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Unveiling the effect of non-performing loans on lending behaviour: Evidence from Vietnam's banking system

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Abstract

This study shows how non-performing loans (NPLs) and other variables specific to banks affect loan growth and the risk-weighted composition of assets in the Vietnamese banking sector. We use a large panel dataset of Vietnamese commercial banks from 2008 to 2022 and different econometric estimators to look at how NPLs, loan loss provisions (LLPs), and bank-specific factors affect how banks lend money. Additionally, we conduct a sensitivity analysis to bolster the robustness of our empirical findings. Our analysis reveals a statistically significant inverse relationship between NPLs/LLPs and loan growth rates, underscoring the critical role of effective credit risk management. Furthermore, institutional characteristics such as bank size, liquidity position, profitability metrics, and tangible asset ratios substantially influence lending patterns and risk exposure. Conversely, macroeconomic and broader institutional factors demonstrate mixed effects, with many exhibiting statistical insignificance. This study addresses a notable gap in the extant literature concerning the determinants of bank lending behaviour in Vietnam, offering nuanced insights into the role of credit risk indicators and bank-specific attributes. Our findings yield substantial implications for regulatory bodies, policymakers, and banking executives in their pursuit of enhancing the stability and operational efficiency of Vietnam's financial system. By elucidating these relationships, our research contributes to the ongoing discourse on banking sector dynamics in emerging economies. It provides an empirical foundation for informed decision-making in financial policy and risk management strategies.

1. Introduction

The banking industry is a central part of financial development in any country and is crucial in the enhancement of a nation's economy. However, Ghosh (2015) observes that non-performing loans (NPLs) pose several challenges to the functioning of integrated banking structures and lead to credit development issues. According to Louzis, Vouldis, and Metaxas (2012) NPLs, defined as loans that are either non-performing or potentially non-performing due to their likelihood of write-off, negatively impact the level of profits, entail increased risks, and potentially limit the credit supply for banking institutions. Lending behaviour on the basis of NPLs has, therefore, emerged as a topical issue in the recent past, specifically due to the credit crunch effect on the global economy and ensuing recessions (Ari, Chen, & Ratnovski, 2019). Vietnam, being an emerging

economy in Southeast Asia, has seen a fairly satisfactory rate of economic growth and financial sector development in the last one and a half decades. Nevertheless, the country's banking structure has also had issues with or concerning NPLs (Batten & Vo, 2019). The State Bank of Vietnam (SBV) has implemented various measures to address the problem, including enhancing provisioning and improving the management of bad debts (IMF, 2019). However, the stock of NPLs in Vietnam's banking system is still a problem, and additional research is required concerning their influence on credit practices.

Previous research has sought to identify the antecedents and outcomes of NPLs in different settings. It is in this regard that research has established that factors like gross domestic product (GDP), inflation, and unemployment affect the level of NPLs, as noted by Beck, Jakubik, and Piloiu (2015) and Ghosh (2015). Researchers have established that other macro variables, including the bank's organizational structure, size, and general management policies and procedures for handling loans and advances, significantly influence the level of NPLs (Berger & DeYoung, 1997; Louzis et al., 2012). Ari et al. (2019) and Cucinelli (2015) also examined the extent to which NPLs affect the features of banking activities, the bank's performance, and the stability of the financial systems. Nonetheless, there is still limited extensive literature that exhaustively examines the case of Vietnam for the presence of NPLs, especially concerning the lending pattern using the panel data method. So, this study will try to do a full investigation of the Vietnamese banking system to find out how strongly there is a link between NPLs and credit growth. It will also try to find ways to lessen the impact of the many macroeconomic and bank-specific factors that could change the study's results. The study will use cross-section time series data, as the data collected will enable the analysis of cross-sections and variations within the same fiscal year; hence the time series (Baltagi, 2005).

The main objectives of this study are as follows: This paper aims at investigating three important questions: (1) What factors affect NPLs in the context of the Vietnamese banking sector? (2) What are the effects of NPLs on credit expansion rate? And (3) what outcomes should be expected with the current policies and measures for NPL and prospects for healthy credit in Vietnam? Therefore, the purpose of the subsequently presented study is to enhance the existing theoretical understanding of NPLs and lending behavior, specifically within the Vietnamese context. The studies' findings will also be useful for policymakers, regulators, and bank managers in Vietnam who are struggling to work the effects of NPLs and sustain credit growth.

The following sections include the literature review, research methodology, research findings, and conclusions. The literature review discusses the relevant issues of non-performing loans and lending behaviour to develop the estimation model. The research methodology section then demonstrates the appropriate estimation approach for the research model. The research findings provide detailed estimation results with relevant discussions of research implications. Finally, the conclusion section summarizes the whole research paper.

