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Bank-specific factors and non-performing loans in the banking sector: Comparative analysis of the Canadian and United States banking sector

Oluwatosin Adetutu Ogunsola

Department of Accounting, Babcock University, Ilishan Remo, Ogun State, Nigeria.

(*Email: ogunsola0001@pg.babcock.edu.ng*)

Abstract

This study aims to examine the nexus between bank-specific factors and non-performing loans, comparing the level of activities managers undertake towards non-performing loans, using data from Canadian and United States banks. There has been a lack of comparative studies researching the effect of bank-specific factors on non-performing loans in Canada and the United States in a single study of lending behavior and the extent of manager efficiency in mitigating the issue of non-performing loans. Consequently, in bridging the gap in the literature and contributing to knowledge, this study examines the effect of bank-specific factors on non-performing loans using a panel regression analysis of standard fixed and Driscoll-K fixed effects. The study explored credit growth, loan loss provisions, bank diversification, operating efficiency, net interest margin, and return on assets as the explanatory variables to measure bank-specific factors. The results of the regression showed that, comparatively, loan loss provisions, bank diversification, operating efficiency, and net interest margin exhibited positive and significant effects on non-performing loans, whereas credit growth and return on assets exerted negative effects on the non-performing loans of banks listed on the Toronto Exchange. On the other hand, while bank diversification, operating efficiency, and net interest margin exhibited positive and significant effects, credit growth, loan loss provisions, and return on assets exerted negative effects on the non-performing loans of banks listed on the New York Stock Exchange. The study recommends that managers implement stringent credit risk assessment frameworks and ensure a loan monitoring system to proactively manage and reduce non-performing loans.

Keywords: Bank diversification, Bank specific factors, Credit growth, Loan loss provision, Net interest margin, Non-performing loan, Operating efficiency.

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1. Introduction

Non-performing loans (NPLs) are a dangerous trend of red flags providing a trajectory of unhealthy banking practices that are detrimental to the banks' asset quality, the owners of the banks, and the economies of nations, as nations become financially vulnerable when the friction in credit performance persists as a consequence of growing NPLs. The economies of Canada and the United States are strategic and important in the community of nations' banking sectors. The banking sectors of Canada and the United States are trapped in a gridlock of unfulfilling loan covenants, and this has become an alarming precedent impeding the sustainable Basel regulations [1, 2]. The stable credit quality of the loan portfolio globally has suffered a significant decline following the impact of the 2007-2008 global financial crisis, and this has deepened the weakening of bank asset quality. Given this, scholars have explored different indicators to evaluate and attempt to understand the concept of credit quality aimed at proffering possible solutions. Studies have considered bank credit quality from the non-performing loans (NPLs) [3-5]. Prior to the global financial crisis of 2008, there had been relative stability in loan portfolios throughout the world. Incidentally, the advent of the global financial crisis and the economic slump from the crisis that hit the capital market had caused a dramatic deterioration in banks' asset quality and a breakdown of loan covenant obligations, creating undue vulnerability in the financial system.

The effects of credit quality during the global financial crisis of 2008 had been very devastating, as banks' asset quality and performance declined, and this brought unprecedented ripple effects on the economy due to the increase in non-performing loans (NPLs). The severity of this crisis and its detrimental impact on various banks' credit performance have compelled researchers and monetary authorities to now focus more on managing credit quality within banks. In fact, when the banking system is working well, economic growth is accelerated, but when it is not, economic progress is impeded, which worsens poverty and heightens the propensity of borrowers [6-8]. In each nation or territory, the performance of the banking sector is a sign of wealth and economic progress, and when these institutions perform poorly, it not only impacts negatively on the growth and structure of a specific region but also the global economy in general [9, 10].

Banks' credit risk is widely recognized as the most influential risk factor impacting banks' performance, and elevated levels of non-performing loans on a bank's balance sheet diminish profitability and overall performance [11]. Given that banks are particularly exposed to credit risk, among other risks, effective management of this risk has become critical for their survival and expansion, and credit risk management serves as an intrinsic determinant of bank performance, directly influencing profitability, Cug and Cugova [12]. Sobarsyah et al. [13] posited that by implementing robust credit risk management practices, banks not only safeguard the sustainability and profitability of their operations but also contribute to economic stability and facilitate efficient capital allocation within the broader economy.

Credit performance is an embodiment of how banks can navigate the various risks (credit risk, market risk, non-performing loans, operational risks, efficiency risk, liquidity risk, and non-compliance) associated with their performance and regulatory requirements [14-16]. One notable setback was the failure to realize that the financial system was overleveraged and undercapitalized following the 2008 global recession. BASEL III came into improve the regulation, supervision, and risk management of the banking sector. It represents a repetitive step in the efforts to improve the banking regulatory framework. Corbet and Larkin [4] said that, according to the Bank for International Settlements, it is still in the process of implementation. The level of supervision and the number of different types of regulations that are applied to the banking system are helping to improve the efficiency and resilience of the global financial system, no doubt, but what is evident is that it is leading to some potential increase in risk. The effectiveness of the regulators, despite the high number of collapsed banks in the system, has come under serious scrutiny in recent times.

