social segments to fund more loans. On the other hand, diversified terms of deposit products could mismatch with the terms of consumer loans, and then conversely affect the ability to grow bank consumer loan portfolios.

Specifically, the coefficient of the bank branch variable is positive and statistically significant in the case of consumer and corporate loans. The implication is that the growth of the two loan types are likely to increase with the rise of gross loan growth when banks open more branches. However, this coefficient is insignificant for other loans growth. Similarly, consumer and corporate loan growth are found to be negatively related to bank size. The growth rate of consumer and corporate loans could follow by a decline in the size of banks.

There is a notable difference between the impact of state versus private ownership on consumer loans growth while this indicator does not significantly involve the growth of corporate and other loans. Accordingly, state-owned banks tend to exhibit not only a higher growth rate of gross loans but also of consumer loans. Fig.4-4 and Fig 4-5 show the shares of consumer loans and the growth of consumer loans between state-owned banks and privately owned banks in our sample, respectively. Average consumer loans of three state-owned banks made up nearly 40% of 22 banks and their growth rate of this loan type are higher than most of the private banks.

Following the empirical estimation in Column (3) of Table 4-3, there is a significantly negative link between capital and corporate loan growth. It indicates that this loan type may have a slower growth rate when banks are better capitalized. In addition, the growth for corporate loans in the current year is associated with its value in the previous year. For the case of other loans, the profitability effect (captured by ROA) is negative, implying that banks with weak profitability are able to grow their other loans. On the contrary, other variables do not affect the growth of other loans (the impact of bank size or ownership on other loans growth are weak). Finally, the effect of GDP is found to be strong only for the case of consumer loan growth. The significance and positive sign of GDP is as expected. A boom in the economy could enhance households' income; consequently, consuming debtors can finance their debts and have fewer incentives to borrow for consumption. Nonetheless, there is no evidence that the lending interest rate influences any loan type growth.

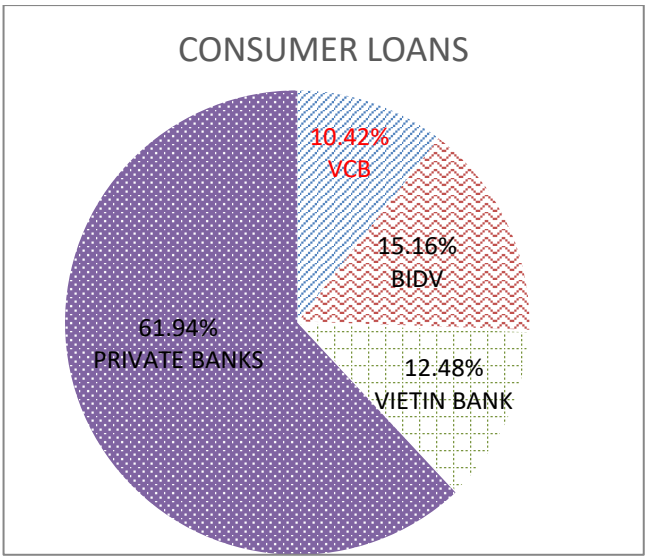

Figure 4-4 The shares of consumer loans between state-owned banks and privately-owned banks from 2008 - 2019