2. Literature Review
2.1. The Key Concepts

The topic of the analysis of lending behaviour is one of the significant areas of banking activity and has been discussed by many researchers from various countries. As a result of the various variables that have been employed in trying to explain the lending behaviour of the financial institutions, each of the variables offers a different perspective on the institutions' decisions. The most commonly used proxy, the loan growth rate, illustrates the development of the banks' loan product over a specific period (Altunbas, Gambacorta, & Marques-Ibanez, 2010; Gambacorta & Mistrulli, 2014). This proxy is helpful in understanding the extent of the banks' capacity and motivation to dispense loans and the strategies they employ in lending. Another widely employed measure that indicates the bank's lending activities is the loan-to-deposit ratio (LDR), which is calculated as the total loans divided by the total deposits (Berger & Udell, 1995; Foos, Norden, & Weber, 2010). An LDR greater than 1 means that banks are more willing to give out loans as they employ more of their deposits to make loans. On the other hand, a lower LDR indicates that the banks are not liberal with the amount of loan they are providing and, thus, are holding more deposits as a form of safety in case of default. The ratio of RWA to total assets has also been employed in the literature to show the bank's lending behaviour (Hasan, Horvath, & Mares, 2018; Košak, Li, Lončarski, & Marinč, 2015) to acknowledge the possibility of risk that is associated with different types of assets, especially loans, and provides a more realistic view of the banks' activities in lending. Hence, a high value of RWA to total assets means that the banks are involved in risk-taking in their lending, while a low value means that the banks are cautious in their lending activities.

For that reason, there are numerous factors that affect the behaviour of banks in lending; these include economic conditions at a broader level as well as characteristics of the individual banks. The most important factor that influences the lending behaviour of the banks is the level of non-performing loans (NPLs) of the banks (Berger & DeYoung, 1997; Louzis et al., 2012). Non-performing loans (NPLs) are loans that have either defaulted or are likely to default, and their presence on the bank's balance sheet is detrimental. With the level of NPLs rising, banks usually become more cautious and stricter in their lending practices, and thus, there will be slower loan growth and a careful approach to credit extension. Global economic conditions and macroeconomic variables like economic development, inflation rates, and interest rates also influence the lending activities of banks (Abaidoo & Agyapong, 2023; Gambacorta & Mistrulli, 2014; Jiménez & Saurina, 2006). In the course of

economic growth, banks are more confident about the client's capacity to repay the loans and, therefore, provide more credit. Therefore, during periods of economic recession, the same banks may choose to adopt a more conservative approach, thereby reducing the amount of funds they advance to the public. The lending process is also influenced by inflation and interest rates, as higher rates can impact the cost of borrowing and, consequently, the demand for loans. Other factors that are also relevant to lending behaviour include size, liquidity, and capitalization of the bank, among others (Altunbas et al., 2010; Foos et al., 2010). Larger banks have more capital and are less exposed to losses, so they can lend during economic downturns. Banks that are better capitalized and have a higher equity-to-assets ratio are also more likely to lend more since they have a better position in the case of losses. Liquidity, or the ability of banks to meet their short-term liabilities, is another factor that influences lending behavior, as more liquid banks are better equipped to finance loan growth. The legal framework and the practices of supervision also influence lending activity (Berger & Udell, 1995; Košak et al., 2015). Basel Agreements such as capital adequacy requirements, which require banks to hold a specific level of capital against risk-weighted assets, can limit their ability to extend credit. Other supervisory measures, such as on-site audits and off-site surveillance, also impact lending activities, as banks may adjust their operations to comply with regulatory requirements and reduce potential fines.