Literature shows that banks' poor credit performance is encompassing and critical as one of the bases of the banks' crisis [4, 17-19]. Posited that effective credit performance contributes to global economies, and according to the 2021 report on the Global Economy.com website, Hong Kong tops in banks' contribution to GDP with 269%, followed by China at 214%. The United Kingdom, Germany, South Africa, and Nigeria, respectively, have 136%, 96%, 74%, and 16% [20, 21]. With the relatively low percentage score in Nigeria, it is imperative, therefore, that the banking sector is properly managed, regulated, and appraised to guarantee financial stability in the system and contributions to the national economy. BASEL II, which was released in 2004, expanded on BASEL. It provided guidelines for the calculation of the minimum regulatory capital ratio and confirmation that banks keep a capital reserve equal to at least 8% of their risk-weighted assets. Secondly, it provided the framework for national regulatory bodies to deal with systemic risk and liquidity risk [22, 23].

Resolving the problem of non-performing loans from banks is a complex task that must be addressed in countries like Canada and the United States, among the advanced economies. Consequently, considering the implications of growing non-performing loans, it is imperative to study the bank-specific factors and the continuous lending and repayment habits of borrowers using Canadian banks and United States banks. In contributing to knowledge, this study examines the effect of bank-specific factors on non-performing loans in Canada and the United States of America.

The rest of the study was structured as follows: In Section 2, the study considered the literature review and methodology; in Section 3, data analysis, results, and discussion of findings were presented; and in Section 5, the conclusion, recommendations, limitations, and suggestions for further studies were presented.

2. Literature Review

Prior studies have attempted to research bank-specific factors that affect NPLs using different elements such as income diversification, credit growth, profitability, capitalization, operating efficiency, loan loss provisions, bank size, and net interest margin. Through various studies, the nexus between NPLs and these bank-specific factors has remained unclear, filled with mixed results and divergent opinions. Some studies have found positive significant effects, while others have found contradictory insignificant effects.

2.1. Bank-Specific Factors

2.1.1. Loan Loss Provisions

Banks in Canada and the United States generally tend to cover different loan losses, such as NPLs, lender unfaithfulness, customer repayment uncertainties, possible customer bankruptcy, etc. Incidentally, the lower portion is associated with NPLs, as the banks in these countries have significant NPLs each year [4, 24, 25]. Prior studies have shown that loan loss provision is an indicator of managerial inefficiency, and this is positively associated with bank losses [26-29]. Posited that poor bank asset quality faces higher risk in relation to loan portfolios that reveal higher NPLs [28, 30]. Consistent with the literature, this relationship is considered

Hypothesis 1 (H1a): Loan loss provisions have a significant positive effect on non-performing loans in Canada and the United States.

2.1.2. Credit Growth

Literature has shown that credit growth differs across nations, and its impact on banking non-performing loans differs. It has an impact on banks' operations because of its features, which are considered important indicators of the banking sector's stability [14, 31, 32]. Consistent with the literature, faster credit growth leads to higher loan losses in the United States [33-35]. Posited that loan losses heighten with an increase in the supply of loans from banks due to a declining interest rate, and this makes the procedures for obtaining loans quicker [30, 36-39] noted that banks with a profile of higher credit growth are predisposed to being more vulnerable to NPLs, particularly in developing economies, but advanced economies like Canada and the United States are not spared when bank managers become reckless in loan advancing, and in this instance, uncertainties prevail. Based on prior studies, the following nexus is expected:

Hypothesis 1 (H1b). Credit growth has a significant positive effect on non-performing loans in Canada and the United States.

2.1.3. Bank Diversification

From a global perspective, literature has shown that there are two main sources of income open to banks: interest and non-interest income. Whereas bank interest is earned from different loan classifications and securities, non-interest income is directly from asset management, fees and commission-paying services, trading, and other derivatives available to banks. In recent times, non-interest income signifies a crucial source of bank diversification [40, 41]. Consistent with studies, bank diversification tends to reduce the level of vulnerability and volatility of bank earnings [10, 42, 43]. Argued that bank diversification deepens stockholders' value by shifting emphasis from traditional earnings to non-interest earnings sources [17, 33]. On the contrary, Ghazo et al. [40] pointed out that though non-interest earnings are good sources of income, they increase the vulnerability and volatility of bank earnings. Consistent with these views, this study is expecting the following nexus:

Hypothesis 1 (H1c): Bank diversification has a significant negative effect on non-performing loans in Canada and the United States.

2.1.4. Operating Efficiency

The impact of efficiency cost is complex and quite uncertain and has implications for the NPLs. Scholars have argued that while it is possible that banks that spend less to monitor lending risks make many cost savings, this tends to increase NPLs in the future [24, 44, 45] and this points to the negative effect of lending risk, as NPLs are difficult to control due to low spending on monitoring loans, poor managerial skills, and possible attitudinal lapses and unethical practices. Gashi et al. [44] pointed out that non-interest earnings deepen the volatility of bank income. Consistent with these viewpoints, this study expected the following relationship:

Hypothesis 1 (H1d): Operating efficiency has a significant negative effect on non-performing loans in Canada and the United States.