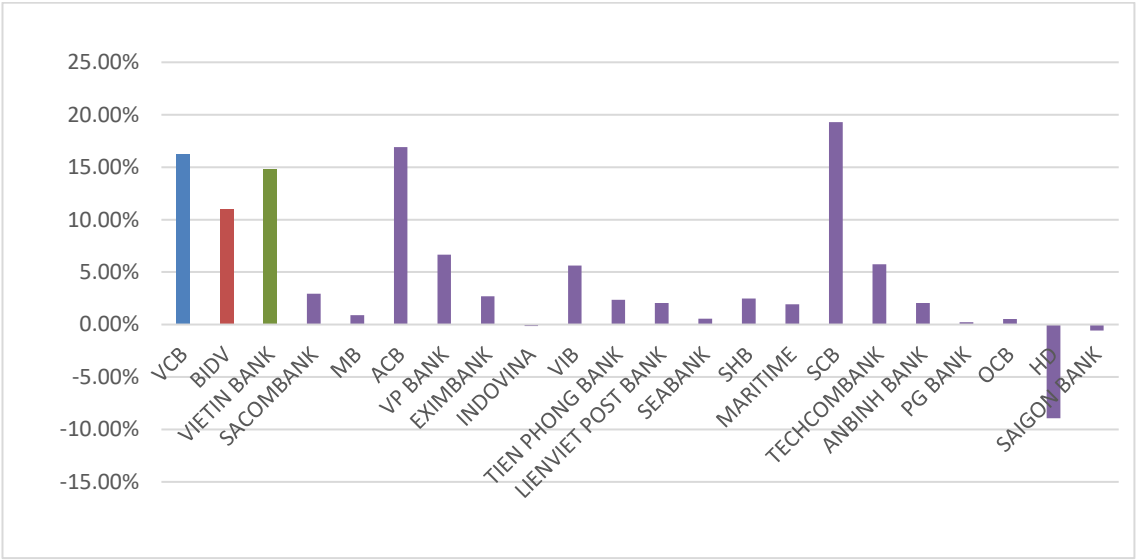

Figure 4-5 The growth of consumer loans between state-owned banks and private banks from 2008 – 2019

4.5 Robustness Checks

This section demonstrates further empirical tests that have been carried out to consider whether our main results are consistent. Generally, the main findings of the robustness checks are broadly similar to the main results. The same methodology (2SLS) is used.

First, ROA is employed in the primary regressions to measure banks' profitability (Yildirim and Efthyvoulou, 2018; Cull and Martínez Pería, 2013). However, there is a concern that using ROA

to approximate bank earnings could cause misleading results. Therefore, we use ROE as another proxy of profitability and re-estimate our models (Meslier et al, 2016; Stiroh and Rumble, 2006). Table 4 shows the results of new regressions for the growth of gross loans and each loan type. Highly similar results are obtained in this additional analysis of robustness. In terms of our main interest, geographic diversification is strongly significant to the growth of gross loans, consumer loans and corporate loans. It continues to indicate that greater diversification of geography leads to higher growth rate of gross loans and these two major loan categories. Meanwhile, deposit diversification retains its significance on the growth of consumer loans but its impact is slightly weaker. Other control variables do not change their effects as compared to the original results.

Second, a set of control variables is included into the regressions to avoid a potential omitted variable problem. In respect of the macroeconomic condition, not only GDP growth and the lending interest rate but the inflation rate also is expected to affect bank loan growth (Abedifa et al., 2018; Kim and Sohn, 2017; Brei et al., 2013). However, there is multicollinearity between the lending interest rate and the inflation rate. Consequently, we have not used both macroeconomic indicators at the same time in the regressions. As a robustness check, further estimations are conducted by using the inflation rate instead and Table 5 performs the results of this test (Yildirim and Efthyvoulou, 2018). Clearly, the results provide evidence that the results are robust and consistent for all variables. Geographic diversification maintains statistically positive influences on the gross loans growth and the growth rate of consumer and corporate loans. An exception is the impact of deposit diversification on the consumer loan growth. The effect is still significant with a negative sign (or the positive sign of *HHI* indicator denoting deposit concentration); however, its significance is weaker at the 10% level.

Table 4-4 Robustness (Replacing ROA by ROE)