2.2. Non-Performing Loans and Lending Behaviour

The effects of non-performing loans (NPLs) on credit expansion and banks' lending behavior have garnered significant attention in banking and finance literature. Cucinelli (2015) sought to examine the effect of NPLs on bank lending in the context of the Italian banking system over the period 2007–2013 with a sample of 488 banks. The study also established that high NPL ratios led to a decrease in credit supply, as they prompted banks to exercise greater caution in their lending activities and increase their sensitivity to credit risks. This finding highlights the detrimental effects of Nonperforming Loans (NPLs) on bank lending, as the accumulation of nonperforming loans can restrict a bank's ability to provide credit to the real economy. Ari et al. (2019) proposed a new dataset of NPLs in banking crises for 88 banking crises in 78 countries during the period of 1990-2017. They agreed that the provision of credit and the rehabilitation of the banking industries in the post-crisis period are likely to suffer significantly from high NPLs. So, the research that looked at the link between NPLs and economic performance found that countries with more NPLs have slower credit growth. This shows how important it is to use the best practices to stop NPLs and their effects on the banking system and economy as a whole. Espinoza and Prasad (2010) investigated the macroeconomic consequences of NPLs for the Gulf Cooperation Council (GCC) countries using the panel vector autoregressive (VAR) model. They also pointed out that, due to high NPLs such as these, the formulation of strict lending policies by the banks toward the private sector limits credit and economic activities. The study also observed that the non-performing loans (NPLs) have a feedback effect on the macroeconomic conditions. Specifically, a poor macroeconomic environment can lead to an increase in the NPL situation, which in turn can impact the stability and growth of the financial sub-sector. In their study, Accornero, Alessandri, Carpinelli, and Sorrentino (2017) analysed the effects of NPLs on the supply of credit from banks in Italy with the help of the data set that links banks' balance sheet data with the data on firms. They found that banks with high NPLs have slow credit expansion since the weight of the impaired assets hampers the institution's ability to approve new loans and raise its funding expenses. This analysis also revealed that NPLs primarily restrict credit supply to small and risky firms, potentially worsening credit conditions for susceptible firms and influencing the distribution of credit in the economy.

Later works have also attempted to expand on the channels by which NPLs influence lending patterns and the possible solutions to the NPLs issue. Balgova, Nies, and Plekhanov (2018) evaluated the effectiveness of NPL reduction concerning credit growth in Central, Eastern, and Southeastern Europe and included a new bank-level data set. The authors found that reducing NPLs can lead to a significant increase in credit levels, as banks can free up funds and capital previously used for managing the problematic loans. The research under consideration underscores the importance of effective NPL-resolution mechanisms, such as advance market commitment (AMC) and secondary markets for NPLs, in eliminating non-performing assets from banks' balance sheets and fostering credit growth. Karadima and Louri (2020) studied the impact of NPLs on credit rationing in the Greek banking system based on novel panel data on bank-firm linkages. They established that banks with high levels of NPLs experience higher levels of credit rationing as they become more discerning in their lending and only offer credit to borrowers who are least likely to default. However, the study also highlighted the significance of having adequate bank capital in mitigating the negative impacts of NPLs, as well-capitalized banks are able to absorb losses and maintain their business operations despite having high levels of NPLs.

Although there is a vast literature on NPLs and lending behaviour, research on the Vietnamese context is still rather scarce. Nguyen and Dang (2018) conducted a study to investigate the factors influencing the incidence of Non-Performing Loans (NPLs) in Vietnam's banking sector. They concluded that both macroeconomic factors, such as economic growth and inflation rate, and micro factors, like the size and capital position of the banks, influence the level of NPLs. In the previous studies done by Batten and Vo (2019) on the determinants of bank profitability in Vietnam, they established that NPL is unfavourable to banks. In the case of the studies conducted in the Vietnamese environment, Nguyen (2017) studied the connection between NPLs and the efficiency of Vietnamese banks and established that the efficiency decreases as the NPLs increase. To

the author's knowledge, no empirical study using panel data analysis has explored the impact of NPLs on lending practices in Vietnam. This research aims to accomplish this by conducting a comprehensive and accurate analysis of the relationship between Non-Performing Loans (NPLs) and credit growth in Vietnam's banking sector, as well as other macroeconomic and banking factors.

2.3. Variables of the Research

This study thus employs two measures of the dependent variable to look at two distinct features of the shift in lending behaviour in the Vietnamese banking industry. The first dependent variable is the loan growth rate, which is the growth rate of loan stock which is provided by Vietnamese banks in a certain period of time (Altunbas et al., 2010; Gambacorta & Mistrulli, 2014). The loan growth rate directly indicates the banks' willingness and capacity to extend credit and the overall banking culture. The purpose of this paper is to investigate the variation in loan growth in a bid to understand how the existence of NPLs and other factors influence the lending process. The second dependent variable applies the RWA to the total assets ratio, which measures the level of risk that is present in the banking institutions' lending activities (Hasan et al., 2018; Košak et al., 2015). The RWA-to-total-assets ratio considers the risk associated with the bank's assets, including loans, providing a more comprehensive view of the bank's lending activities. Therefore, a high value of RWA to total assets implies that the bank has extended more credit facilities to its clients, while a low ratio shows the bank has been cautious in its lending business. This paper will adopt the loan growth rate and RWA-to-total-assets ratio as dependent variables to examine the lending behavior in Vietnam's banking sector. The loan growth rate captures the net movement in the amount of loans, while the ratio of RWA to total assets shows the banks' inclination to risky lending. Thus, all these factors make it possible to track trends in lending and dependence on NPLs.