2.1.5. Net Income Margin

Net income margin has been advanced as a crucial bank-specific factor and has a correlation with NPLs. Gashi et al. [44] argued that the net interest margin has a positive relationship with non-performing loans. In addition, in a similar study, Bhattarai [46] and Wairimu and Gitundu [47] documented that net interest margin has a joint positive relationship with non-performing loans, suggesting that a higher net interest margin has implications and deepens the interest weight. Typically, banks intentionally increase interest margins to minimize default risk, and this has direct implications and associations between interest margins and non-performing loans. Based on this understanding, the following association is expected:

Hypothesis 1 (H1e): Net interest margin has a significant positive effect on non-performing loans in Canada and the United States

2.1.6. Return on Assets

Banks' ability to optimize corporate assets is a core aim of banking operations, and it is believed that highly maximized assets and other corporate assets increase profitability and sustainable growth of banks and at the same time reduce high-risk activities. Resultantly, a persistent adequate return on assets has an inverse effect on non-performing loans [11, 48]. On the contrary, Aysan and Disli [15] argued that credit policy is not the only factor in determining the income of the banks; rather, the reputation and ethical practices of the managers' disposition to implement credit policy play a significant role between

the return on assets and non-performing loans. In addition, studies have documented a negative relationship between return on assets and non-performing loans. Based on this assertion, this study expected the following nexus:

Hypothesis 1 (H1f): Return on assets has a significant negative effect on non-performing loans in Canada and the United States.

2.2. Empirical Review

Aysan and Disli [15] studied the implications and effects of macroeconomic indexes on NPLs. The study considered secondary data extracted from the financial records of the banks' operating activities for the period under consideration. Descriptive statistics and inferential analysis were adopted, as well as ordinary least squares. The results of the study revealed that loan loss provisions negatively affected the performance of the banks for the period under consideration. Sahraoui and Merhoun [38] looked at non-performing loans, an analysis of the relationship between non-performing loans and profitability among European banks. With the use of econometric models and panel data, the thesis examined the relationship between NPL, banks' profitability, and the economic cycle (GDP growth). With the combination of qualitative economic theories, the thesis provided a solid analysis of the relationship and found strong evidence that the NPL ratio has a negative correlation with both the profitability of banks and the economic cycle.

Similarly, Anastasiou et al. [49] considered an empirical examination of the problem of credit performance, non-performing loans, macroeconomic factors, and institutional quality in European countries. The study employed an ex post facto research design, as data extracted from the financial records of the banks selected for the study were used for the estimation. A pooled panel data analysis using a random effects model was employed for the analysis. The results of the study demonstrated that bank specifics impact NPLs in the selected European countries sampled in the study. In the same manner, Wei et al. [50] examined the effect of bank-specific factors on non-performing loans in four selected European countries, France, Germany, Italy, and Spain for a period of 13 years, covering 2005 to 2017. A total of 507 banks were purposively selected from these four countries from the database in each of France, Germany, Italy, and Spain, respectively. The regression analysis using a panel dataset revealed that economic policy, as a measure of bank-specific factors, had a positive effect on non-performing loans in each of the countries sampled in the study.

Kjosevski and Petkovski [43] conducted an empirical examination of the effect of macroeconomic and bank-specific indexes on nonperforming loans in the Republic of Macedonia. The study employed NPLs of corporate businesses and NPLs of households and individual investors as proxies to measure nonperforming loans in the study. An ex post facto approach was adopted as data were obtained from the records and financial books of the banks. The pooled panel data analysis revealed mixed results. While macroeconomic and bank-specific factors had a positive effect on nonperforming loans, corporate businesses and households were negatively affected by the nonperforming loans of the banks, as the banks were incapacitated to release fresh loans to them. Furthermore, Khan et al. [51] studied the determinants of NPLs and their effects on the performance of banking services in developing economies. The study used an ex post facto research approach, using secondary data extracted from the financial statements of the banks selected for the study over a period of 15 years. Total loan growth and NPLs to households and corporate businesses were used as proxies to measure NPLs, while the loans-to-deposit ratio and operating efficiency measured the performance of the banks. The results of the analysis revealed that NPLs had a negative effect on the loans-to-deposit ratio of the banks during the period.

3. Data and Methodology

3.1. Data Collection

In this current study, balanced panel data with 12 banks was explored; the identified and selected banks were listed in Canada and the United States of America. The data frequency was on an annual basis for the period of 10 years, 2015-2024. The study collected data from two main sources. First, the study collected data on bank-specific factor variables from the financial statements of the banks based on the sample size of the study. At the same time, the study cross-checked the data in line with the variables and matched it with the performance of the banks, and missing data were collected from banks listed on the New York Stock Exchange and Toronto Stock Exchange for a period of 10 years, 2015-2024. The bank-specific factor variables included credit growth, loan loss provision, bank diversification, operating efficiency, net interest margin, and return on assets: credit growth (CGT), loan loss provision (LLP), bank diversification (BDV), operating efficiency (OPE), net interest margin (NIM), and return on assets (ROA).