	Growth rate of gross loans (1)	**Growth rate of consumer loans (2)**	**Growth rate of corporate loans (3)**	**Growth rate of other loans (4)**
HHI_{it-1}	0.0250	**0.267***	0.287	-0.114
	(0.25)	*(1.75)*	*(1.51)*	*(-0.37)*
$Bran_{it-1}$	**0.0026****	**0.0037*****	**0.0027****	0.0021
	(2.14)	*(2.68)*	*(2.46)*	*(0.42)*
ROE_{it-1}	0.240	0.282	-0.587	**-2.255****
	(0.48)	*(0.50)*	*(-0.76)*	*(-2.09)*
NPL_{it-1}	-0.0290	-0.0364	-0.0387	0.0272
	(-0.93)	*(-0.82)*	*(-1.05)*	*(0.24)*
$Capital_{it-1}$	-1.023	-2.135	**-2.596****	-0.0839
	(-1.01)	*(-1.29)*	*(-2.06)*	*(-0.04)*
$Liquidity_{it-1}$	-0.128	-0.293	0.161	0.226
	(-0.92)	*(-1.26)*	*(0.82)*	*(0.54)*
$Size_{it-1}$	**-0.0304****	**-0.0685*****	**-0.0408****	0.0658
	(-2.20)	*(-2.91)*	*(-2.23)*	*(1.59)*
$Ownership_{it-1}$	**0.319****	**0.821*****	**0.362***	-0.650
	(2.49)	*(3.46)*	*(1.74)*	*(-1.52)*
GDP_{t-1}	-0.0584	**-0.119****	-0.0344	0.0179
	(-1.58)	*(-2.31)*	*(-0.81)*	*(0.14)*
LIR_{t-1}	-0.0063	-0.0133	0.010	-0.0047
	(-1.05)	*(-0.95)*	*(0.86)*	*(-0.27)*
Growth rate of gross $loans_{it-1}$	**0.201****			
	(2.07)			
Growth rate of consumer $loans_{it-1}$		-0.122		
		(-1.38)		
Growth rate of corporate $loans_{it-1}$			**0.209****	
			(2.44)	
Growth rate of other $loans_{it-1}$				0.0734
				(0.74)
Constant	**0.885****	**1.700*****	0.439	-0.166
	(2.42)	(3.34)	(1.01)	(-0.15)
N	*197*	*179*	*169*	*149*
R^2	*0.7183*	*0.4098*	*0.4464*	*0.4032*
Wald χ^2	*103.89*	*46.69*	*49.47*	*31.79*
Log-likelihood	*-51.945*	*-23.345*	*-24.735*	*-15.895*

t statistics in parentheses

*, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

Table 4-5 Robustness (Replacing Lending interest rate by Inflation rate)

	Growth rate of gross loans (1)	**Growth rate of consumer loans (2)**	**Growth rate of corporate loans (3)**	**Growth rate of other loans (4)**
HHI_{it-1}	0.0316	**0.305***	0.263	-0.196
	(0.33)	*(1.96)*	*(1.55)*	*(-0.70)*
$Bran_{it-1}$	**0.0026****	**0.0031****	**0.0027****	0.0017
	(2.08)	*(2.09)*	*(2.22)*	*(0.33)*
ROA_{it-1}	-0.00517	0.0969	-0.0127	**-0.254****
	(-0.13)	*(1.34)*	*(-0.15)*	*(-2.03)*
NPL_{it-1}	-0.0097	-0.0320	-0.0348	0.0347
	(-0.27)	*(-0.77)*	*(-1.02)*	*(0.29)*
$Capital_{it-1}$	-1.041	**-2.767***	**-2.105****	2.358
	(-1.03)	*(-1.82)*	*(-2.43)*	*(1.30)*
$Liquidity_{it-1}$	-0.0781	-0.358	0.150	0.0792
	(-0.54)	*(-1.48)*	*(0.77)*	*(0.25)*
$Size_{it-1}$	**-0.0227****	**-0.0759*****	**-0.0374****	**0.0708***
	(-2.05)	*(-3.16)*	*(-2.25)*	*(1.67)*
$Ownership_{it-1}$	**0.239****	**0.910*****	0.313	-0.724
	(2.16)	*(3.63)*	*(1.57)*	*(-1.60)*
GDP_{t-1}	-0.0473	**-0.114****	-0.0635	0.0363
	(-1.30)	*(-2.54)*	*(-1.48)*	*(0.30)*
INF_{t-1}	-0.0036	-0.0109	0.0001	-0.0003
	(-0.83)	*(-1.16)*	*(0.02)*	*(-0.03)*
Growth rate of gross $loans_{it-1}$	**0.227****			
	(2.31)			
Growth rate of consumer $loans_{it-1}$		-0.154		
		(-1.57)		
Growth rate of corporate $loans_{it-1}$			**0.218****	
			(2.53)	
Growth rate of other $loans_{it-1}$				0.0841
				(0.83)
Constant	**0.691***	**1.667*****	0.628	-0.410
	(1.77)	*(3.91)*	*(1.38)*	*(-0.39)*
N	*197*	*179*	*169*	*149*
R^2	*0.7113*	*0.4762*	*0.4933*	*0.4225*
Wald χ^2	*99.97*	*39.47*	*54.12*	*33.16*
Log-likelihood	*-49.985*	*-19.735*	*-27.06*	*-16.58*