The research independent variable of interest in this study is the level of Non-Performing Loans (NPLs) of the Vietnamese banks. NPLs are defined as loans that either are not performing or are almost not performing, and the presence of such loans in the banks' balance sheets can significantly affect the banking operations of lending (Berger & DeYoung, 1997; Louzis et al., 2012). In this work, we will assess NPLs using the NPL ratio, which represents them as a proportion of total loans. This ratio allows us to compare the size of NPLs across various banks, thereby providing a benchmark for the assessment of NPLs. LLP is the second independent variable that this study uses to explain the effects of credit risk on lending policy. LLPs, an asset side of the banks' balance sheet, serve as a provision for expected losses from loans advanced to borrowers (Bouvatier & Lepetit, 2012; Ozili & Outa, 2017). The level of LLPs is the function of banks' evaluation of the credit risks arising from the lending processes, which can affect the decisions on the credit policies of the banking institutions. In this study, we will compute LLPs using the LLP ratio, which represents the ratio of loan loss provisions to total loans. This implies that banks with low LLP ratios anticipate fewer credit losses and, therefore, may extend credit more liberally, encompassing both Non-Performing Loans (NPLs) and Loan Loss Provisions (LLPs). These predictors of the dependent variable aid in elucidating the impact of credit risk on the lending practices of the Vietnamese banking system. Non-performing loans are the actual defaults on credit facilities, while loan loss provisions (LLCs) are the bank's provision of the probable losses from credit risk. Therefore, this paper attempts to define credit risk and its impact on the lending operations of banking institutions using the two variables it examines. This study has reviewed the effects of Non-Performing Loans (NPLs), Limited Liability Companies (LLPs), and lending behavior to inform future research in the literature review. Due to increased risk aversion and stricter lending criteria by the banks, more NPLs and LLPs typically correlate with lower lending levels (Berger & DeYoung, 1997; Bouvatier & Lepetit, 2012). Nevertheless, the nature of this relationship might differ depending on the characteristics of the banking system and economy in question. Therefore, this study enriches the literature on the effect of NPLs and LLPs on lending behaviour in Vietnam and how credit risk influences banks' lending strategy in an emerging market context.

In order to control for other factors that could affect lending behaviour and the level of NPLs, this study includes other control variables that relate to banks' specific attributes and the general economic environment. The size of the bank has also been included in the model; the total assets of the bank are taken in logarithmic form because it is believed that large and small banks may have different lending behaviour (Altunbas et al., 2010; Foos et al., 2010). Large banks may possess more resources and product lines, enabling them to manage issues and continue lending when other institutions must cease. Berger and Udell (2004) have also emphasized the use of other ratios, like the liquidity ratio, to regulate the impact of bank liquidity on lending activities. Hence, organizations with high liquidity ratios here will be in a position to meet their short-term commitments, which affects the growth of the loans in the clients' books and subsequently their lending powers.

The model incorporates the annual growth rate of Vietnam's GDP as a macroeconomic factor to examine the impact of economic conditions on lending (Gambacorta & Mistrulli, 2014; Jiménez & Saurina, 2006). During the phases of economic growth, the banks may have a more positive perspective towards the borrowers' ability and willingness to repay the loans and hence Approve more credits. The model incorporates the Consumer Price Index (CPI) for the annual inflation rate as a control, as the stability of prices is crucial for lending (Berger & Udell, 2004). This, in turn, can affect the interest rates and the demand for loans, which in turn can affect the choice of the banks' loaning strategies, as Abaidoo and Agyapong (2023) noted. Lastly, the lending interest rate is the other control variable that reflects the interest rates' effect on the decision to lend (Gambacorta &

Mistrulli, 2014). Higher interest rates reduce the tendency to borrow and, in turn, reduce the demand for loans, which affects the banking sector's role in lending.

3. Research Methodology

This study employs panel data analysis, a methodological approach that synthesizes cross-sectional and time-series data (Gujarati & Porter, 2009). The empirical investigation utilizes a comprehensive panel dataset encompassing Vietnamese commercial banks over the period 2008-2022. Data acquisition involved multiple authoritative sources, including the State Bank of Vietnam (SBV), the World Development Indicators (WDI), and individual banks' annual reports. Specifically, credit growth metrics, non-performing loan (NPL) ratios, and other pertinent financial parameters were extracted from SBV records and banks' financial statements. Macroeconomic indicators, namely GDP growth and inflation rates, were sourced from the WDI database. The sample comprises 36 commercial banks operating within Vietnam, representing a substantial proportion of the nation's banking sector. The study selected banking institutions based on the availability of data and the reliability of their reporting over the specified temporal range. We systematically excluded banks with incomplete or inconsistent data from the sample to ensure analytical robustness and mitigate potential biases, following established econometric practices (Wooldridge, 2010). Table 1 presents a detailed specification of the variables incorporated in this study, delineating their operational definitions and measurement protocols.