The banks sampled included the Bank of Montreal, the Bank of Nova Scotia, Canada Western Bank, CIBC, Laurentian Bank of Canada, the National Bank of Canada, the Royal Bank of Canada, the Toronto-Dominion Bank, and VersaBank (formerly Pacific & Western Bank of Canada), all listed on the Toronto Stock Exchange, and Bank of America, Bank United Inc., Capital One Financial Corp., Citigroup Inc., Comerica Inc., KeyCorp, PNC Financial Corp., U.S. Bancorp, and Wells Fargo & Company subsidiaries, all listed on the New York Stock Exchange, respectively.

Table 1.
Variance and their measurements.

Variables	Abrev.	Variable Type	Measurement
Non-Performing Loans		Dependent Variable	Ratio of Impaired (NPL) to Total (Gross) Loans
Credit Growth	CGT	Independent Variable	Loans-to- Assets Ratio
Loan Loss Provision	LLP	Independent Variable	Ratio of Non-interest Income to Total Income
Bank Diversification	BDV	Independent Variable	Ratio of Non-interest Income to Total Income
Operating Efficiency	OPE	Independent Variable	Ratio of Non-interest Expenses to Total Assets
Net Interest Margin	NIM	Independent Variable	Difference between Lending and Borrowing Rates
Return on Assets	ROA	Independent Variable	Income before Tax to Total Assets

3.2. Dependent Variable

In this section, the study presents the identified variable to measure non-performing loans as the ratio of impaired non-performing loans to total (gross) loans, which is the identified dependent variable of the study. Importantly, it is essential to clarify that the scope of reported impaired loans may differ from the official classification of non-performing loans. In this instance, the impaired loans are accounting concepts and imply the possibility that creditors may not collect the full amount advanced in line with the loan agreements and have remained unpaid for more than 90 days. Based on this, the study employed non-performing loans as the baseline dependent variable of the study.

3.3. Independent Variable

The study employed bank-specific factors as the dependent variable, which were surrogated using six identified explanatory variables of credit growth (CGT), loan loss provisions, bank diversification, operating efficiency, net interest margin, and return on assets to measure the bank-specific factors in line with the literature [52].

3.4. Model Specifications

The current study used panel data regression analysis the nexus between bank-specific factors and non-performing loans from a comparative viewpoint of banks listed in Canada and the United States of America.

$$NPLs_{it} = \alpha + \beta_1 CGT_{it} + B_2 LLP_{it} + \beta_3 BDV_{it} + \beta_4 OPE_{it} + \beta_5 NIM_{it} + \beta_6 ROA_{it} + \varepsilon_{it}$$

Where

CGT = credit growth, LLP = loan loss provision, BDV = bank diversification, OPE = operating efficiency, NIM = net interest margin, ROA = return on assets, $\alpha = \beta 1\text{-}\beta 6 =$ and ε the error term of the study.

4. Results and Discussion

This subsection presents and discusses the results of the empirical investigation into the relationship between bank-specific factors and non-performing loans (NPLs) in the banking sectors of Canada and the United States. The focus is on assessing how credit growth, bank diversification, operating efficiency, net interest margin, and return on assets influence the level of NPLs in the two countries. The study employed secondary data sourced from the published financial statements of selected listed banks, covering a panel structure suitable for comparative analysis.

The chapter is structured into four main parts. First, a preliminary analysis is conducted, including descriptive statistics (mean, standard deviation), a correlation matrix, and multicollinearity checks using Variance Inflation Factors (VIFs). Second, the core estimations are performed using static panel data approaches: pooled ordinary least squares (OLS), fixed effects (FE), and random effects (RE) models to test the specified hypotheses. Third, Hausman and other model selection tests are used to identify the most appropriate estimation technique. Lastly, post-estimation diagnostics are presented to ensure the robustness and reliability of the results.

The hypotheses tested in this study explore both positive and negative relationships between selected bank-specific indicators and non-performing loans (NPLs), allowing for a comprehensive understanding of the determinants of credit risk in advanced banking systems.

4.1. Preliminaries

This subsection presents the preliminary analysis of the study, providing an initial overview of the data characteristics and relationships among the variables used to examine the determinants of non-performing loans in the banking sectors of Canada and the United States. It begins with descriptive statistics, including graphical presentations, measures of central tendency (mean), and dispersion (standard deviation), to offer insights into the distribution and variability of key bank-specific indicators. The correlation matrix is then used to evaluate the strength and direction of the linear relationships between variables, helping to identify potential associations prior to regression analysis. Finally, the Variance Inflation Factor (VIF) is computed to detect any multicollinearity issues among the independent variables, ensuring the validity of subsequent regression estimates.