t statistics in parentheses

*, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

4.6 Conclusion

The empirical analysis aims to identify the role of diversification in loan growth in Vietnam. The study not only focuses on the growth of gross loans but also separately examines the growth of various individual loan types. The findings are in support of traditional portfolio and intermediation theories that banks can significantly benefit from loan growth diversification.

The study contributes to the existing literature in the following ways. First, we find evidence that geographic diversification (proxied by the growth of bank branches) statistically affects loan growth at Vietnamese commercial banks in the sample. More specifically, banks with a more diversified geographical expansion tend to grow their gross loan portfolio as well as two major loan types, consumer and corporate loans. Additionally, the results are robust for other bank-specific variables and when controlling for macroeconomic conditions. Our results remain consistent even when other additional tests are conducted. Second, contrary to the case of geographic diversification, the estimation suggests a significant impact of deposit diversification (product-market diversification) on the growth rate of consumer loans only. However, this result is weakly significant when we control for bank-level characteristics and macroeconomics by using another proxy of profitability or other macroeconomic indicators.

To an emerging country like Vietnam, lending is the core banking activity and the findings suggest important implications for bank managers and regulators. Policies related to sustaining bank loans and lending schemes should be implemented effectively by referring to banks' strategy of expanding their network and the composition of the deposit portfolio held. Moreover, further research should be carried out by considering the impact of international network expansion on loan growth once Vietnamese commercial banks have opened branches in other emerging countries in South East Asia, especially in Laos and Cambodia.

Chapter 5 Conclusion

5.1 Introduction

The final chapter provides overall concluding remarks for each one of the three core chapters. In particular, this thesis conclusion not only highlights the contributions to the existing literature of each chapter but also underlines the limitations faced by the researcher. This chapter ultimately offers recommendations and policy implications as well as suggests some areas for further research.

5.2 Chapter 2: Determinants of Non-Performing Loans at Vietnamese Commercial Banks

The aim of Chapter 2 is to examine the impact of macroeconomic and bank-level factors on non-performing loans (NPL). While most previous studies largely draw on problem loans in developed economies such as the US, the Euro region, or other European economies, this empirical research focuses on factors affecting NPL in an emerging country in South East Asia. In addition, this chapter offers the first analysis that aims to give insight into the influence of new NPL regulations on NPL.

Using a dataset comprising of the 22 largest commercial banks in Vietnam over the sampling period 2008 – 2017, this chapter indicates the relationship between NPL and a range of drivers. In terms of macroeconomic magnitude, there is a tendency for NPL to rise in periods of strong economic performance. In addition, higher lending interest rates are associated with greater NPL. Additionally, many extensions to the baseline model are carried out by examining the effects of bank-specific factors. Furthermore, using Generalized Method of Moments (GMM) estimation, and the Difference-in-Difference (DID) approach, we find that tightening NPL regulation in Vietnam is associated with a lower level of problem loans compared with before.

In terms of recommendations, the result reveals that there is a trade-off between GDP growth and problem loans in a developing country. Macroeconomic policies without too rapid a growth rate, therefore, should be considered to keep a low level of problem loans in the banking

system. Additionally, optimal monetary decisions need to consider interest rates based on the positive link between NPL and lending interest rates. Moreover, profitability, capital level or non-interest income share can be used as early warning indicators of future NPL and can help regulators implement prompt corrective action.

5.3 Chapter 3: Does the Ratio of Non-Performing Loans to Loan Loss Reserves Provide a Signal about Bank Future Profitability? Evidence from Vietnam

Motivated by the importance of bank performance and stability, Chapter 3 is the first study that focuses on analysing how the link between NPL and its expected value provides information about bank earnings in the next period. Furthermore, this chapter examines whether or not the impact of this ratio on bank future profitability depends upon macroeconomic conditions.