Table 1. Variables' specification.

Variable	Abbreviation	Definition
Loan growth rate	LGR	The annual change in the volume of loans issued by banks
Risk-weighted assets	RWA	The risk-weighted assets to total assets ratio
Non-performing loan	NPL	The proportion of non-performing loans to total loans
Loan loss provision	LLP	Calculated as the proportion of loan loss provisions to the aggregate loan portfolio
Firm size	TA	Natural logarithmic transformation of total asset value
Liquidity	LQ	Expressed as the quotient of current assets to current liabilities
Tangibility	TAN	Quantified as the proportion of fixed assets relative to total assets
Profitability	PRO	Measured by the ratio of earnings before interest and taxes (EBIT) to total assets
GDP growth	GDPGR	The mean logarithmic value of per capita GDP growth was adjusted for constant 2010 US dollars.
Inflation	INFLA	Average consumer price index (CPI), representing the annualized percentage fluctuation in the cost of a standardized basket of goods and services for the typical consumer, with potential adjustments at predetermined intervals (e.g., annually)
Interest rate	Interest	Vietnamese lending interest rate, defined as the mean interest rate imposed by financial institutions on business loans
Size of the banking sector	SBS	Represents the mean ratio of deposit money banks' claims on the domestic real nonfinancial sector to GDP, derived using the following deflation methodology: $$\frac{0.5 \times (F_t/P_{et} + F_{t-1}/P_{et-1})}{GDP_t/P_{at}}$$ Where F_t denotes deposit money bank claims at time t, P_{et} signifies the end-of-period Consumer Price Index (CPI) at time t, and P_{at} represents the average annual CPI at time t
Financial development index	FDI	A multidimensional indicator quantifying the comprehensive state of financial development in Vietnam, encompassing various aspects such as the magnitude, accessibility, and operational efficiency of both financial institutions and markets
Corruption perceptions index	CPI	The perceived extent of public sector corruption within a nation, as assessed through standardized metrics

To investigate the influence of non-performing loans (NPLs) on lending behaviour, this research utilizes a dynamic panel data model, which addresses potential endogeneity issues and accounts for persistence in the dependent variables (Arellano & Bond, 1991). The dataset comprises financial statement information from all 36 Vietnamese commercial banks, complemented by macroeconomic indicators sourced from the World Bank Open Data repository and Transparency International, spanning the period 2008-2022. Lending behaviour is conceptualized as a function of k bank-specific explanatory variables (X) and l macroeconomic variables (Z). In this framework, X_{jit} denotes the jth variable for bank i at time t, where $j \in [1, k]$, while Z_{nt} represents the nth macroeconomic variable at time t, where $n \in [k+1, l]$. The functional relationship is expressed as follows:

$$Y_{it} = \sum_{j=1}^{k} \beta_j X_{jit} + \sum_{n=k+1}^{l} \beta_n Z_{nt} + c_i + \varepsilon_{it}$$

In this equation, Y_{it} represents the dependent variables under investigation, specifically the loan growth rate (lgr) and risk-weighted assets (rwa). The term c_i captures time-invariant unobserved heterogeneity (capturing bank-fixed effects), and ε_{it} is the standard error of the estimated equation. The vector X represents multiple bank-specific determinants of Y such as size (ta), liquidity (lq), profitability (pro), and tangibility (tan). The vector Z represents several other macroeconomic determinants such as GDP growth (gdpgr), inflation rate (infla), interest rate (interest), the size of the local banking system (sbs), the country's financial development index (fdi), and the country's corruption perception index (cpi). Table 2 provides the descriptive statistics for the variables used in the study, summarising their key characteristics such as mean, standard deviation, and range (minimum and maximum values).

Table 2. Descriptive statistics of the variables.

Variable	Mean	Standard deviation	Min.	Max.
Loan growth rate (LGR)	0.503	0.211	0.077	0.930
Risk-weighted assets (RWA)	0.408	0.188	0.042	0.868
Non-performing loan (NPL)	1.207	1.246	0.014	5.194
Loan loss provisions (LLP)	25.383	1.728	21.259	30.079
Bank size (TA)	27.105	1.553	23.881	30.846
Liquidity (LQ)	2.182	1.857	0.318	16.172
Tangibility (TAN)	25.205	2.210	17.428	30.399
Profitability (PRO)	0.156	0.171	-1.079	0.862
GDP growth (GDPGR)	0.060	0.015	0.036	0.090
Inflation (INFLA)	0.085	0.112	-0.021	0.416
Interest rate (Interest)	0.098	0.032	0.070	0.184
Size of bank sector (SBS)	0.171	0.044	0.132	0.300
Financial development index (FDI)	0.379	0.036	0.290	0.510
Corruption perception index (CPI)	32.600	4.352	27	42