4.2. Trend Analysis

This subdivision provides a comparative overview of the trend in non-performing loans (NPLs) between Canada and the United States from 2015 to 2024.

From Figure 1, the trend in non-performing loans (NPLs) between 2015 and 2024 reveals notable fluctuations and a dynamic pattern across both Canada and the United States, with Canada generally exhibiting lower NPL ratios in the earlier

years. From 2015 to 2016, the U.S. recorded higher NPL rates than Canada, peaking at 0.85% in 2016 compared to Canada's 0.53%. However, between 2017 and 2019, both countries experienced a gradual decline, with the gap narrowing significantly in 2019 when Canada slightly surpassed the U.S. at 0.52% versus 0.51%. In 2020, amid global economic disruptions, both countries saw a rise in NPLs, with Canada (0.58%) and the U.S. (0.72%) reflecting increased credit risk. From 2021 to 2022, both economies witnessed improvement, particularly in Canada, where the NPL rate fell to a low of 0.35%. Interestingly, by 2023 and 2024, the trend reversed, with Canada's NPL ratio climbing sharply to 0.79% in 2024, overtaking the U.S. at 0.68%. Overall, while both countries demonstrate sensitivity to economic cycles, the U.S. maintained relatively higher NPL levels in the early years, whereas Canada experienced a sharper rise in later periods, suggesting differing macro-financial responses and credit risk dynamics over the decade.

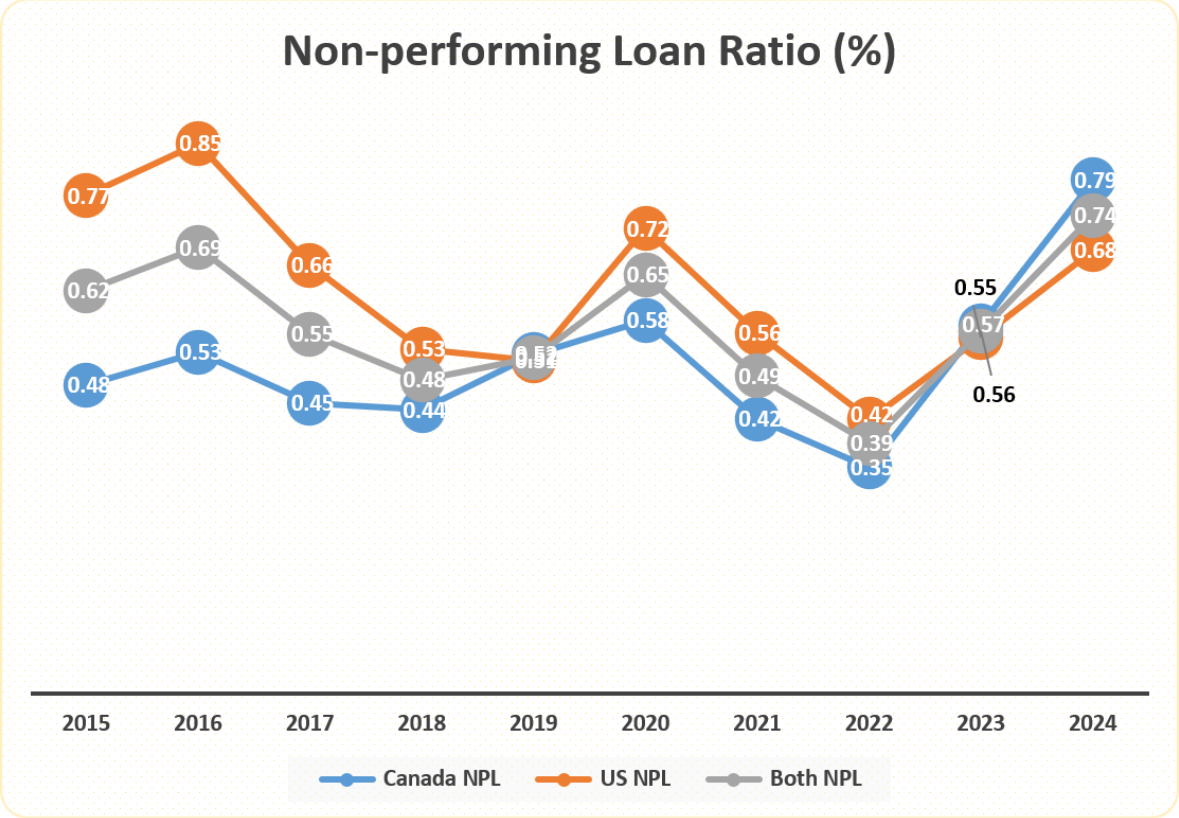

Figure 1.
Non-performing Loan Ratio (%).

4.3. Descriptive Statistics

Table 2 presents the descriptive statistics for the key variables used in the empirical analysis, disaggregated by country and pooled for both Canada and the United States.

Table 2.
Descriptive Statistics.

Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	Canada		US		Both Canada & US	
NPL	0.51	0.27	0.63	0.24	0.57	0.26
CGT	8.69	8.13	3.08	8.69	5.89	8.85
LLP	0.24	0.20	0.61	0.86	0.43	0.65
BDV	23.10	14.78	30.01	11.66	26.55	13.72
OPE	3.10	0.87	3.60	1.19	3.35	1.07
NIM	1.90	0.44	3.16	1.26	2.53	1.13
ROA	0.93	0.28	1.32	0.49	1.12	0.44

Source: Author's Computation. **Note**: NPL = Non-performing Loan, CGT = Credit Growth, LLP = Loan Loss Provision, BDV = Bank Diversification, OPE = Operating Efficiency, NIM = Net Interest Margin, ROA = Return on Assets.

The average non-performing loan (NPL) ratio is lower in Canada (0.51%) than in the U.S. (0.63%), indicating relatively stronger asset quality in the Canadian banking sector. Credit growth (CGT) is markedly higher in Canada (8.69%) compared to the U.S. (3.08%), suggesting more aggressive lending activity, which may have implications for credit risk exposure. Loan loss provisions (LLP), a proxy for expected credit losses, are considerably higher in the U.S. (0.61%) than in Canada (0.24%), reflecting a more conservative provisioning approach or greater perceived credit risk. Bank diversification (BDV) is also

higher in the U.S., with non-interest income forming a larger share of operating income, potentially enhancing income stability. In terms of efficiency and profitability metrics, the U.S. exhibits higher operating efficiency (OPE) and net interest margin (NIM), while return on assets (ROA) is also superior, averaging 1.32% compared to 0.93% in Canada. The standard deviations indicate greater variability in most indicators within the U.S. banking sector, highlighting potential differences in bank size, strategy, and risk profile between the two countries.

4.4. Correlation and VIF Results

The correlation matrix and Variance Inflation Factor (VIF) results presented in Table 3 provide critical insights into the potential presence of multicollinearity among the explanatory variables in the regression models for Canada, the United States, and the pooled dataset.

Table 3.
Correlation and VIF Results.

	NPL	**CGT**	**LLP**	**BDV**	**OPE**	**NIM**	**ROA**	**VIF**	**1/VIF**
NPL	1		Canada						
CGT	-0.432	1						1.25	0.80
LLP	0.519	-0.263	1					1.39	0.72
BDV	0.174	-0.163	0.357	1				2.48	0.40
OPE	0.293	-0.258	0.046	-0.390	1			1.51	0.66
NIM	0.049	0.062	-0.066	-0.541	0.048	1		1.91	0.52
ROA	-0.212	0.230	-0.216	0.020	-0.300	0.323	1	1.43	0.70
Mean VIF								1.66	
NPL	1			United State					
CGT	-0.049	1						1.14	0.88
LLP	-0.175	-0.044	1					5.23	0.19
BDV	0.182	-0.074	-0.318	1				1.84	0.54
OPE	-0.194	-0.127	0.430	-0.459	1			1.53	0.65
NIM	-0.202	0.140	0.666	-0.438	0.441	1		7.39	0.14
ROA	-0.191	0.075	-0.222	0.094	0.051	0.426	1	3.79	0.26
Mean VIF								3.49	
NPL	1		Both Canada & the United States						
CGT	-0.295	1						1.16	0.86
LLP	0.039	-0.157	1					3.46	0.29
BDV	0.222	-0.191	-0.046	1				1.58	0.63
OPE	0.074	-0.239	0.388	-0.327	1			1.49	0.67
NIM	0.028	-0.091	0.643	-0.177	0.409	1		5.39	0.19
ROA	-0.068	-0.035	-0.054	0.163	0.060	0.548	1	3.11	0.32
Mean VIF								2.70	

Source: Author's Computation. **Note**: NPL = Non-performing Loan, CGT = Credit Growth, LLP = Loan Loss Provision, BDV = Bank Diversification, OPE = Operating Efficiency, NIM = Net Interest Margin, ROA = Return on Assets.

Across all three panels, pairwise correlation coefficients are generally modest, with no value approaching the conventional threshold of 0.80, indicating the absence of strong linear dependence among the regressors. Although some moderate correlations exist, particularly between Net Interest Margin (NIM) and Loan Loss Provision (LLP) in the US (r = 0.666) and pooled data (r = 0.643), these do not rise to the level of severe multicollinearity. Consistent with the correlation analysis, the VIF values are highest for NIM and LLP, especially in the US sample (7.39 and 5.23, respectively) and in the pooled sample (5.39 and 3.46, respectively). Nonetheless, all VIF values remain below the commonly accepted conservative threshold of 8, suggesting that multicollinearity is not problematic enough to undermine the reliability of the estimated coefficients. The relatively low mean VIFs—1.66 (Canada), 3.49 (US), and 2.70 (pooled) further reinforce this conclusion and provide statistical assurance regarding the robustness of the regression estimates.