Using the same dataset as in Chapter 2, the two stage least squares (2SLS) methodology used in this study suggests that banks subject to a binding NPL and loan loss reserve requirement enhance the performance and stability of the banking system. Additionally, this chapter sheds new light on the nexus between NPL, expected loan losses and future profitability. Notably, our research has shown that this negative association becomes stronger during an economic upswing. In addition, robustness tests are conducted to confirm the strength of the findings.

5.4 Chapter 4: How Does Diversification Affect Loan Growth? Evidence from the Vietnamese Banking Sector

Chapter 4 investigates diversification and examines the link between diversity strategies and bank lending activity. What the reasons for the aforementioned relationship are: First, diversification has a direct impact on bank behaviour and affects bank stability. Second, diversification also influences

bank efficiency through affecting risk-taking activities and asset structure. In addition, to provide a clear picture, this chapter investigates geographic and deposit diversification impacts on both gross loan growth and growth of each loan category.

Overall, our results indicate a statistically positive link between diversification in geography on the expansion of gross loans, consumer and corporate loans. Furthermore, banks with more diversified deposit-taking or less concentration (captured by HHI) are likely to lend less to consumers. These findings suggest that policies related to sustaining bank loans and lending schemes should be implemented effectively by referring to banks' strategy of expanding their network and the composition of the deposit portfolio held.

5.5 Summary and Policy Implications

This thesis offers several important contributions to the literature on banking stability. To this end, several different econometric approaches (Difference-in-Difference, GMM estimation, and 2SLS) and sample datasets are employed for the purpose of this thesis.

Chapter 2 examines factors affecting NPL in Vietnam. The robust evidence indicates that bank problem loans are statistically driven by both macroeconomic conditions and bank-specific determinants. In addition, this chapter investigates how the changes in NPL regulation have an impact on NPL. The finding emphasizes that a tighter restriction is associated with a lower level of problem loans. Chapter 3 initially examines whether or not the ratio between NPL and its expected value provides signal to bank profitability. The result proposes an indicator to predict bank earnings in the future. Chapter 4 focuses on diversification including geographic and deposit diversification in the banking sector. The empirical analysis points out that the expansion of a regional banking network could lead to an increase in the growth of gross loans, consumer loans and corporate loans. However, diversity of deposits only gives an impact on consumer loan growth.

These results give rise to important policy recommendations: First, the robust findings in Chapter 2 support the argument in the existing literature that NPL is driven by both macroeconomic

and bank-level characteristics. In contrast with previous studies, our result provides evidence for a trade-off between GDP growth and NPL in a developing economy. Consequently, policymakers may need to re-evaluate the conflicting objectives between economic growth and credit risk in banking system. The statistically significant impacts of bank-level indicators have implications for regulators when measuring any changes to these factors on bank risk and stability, and serving as leading indicators for future problem loans. Also, the result offered in this chapter indicates that tighter controls can reduce NPL. It calls for strengthening of rules by bank regulators. Second, the results presented in Chapter 3 have implications for bank managers and regulators. Information from the NPL/LLR ratio is forward-looking enough to be used in early warning models, especially in an upswing period. Moreover, advance information from this ratio has the potential to complement information compiled by regulators. In addition, regulators should place emphasis on risk management systems and procedures followed by banks with the aim of enhancing future stability. Finally, Chapter 4 points out the beneficial impact of diversification on lending activity. Complementing the literature, the findings have implications for the optimal bank size in terms of an expanding geographic network.

5.6 Limitations

This thesis presents strong results and a range of policy implications for regulatory oversight and industrial organisation of banking systems. However, there are a number of limitations in the preceding chapters that are mentioned in this sub section.

Chapter 2 examines the role of banking characteristics and economic conditions in influencing NPL. However, due to data restrictions, we focus only on banking data aggregated NPL because for each loan category, detailed information on their NPL is not available from standard financial statements from the Fitch database. In any case, focusing on aggregated NPL in this thesis is unlikely to get a clear and complete picture of credit risk in the whole banking system.