This study uses various estimators like FGLS, PCSE, DPF, and GMM. (Parks, 1967) uses the Feasible Generalized Least Squares (FGLS) technique to handle panel data with heteroscedasticity and autocorrelation of standard errors. FGLS is especially recommended when the residuals are nonlinear and auto-correlated or when the error terms vary across the observations. Hence, FGLS is more efficient and less biased when compared to Ordinary Least Square (OLS) in cases where these problems are present (Wooldridge, 2010). Many empirical works have used FGLS estimates to establish the factors influencing banks' lending activities. For instance, Louzis et al. (2012) used FGLS to examine the factors that affect NPLs in the context of the Greek banking sector with regard to macroeconomic and bank characteristics. Another estimator employed in this study is the Beck and Katz (1995) Panel Corrected Standard Errors (PCSE), which is appropriate to address heteroscedasticity and contemporary correlation problems in the panel data models. PCSE is useful when the number of cross-sectional units (N), that is, the banks in this case of the study, is larger than the number of time periods (T); this is the common situation in banking research (Reed & Ye, 2011). Therefore, PCSE gives better and more reliable results, and it is simple to check the hypothesis. Some papers have also employed the PCSE estimator to identify the factors influencing the lending activities of the banking industry.

Since the dependent variables in this case are fractional (i.e., limited between 0 and 1), Papke and Wooldridge (2008) introduced the DPF model. We most commonly use the DPF estimator when the dependent variable is a ratio, such as the loan growth rate or the RWA-to-total-assets ratio, in the analysis of bank lending behavior. This means that the DPF estimator gives accurate and consistent results because it takes into account the dependent variable's fractional nature and the possibility of dynamic effects (Elsas & Florysiak, 2011, 2015). Although the DPF estimator is the youngest among the above-mentioned estimators, it is actively used in banking literature. For instance, Brei and Schclarek (2015) used the DPF estimator to analyse the factors

influencing bank lending in a group of Latin American countries, particularly emphasizing the government's ownership percentage. Arellano and Bover (1995) and Blundell and Bond (1998) introduced the System Generalized Method of Moments (GMM) estimator, another widely used estimator in the literature to manage the endogeneity and dynamics problem.

4. Research Findings

NPLs and LLPs are two critical measures of credit risk that many scholars have analysed regarding their effects on banks' lending policies. Hence, the present study offers substantial supporting data for the hypothesized inverse relationship between these credit risk indicators and the loan growth rate in Vietnam's banking industry. The results from all four estimators (FGLS, PCSE, DPF, and GMM) consistently show a negative correlation between the levels of NPLs and LLPs and loan growth rates, aligning with the findings of Cucinelli (2015) and Ghosh (2015). The magnitude of the coefficients varies slightly among the estimators, with the GMM estimator demonstrating the highest impact due to its ability to manage endogeneity and dynamic panel bias (Roodman, 2009). This implies that Vietnam's banking system still requires significant improvement in effective credit risk management to curb the rise in NPLs and LLPs. Policymakers and regulators should prioritize the development of a robust regulatory framework and supervisory mechanisms to address the issue of NPLs. At the same time, banks should focus on maintaining a high-quality loan portfolio and setting aside adequate loan loss provisions.

The study also reveals the variation in the impact of bank-specific variables on loan growth rates. It also turns out that banks' total assets positively affect the loan growth rate, in conjunction with Foos et al. (2010) and Louzis et al. (2012) studies. This indicates that larger banks may have more resources and lending capabilities. The coefficients of liquidity and profitability are negative, which shows that the two variables negatively affect loan growth rate, meaning that banks with high liquidity and profitability may have a low loan growth rate due to conservative lending strategies or focusing on the quality of the loans given out (Cottarelli, Dell'Ariccia, & Vladkova-Hollar, 2005; Louzis et al., 2012). Tangibility, which is defined as the ratio of fixed assets to total assets, has a negative impact on loan growth rate in the DPF and GMM models following the literature on tangible banks, which have been noted to be conservative and less likely to participate in risky lending (Berger & Udell, 1995). It does not find any evidence that supports that GDP growth and interest rates are the determinants of the loan growth rate, contrary to some of the previous research (Demirgüç-Kunt, Detragiache, & Tressel, 2008; Gambacorta & Mistrulli, 2014). This entails that the relationship between economic growth, borrowing costs, and lending activities could be modified by threshold effects, time delays, or asymmetry (Ivanović, 2016). The findings of Cottarelli et al. (2005) and Stepanyan and Guo (2011) are also supported by the results, particularly the negative effect of inflation on the loan growth rate, which supports the need to control inflation. Other institutional factors that significantly impact lending behavior include the size of the banking sector, the financial development index, and the corruption perception index of the economy. The negative sign of the size of the banking sector on loan growth rate agrees with the result of Tabak, Fazio, and Cajueiro (2012), who pointed out that increased competition in the banking sector may lead to a decline in the loaning activity. Hence, there is a need to promote financial sector development to increase the loan growth rate, as pointed out by Brei and Schclarek (2015); Ivanović (2016) and Love and Mylenko (2003). CPI also has negative coefficients with the loan growth rate, similar to Park (2012) and Weill (2011) and the rationale is that augmented corruption reduces loan expansion.