4.5. Regression Results

The regression models estimate the relationship between non-performing loans (NPLs) and several bank-specific factors, including credit growth (CGT), loan loss provisions (LLP), bank diversification (BDV), operating efficiency (OPE), net interest margin (NIM), and return on assets (ROA). The results of the regression models are presented with the coefficients, t-statistics, and significance levels, reflecting the impact of each explanatory variable on NPLs in the banking sectors of Canada, the United States, and both countries combined.

Table 4.
Regression Results.

Variable	Canada		US		Both Canada & US	
	Standard RE		Driscoll-K FE		Driscoll-K RE	
	(1)	(2)	(1)	(2)	(1)	(2)
	Canada	se	Canada	se	Canada	se
CGT	-0.0040**	0.0020	-0.0030	0.0021	-0.0049**	0.0016
LLP	0.2771***	0.0946	-0.0060	0.0446	-0.0328	0.0380
BDV	0.0139***	0.0027	0.0136**	0.0057	0.0103*	0.0049
OPE	0.1687***	0.0231	0.0314*	0.0165	0.0608***	0.0179
NIM	0.3545***	0.0778	0.0438	0.0911	0.0693	0.0435
ROA	-0.0956	0.0852	-0.1540	0.0892	-0.1761***	0.0504
Constant	-0.9502***	0.2189	0.1813	0.2684	0.1554	0.2140
Obs.	100		100		200	
No. of Bank	10		10		20	
F-stat/Wald-chi2	113.7		18.67		155.3	
Prob > F-Stat/chi2	0.0000		0.0000		0000	
R- Squared	0.3628		0.2094		0.1358	
Hauman [Sig.]	7.06 [0.3153]		31.59 [0.0000]		14.92 [0.0209]	
LM [Sig]	95.83 [0.000]		40.84 [0.000]		159.24 [0.000]	
Het. Test [Sig.]	7.29 [0.6978]		87.60 [0.000]		664.01 [0.000]	
CSD [Sig]	1.513 [0.1304]		7.274 [0.000]		6.271 [0.000]	
Serial Corel [Sig.]	3.377 [0.099]		24.101 [0.000]		14.910 [0.001]	

Note: Dependent Variable= Non-performing Loan (NPL), Independent Variables are; CGT = Credit Growth, LLP = Loan Loss Provision, BDV = Bank Diversification, OPE = Operating Efficiency, NIM = Net Interest Margin, ROA = Return on Assets*** p<0.01, ** p<0.05, * p<0.1.

From the results in Table 4, the Hausman and Lagrangian multiplier test (LM) results suggested random effects (RE), fixed effects, and random effects in panels 1, 2, and 3. Additionally, in the Canadian context, credit growth (CGT) has a negative and statistically significant relationship with NPL (coeff. = -0.0040, t-stat. = -2.000, sig. = 0.05), supporting the hypothesis that credit growth contributes to a higher risk of non-performing loans. Bank Diversification (BDV) also shows a significant positive relationship with NPL (coeff. = 0.0139, t-stat. = 5.141, sig. <= 0.01), suggesting that a more diversified bank may have a higher level of non-performing loans. Operating Efficiency (OPE) has a similarly positive and significant effect on NPLs (coeff. = 0.1687, t-stat. = 7.321, sig. <= 0.01), indicating that inefficient banks tend to have higher non-performing loans. However, Net Interest Margin (NIM) and Return on Assets (ROA) do not have significant coefficients, implying that these variables may not directly influence NPLs in the Canadian banking sector. For the United States, the results indicate a more unique picture. Bank Diversification (BDV) and Operating Efficiency (OPE) maintain their positive relationships with NPL, with BDV significant at the 5% level (coeff. = 0.0136, t-stat. = 2.389, sig. <= 0.05), but neither Credit Growth (CGT) nor Loan Loss Provision (LLP) shows significant effects on NPLs. Interestingly, net interest margin (NIM) is not statistically significant in the US, which contrasts with its significant role in Canada. The model diagnostics, including the heteroskedasticity test, Pesaran's test of cross-sectional independence, and autocorrelation in panel data tests, suggest that the random effects model and fixed effects model without and with robust standard errors are appropriate for the analyses in Panels 1 and 2, respectively, and accommodate potential heteroskedasticity and autocorrelation, particularly in Panel 2.

In the combined sample of both countries, the results largely reflect those from Canada, with similar relationships observed for credit growth (coeff. = -0.0049, sig. <= 0.05), bank diversification (coeff. = 0.0103, sig. <= 0.10), operating efficiency (coeff. = 0.0608, sig. <= 0.05), and return on assets (coeff. = -0.1761, sig. <= 0.05). Notably, the coefficient for NIM becomes statistically significant but remains positive, indicating that higher interest margins correlate with higher NPL. This contradicts Hypothesis 4, suggesting that, in the combined sample, NIM may not have the expected negative impact on NPL. Hypothesis 5, regarding the negative relationship between ROA and NPL, is supported in the combined analysis, where a significant negative coefficient for ROA at the 1% level indicates that higher profitability is associated with lower NPLs. Based on the statistical significance of the coefficients and the results from the Hausman, LM, and heteroskedasticity tests, we reject the null hypothesis for Hypotheses 1, 2, 3, and 5 in Canada and accept them in the US, while for Hypothesis 4, we reject the null hypothesis in the combined dataset, suggesting that NIM may not be a key determinant of NPL.