Chapter 3 provides the first analysis to examine whether the link between NPL and expected NPL (captured by LLR) could be used as an indicator to signal bank future earnings. This chapter employs a dataset of annual observations during a 10-year period, therefore, the result may not extend beyond this narrow time period. Thus, it is important to acknowledge that our results will not resolve all concerns about the beneficial information obtained from the NPL_{it} to LLR_{it-1} ratio.

Chapter 4 raises a concern about using data to proxy geographic diversification in our sample. This analysis employs the growth in the number of bank branches as a measure of geography diversity. As a result, it cannot reflect the distinctive impacts of regional or international diversification. Especially, Vietnamese commercial banks are increasingly becoming interested in entering into new geographic markets in the South East Asia region as well as in other countries around the world.

5.7 Avenues for Future Research

Any comprehensive research tends to give rise to additional questions. Therefore, this section offers a number of valuable avenues for future research.

First, future work is advisable to investigate in more detail the determinants of NPL across loan types. While this thesis answers a number of empirical questions, there is wide scope for future work. Future research therefore could analyse factors affecting NPLs by using data of different loan categories, rather than the aggregate level of NPLs.

Second, Chapter 3 aims to analyse the impact of the NPL_{it} to LLR_{it-1} ratio on bank profitability. Future research could investigate this association using the interaction of different regulatory requirements and monetary policy as well as their impact on banks' risk shifting. Additionally, where data is available, another analysis could be conducted by using quarterly observations or comparing the estimation results of three sub periods (pre-2008 financial crisis, during crisis and post-crisis).

Finally, Chapter 4 aims to analyse the impact of diversification on bank lending growth. The estimation suggests that geographic diversification or expanding new bank branches cause banks' loan growth in terms of gross loans and two major loan categories including consumer and corporate loans. However, future avenues of research can benefit by examining international diversification in the Vietnamese banking system. To do this, other proxies of geographic diversification can used such as a binary variable indicating the presence or lack of international diversification; international share captured by the ratio between the number of foreign subsidiaries and the total number of subsidiaries of a bank.

Appendix A **Debt classification in Vietnam**

Group	Overdue status
1. Current debts	- Current debts being assessed as fully and timely recoverable, both principal and interest; or - Debts being overdue for less than 10 days and being assessed as fully recoverable, both overdue principal and interest, and fully and timely recoverable, both remaining principal and interest.
2. Special mention debts	- Debts being overdue between 10 days and 90 days; or - Debts having rescheduled terms of repayment for the first time.
3. Sub-standard debts	- Debts being overdue between 91 days and 180 days; or - Debts having extended terms of repayment for the first time; or - Debts having an exempt or reduced interest because customers are not able to pay the interest according to the credit contract; or - Debts not yet collected within 30 days after the issuance date of the recovery decision; or - Debts in the collection process under inspection conclusions.
4. Doubtful debts	- Debts which are overdue for a period of between 181 days and 360 days; or - Debts which are restructured repayment term for the first time but still overdue for a period of fewer than 90 days under that restructured repayment term; or - Debts which are restructured repayment term for the second time; or - Debts not yet collected between 30 days and 60 days after the issuance date of recovery decision; or - Debts in the collection process under inspection conclusions but being overdue up to 60 days according to recovery term.
5. Loss debts	- Debts which are overdue for a period of more than 360 days; or - Debts having rescheduled terms of repayment for the first time and being overdue more than 90 days according to the first rescheduled terms of repayment; or - Debts having rescheduled terms of repayment for the second time and being overdue according to the second reschedule terms of repayment; or - Debts having rescheduled terms of repayment for the third time or more, regardless of whether the debts are overdue or not; or - Debts not yet collected within 60 days after the issuance date of recovery decision; or - Debts in the collection process under inspection conclusions but being overdue of more than 60 days according to recovery term; or -Debts to credit institutions being announced under special control status by the State Bank of Vietnam, or to foreign bank branches of which capital and assets are blockaded.