Table 3 presents the estimation results for the loan growth rate and risk-weighted assets models adopting FGLS, PCSE, DPF, and GMM estimation approaches.

Table 3. Estimation result for loan growth rate and risk-weighted assets.

Variables	Loan growth rate (lgr) model				Risk-weighted assets (rwa) model			
	FGLS	PCSE	DPF	GMM	FGLS	PCSE	DPF	GMM
Non-performing loan (npl)	-0.010*	-0.010**	-0.005*	-0.023**	-0.007	-0.007	-0.004	-0.104
	(0.005)	(0.005)	(0.004)	(0.042)	(0.005)	(0.004)	(0.004)	(0.146)
Loan loss provisions (llp)	-0.017**	-0.017*	-0.033***	-0.087**	-0.031***	-0.031***	-0.036***	-0.091*
	(0.008)	(0.009)	(0.008)	(0.033)	(0.008)	(0.006)	(0.007)	(0.049)
Bank size (ta)	0.059***	0.059***	0.088***	0.197***	0.068***	0.068***	0.079***	0.209***
	(0.009)	(0.009)	(0.012)	(0.040)	(0.008)	(0.009)	(0.008)	(0.041)
Liquidity (lq)	-0.066***	-0.066***	-0.019***	-0.035***	-0.066***	-0.066***	-0.049***	-0.038**
	(0.004)	(0.006)	(0.003)	(0.011)	(0.003)	(0.005)	(0.003)	(0.014)
Tangibility (tan)	-0.010	-0.010	-0.011*	-0.056***	-0.038***	-0.038***	-0.028***	-0.087***
	(0.007)	(0.007)	(0.006)	(0.017)	(0.007)	(0.007)	(0.006)	(0.028)
Profitability (pro)	-0.205***	-0.205***	-0.125***	-0.008	-0.057	-0.057	-0.058**	-0.078
	(0.038)	(0.038)	(0.032)	(0.060)	(0.036)	(0.037)	(0.029)	(0.144)
GDP growth (gdpgr)	-0.290	-0.290	-0.269	-0.251	-0.296	-0.296	-0.311	-0.108
	(0.507)	(0.293)	(0.535)	(0.369)	(0.477)	(0.180)	(0.350)	(0.888)
Inflation rate (infla)	-0.105	-0.105**	-1.434	-0.077*	-0.068	-0.068***	-0.063	-0.018
	(0.078)	(0.044)	(0.884)	(0.043)	(0.073)	(0.026)	(0.054)	(0.076)
Interest rate (Interest)	-0.183	-0.183	-0.341	0.010	0.029	0.029	0.041	0.115
	(0.360)	(0.206)	(0.312)	(0.182)	(0.339)	(0.125)	(0.249)	(0.584)
Size of banking sector (sbs)	-0.567	-0.567**	-0.815	-0.390	-0.366	-0.366**	-0.377	-0.581
	(0.464)	(0.276)	(0.811)	(0.367)	(0.437)	(0.172)	(0.322)	(1.103)
Financial development index (fdi)	0.571**	0.571***	1.254	0.066	0.366	0.366***	0.308*	0.695
	(0.259)	(0.151)	(0.896)	(0.187)	(0.244)	(0.093)	(0.179)	(0.722)
Corruption perception index (cpi)	-0.001	-0.001	-0.005	-0.003	0.002	0.002	0.001	0.013
	(0.004)	(0.002)	(0.004)	(0.004)	(0.004)	(0.001)	(0.003)	(0.019)
Lagged loan growth rate (lgr_{it-1})			0.644***	0.450***				
			(0.037)	(0.099)				
Initial loan growth rate (lgr_{i0})			0.035					
			(0.040)					
Lagged risk-weighted assets (rwa_{it-1})							0.384***	0.590
							(0.033)	(0.362)
Initial risk-weighted assets (rwa_{i0})							0.038	
							(0.031)	
# Bank years	540	540	540	540	540	540	540	540

$$Y_{it} = \sum_{j=1}^{k} \beta_j X_{jit} + \sum_{n=k+1}^{l} \beta_n Z_{nt} + c_i + \varepsilon_{it}$$