The overall fit of the model, as indicated by the F-statistic and R-squared values, reflects how well the explanatory variables account for the variation in NPLs. For Canada, the F-statistic of 113.7 ($p < 0.01$) and an R-squared of 0.3628 suggest that the model explains about 36.28% of the variation in NPLs, indicating a moderate fit. For the United States, the model explains 20.94% of the variation in NPLs, with a slightly lower F-statistic of 18.67 ($p < 0.01$), which indicates a weaker fit than the Canadian model. In the combined sample of both countries, the overall fit is further reduced, with an R-squared of 0.1358 and an F-statistic of 155.3 ($p < 0.01$), pointing to a lower explanatory power for NPLs in the combined analysis. The standard errors across all models are robust, suggesting that the results are resilient to heteroskedasticity and autocorrelation in the data.

5. Discussion of Findings

The study's regression analysis revealed mixed results in each of the countries of Canada and the United States sampled in this study. The characteristics of the results were found to be in tandem with some prior studies of Ayhan and Kartal [42], who studied the implications and effects of macroeconomic indexes on NPLs, and the results of the study revealed that loan loss provisions negatively affected the performance of the banks for the period under consideration. Sahraoui and Merhoun [38] looked at non-performing loans, an analysis of the relationship between non-performing loans and profitability among European banks, and with the combination of qualitative economic theories, the thesis provided a solid analysis of the relationship and found strong evidence that the NPL ratio has a negative correlation with both the profitability of banks and the economic cycle. Similarly, Kjosevski and Petkovski [43] conducted an empirical examination of the effect of macroeconomic and bank-specific indexes on nonperforming loans in the Republic of Macedonia, and the pooled panel data analysis revealed mixed results. While macroeconomic and bank-specific factors had a positive effect on nonperforming loans, corporate businesses and households were negatively affected by the nonperforming loans of the banks, as the banks were incapacitated to release fresh loans to them. In addition, Khan et al. [51] studied the determinants of NPLs and their effects on the performance of banking services in developing economies, and the results of the analysis revealed that NPLs had a negative effect on the loans-to-deposit ratio of the banks for the period.

6. Conclusion and Recommendations

This study examined the effect of bank-specific factors and non-performing loans in the banking sector, a comparative analysis of the Canadian and United States banking sectors. The study analyzed how bank-specific factors affect non-performing loans using the data of Canadian and United States banks. During the highly reported economic downturn, the economies of Canada and the United States witnessed unprecedented financial crises that drew the attention of the research, and these equally affected other nations of the world. During this period, the banking sector became more vulnerable, and production in each sector decreased. As a result, the repayment capacity of borrowers declined, which intensified and deepened non-performing loans. This paper employed non-performing loans as the dependent variable and bank-specific factors surrogated using credit growth, loan loss provisions, bank diversification, operating efficiency, net interest margin, and return on assets as the explanatory variables of the study. The panel regression models, supported by diagnostic tests, provide a unique understanding of the relationship between bank-specific factors and non-performing loans.

Comparatively, the results showed that all the explanatory variables of loan loss provisions, bank diversification, operating efficiency, and net interest margin exhibited positive and significant effects on non-performing loans, whereas credit growth and return on assets exerted negative effects on the non-performing loans of banks listed on the Toronto Stock Exchange. On the other hand, while bank diversification, operating efficiency, and net interest margin exhibited positive and significant effects, credit growth, loan loss provisions, and return on assets exerted negative effects on the non-performing loans of banks listed on the New York Exchange, United States. In both countries, return on assets specifically exhibited negative and insignificant effects. The statistical significance of key variables, such as credit growth, bank diversification, and operating efficiency, underscores their relevance in both the Canadian and U.S. banking sectors, with variations in their impacts across countries. The robust standard errors further validate the reliability of the estimates, while the overall fit indicates that the models offer a reasonable, though not perfect, explanation of NPL behavior across the banking sectors.

The implications of this study are as follows: First, the results suggest that non-performing loans in Canada and the United States include the inefficiency of asset utilization and slack in credit collection. It is necessary for the banks to create more options and effectively optimize Know Your Customer (KYC) policies to ensure that poor-quality loans are closely monitored and reduced while intensifying diligence and background checks of their customers. Secondly, the means of selling non-performing loans are operationally activated in an effort to ensure efficient debt collection and bankruptcy procedures.

The limitations of this study include, first, the inability to obtain sufficient data on Canadian and United States banks beyond the number explored in this study, and second, the inability to compare the banks in both countries' lending conduct of the borrowers and the extent of KYC in operation in both countries, Canada and the United States. The study suggests that future studies could extend the frontiers in this regard and compare and analyze the lending and repayment behavior of the banks' managers and the customers in both countries using appropriate data.

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