Source: Circular 02/2013/TT-NHNN and Circular 09/2014/TT-NHNN issued by SBV

Appendix B **List of Vietnamese Commercial Banks in the sample**

No.	Banks	Abbreviations	Listing date
1.	An Binh Commercial Joint Stock Bank	Anbinh	Non-listed
2.	Asia Commercial Joint Stock Bank	ACB	21/11/2006
3.	Joint Stock Commercial Bank for Investment and Development of Vietnam	BIDV	16/01/2014
4.	Vietnam Export-Import Commercial Joint Stock Bank	Eximbank	20/10/2009
5.	Ho Chi Minh City Development Joint Stock Commercial Bank	HDBank	05/01/2018
6.	Indovina Bank Limited	Indovina	Non-listed
7.	Lien Viet Post Joint Stock Commercial Bank	Lienvietpostbank	14/10/2020
8.	Vietnam Maritime Commercial Joint Stock Bank	Maritime	Non-listed
9.	Military Commercial Joint Stock Bank	MB	18/10/2011
10.	Petrolimex Group Commercial Joint Stock Bank	PGBank	Non-listed
11.	Orient Commercial Joint Stock Bank	OCB	Non-listed
12.	Saigon Thuong Tin Commercial Joint Stock Bank	Sacombank	02/06/2006
13.	Saigon Bank for Industry and Trade	Saigonbank	Non-listed
14.	Saigon Joint Stock Commercial Bank	SCB	Non-listed
15.	Southeast Asia Commercial Joint Stock Bank	Seabank	Non-listed
16.	Saigon - Hanoi Commercial Joint Stock Bank	SHB	20/04/2009
17.	Vietnam Technological and Commercial Joint Stock Bank	Techcombank	22/05/2018
18.	Tien Phong Commercial Joint Stock Bank	Tienphongbank	22/03/2018
19.	Joint Stock Commercial Bank For Foreign Trade of Vietnam	VCB	12/06/2009
20.	Vietnam International Commercial Joint Stock Bank	VIB	16/10/2020
21.	Vietnam Joint Stock Commercial Bank for Industry and Trade	Vietinbank	09/07/2009
22.	Vietnam Prosperity Joint Stock Commercial Bank	VPbank	08/08/2017

Source: Ha Noi stock exchange; Ho Chi Minh stock exchange and Author's summary

Appendix C **The empirical results of the first stage estimations (Chapter 3)**

Explanatory variable	**2SLS**	
	First-stage $-Capital_{it}$	
	(1)	**(2)**
$\frac{\mathrm{NPL_{it}}}{\mathrm{LLR_{it-1}}}$	0 .02	0.01
	(0.09)	*(0.07)*
$\frac{\mathrm{NPL_{it}}}{\mathrm{LLR_{it-1}}}$ x D_{GDP}	-0.03	
	(-0.13)	
$\frac{\mathrm{NPL_{it}}}{\mathrm{LLR_{it-1}}}$ x D_{Ratio}		0.04
		(0.12)
$\mathrm{ROE_{it}}$	-0.04	-0.04
	(-1.48)	*(-1.55)*
$\mathrm{Capital_{it-1}}$	0.68***	0.67***
	(7.02)	(6.96)
$\mathrm{Size_{it}}$	-0.09*	-0.09*
	(-1.92)	*(-1.77)*
$\mathrm{Expenses-management_{it}}$	1.28***	1.29***
	(2.90)	*(2.92)*
$\mathrm{Liquidity_{it}}$	1.89*	1.94*
	(1.81)	*(1.79)*
$\mathrm{Ownership_{it}}$	0.43	0.41
	(0.64)	*(0.54)*
$\mathrm{Inflation_{t}}$	0.08*	0.08
	(1.66)	*(1.45)*
$\mathrm{Money\ supply_{t}}$	0.16	0.17
	(1.27)	*(1.17)*
$\mathrm{GDP_{t}}$	0.67	0.68
	(0.76)	*(0.66)*
Constant	-7.74	-7.77
	(-1.02)	*(-0.93)*
No. of Obs.	*191*	*191*
R^2	*0.7711*	*0.7710*
Wald χ^2	*482.38*	*495.87*
Log likelihood	*-241.19*	*-247.935*

Note: t statistics in parentheses

*, **, *** denote significance at 10%, 5%, 1% respectively

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