Note: Y_{it} represents two distinct dependent variables in this model specification: the loan growth rate and risk-weighted assets. The term c_i captures time-invariant unobserved heterogeneity (bank-specific fixed effects), while ε_{it} denotes the idiosyncratic error term. X_{jit} symbolizes the jth bank-specific variable for institution i at time t, where $j \in [1, k]$, and Z_{nt} represents the nth macroeconomic variable at time t, where $n \in [k+1, l]$. Table 1 provides a comprehensive delineation of the X_{jit} and Z_{nt} variables that are hypothesized to influence a bank's loan growth rate and risk-weighted assets. In accordance with standard dynamic panel framework (DPF) estimation procedures, the initial loan growth rate (lgr_{i0}) and risk-weighted assets (rwa_{i0}) are incorporated as baseline regressors. To account for temporal effects and to mitigate potential omitted variable bias, year dummy variables and mean values of bank characteristics (X_{jit}) are included in the estimation. However, for conciseness, their corresponding coefficients are not reported in the results. Statistical inference is facilitated through the reporting of standard errors, which are presented in parentheses adjacent to the coefficient estimates. The levels of statistical significance are denoted as follows: *** signifies $p < 0.01$, ** indicates $p < 0.05$, and * represents $p < 0.10$, thereby allowing for the interpretation of the precision and reliability of the estimated effects.

The evaluation of risk-weighted assets in Vietnam's banking system reveals that NPLs, LLPs, size, liquidity, tangibility, and profitability of banks significantly influence the risk weights assigned to them. Therefore, the study also reveals a negative correlation between NPLs and RWA, despite their coefficients not being statistically significant in most regressions, a finding that is consistent with previous studies (Ghosh, 2015; Louzis et al., 2012). This may suggest that banks with higher levels of NPLs will probably have fewer RWA for the reason that they have adopted more cautious credit policies or have been required to do so by the regulator in order to boost up capital (Laidroo & Männasoo, 2017). The results of this study are similar to those from other studies because the coefficients for LLPs are negative and statistically significant in all cases. This is because LLPs are seen as a strategic way to manage credit risk and absorb losses (Laidroo & Männasoo, 2017; Ozili, 2019). The fact that there are many LLPs has somewhat diminished their impact on risk-weighted assets; therefore, proper credit risk management and provisioning are critical to Vietnam's banking system. Similarly, the estimation results of other bank-specific factors are consistent with those of the above studies. The large and positive sign of bank size on risk-weighted assets means that as the bank gets bigger, it may offer more loans and advances to customers, which can raise the risk exposure (Foos et al., 2010; Laidroo & Männasoo, 2017). As expected, the negative signs of liquidity and tangibility on risk-weighted assets mean that banks with high liquidity and high tangibility of assets will have fewer risk-weighted assets (Berger & Udell, 1995). Thus, the mixed results on profitability suggest that the relationship between profitability and bank risk could be more nuanced and contingent on other factors such as the quality of risk management and the conditions of the market (Foos et al., 2010).

5. Conclusion

This paper aims to identify the factors influencing loan growth rates and risk-weighted assets within the Vietnamese banking sector. The findings improve credit risk management, enhance provision capacity, and understand how specific bank characteristics affect lending and risk-taking (Nguyen, Le, & Tran, 2024; Nguyen, Nguyen, Le, & To, 2023; Sarath & Pham, 2015). The analysis of non-performing loans (NPLs) and loan loss provisions (LLPs) demonstrates the importance of responsible lending practices and robust regulatory measures (Khan, Siddique, & Sarwar, 2020). Based on the analysis of bank-specific factors influencing lending and risk-taking, the study underscores the necessity of accounting for individual bank features in credit risk management. This research contributes to the existing literature by examining the impact of key credit risk indicators, specifically NPLs and LLPs, on loan growth and RWAs in Vietnamese banks. The findings provide valuable insights into how certain bank characteristics influence lending behaviour and risk appetite, highlighting the need to incorporate these factors into credit risk management strategies. Finally, the paper adds to the body of knowledge on the determinants of bank lending and risk at the macro-institutional level, although some conclusions remain open for further investigation. Overall, the study deepens the understanding of the relationship between credit risk, bank characteristics, and lending behaviour, offering guidance for policy, regulation, and the management of banking systems in emerging economies.

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