Effect of Bank-Specific Factors on Non-performing Loans Among Commercial Banks in Tanzania

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Abstract

Objective –This paper examines the effect of bank-specific factors on non-performing loans in Tanzanian commercial banks (CBs).

Design/methodology – Using annual data covering the period of 2011 -2020, a quantitative study methodology was employed. The authors used a one-step generalised method of moments (GMM) approach to estimate the effect of bank-specific factors on the percentage growth of NPLs in Tanzania.

Results – According to the findings, increased return on assets, bank operating efficiency, income diversification, loan to-asset ratio in CBs reduces NPLs. In contrast, an increase in the deposit-to-asset ratio, capital adequacy, and age significantly increases the level of NPLs, which is consistent with the adverse selection theory. Conversely, decreased lag NPLs and raised bank operating efficiency will reduce the current year's NPL rate and vice versa.

Research limitations/implications – Commercial banks should reduce the risk of defaulting borrowers by adjusting the contractual terms to the anticipated average quality of their applications. In addition, small banks should strive to maintain management efficiency to increase their profitability. Authorities should impose micro-prudential supervision on commercial banks' lending behaviour to reduce the number of NPLs.

Novelty/Originality – The paper includes bank size (large and small banks) using both a one-step difference and a one-step system approach to measure the effect of bank-specific factors, which is usually not the case with most studies.

Keywords: Tanzania, bank-specific factors, non-performing loans, commercial banks

1. Introduction

Credit remains the basis of income for Commercial Banks (CBs). This is frequently corroborated by the higher share of loans in banking institutions' overall operational assets (Adusei, 2018), where interest on loans accounts for more than 85% of their revenue (Khan *et al.*, 208; Wood & Skinner, 2018). On the contrary, loans are risky products, mainly when borrowers cannot service their loans properly, thus creating non-performing loans (NPLs). Lending banks, especially CBs worldwide, suffer from increasing NPLs (Kuzucu & Kuzucu, 2019). Furthermore, the average NPLs in the world was reported to be 6.78%; in Africa, it was 11.55%, and in Tanzania, the average NPLs was 8.34% for a period ranging from 2011 to 2020. The figures were both above the required level of NPLs of 5% (BoT, 2020; World Bank, 2018).

NPLs are bank loans for which the borrower has not made the anticipated payments of principal or interest for more than 90 days following maturity (Khan *et al.*, 2020; Abel & Roux, 2016). Increasing NPLs have several adverse effects that may hinder banks from fulfilling their intermediary role, such as increased loan monitoring expenses, capital consumption, recapitalisation, deposit shock, and credit provision restrictions (Selma Messai & Jouini, 2013). Because NPLs are a crucial contributor to

economic stagnation, the widespread loan defaults in the banking system typically result in a bank failure. A requirement for enhancing economic growth is the reduction of NPL. These will affect the resources in unprofitable locations when NPLs are permanently kept. Therefore, NPL will likely slow economic growth and decrease economic efficiency (Louzis *et al.*, 2012). The reasons that cause financial system shocks can be macroeconomic imbalances or bank-specific ones. Research conducted in developed economies has generally confirmed that macroeconomic conditions influence credit risk. This study's initial objective is to identify the variables that affect the bank's loan quality in general and impaired loans in particular (Kuzucu & Kuzucu, 2019). The variables may include ones that are specific to that bank.

According to Kuzucu and Kuzucu (2019), many CBs in advanced Western nations and emerging economies struggled with NPLs throughout and after the financial crisis. NPLs have been under government and bank management monitoring since the global financial crisis, and they are thought to be linked to bank failure (Makri et al., 2014) . The quality of loan portfolios was relatively stable before the financial crisis of the previous years (Radivojevic & Jovovic, 2017). Following that, the rate of their lending portfolios dropped. As the quality of banks' loan portfolios deteriorated, the number of NPLs increased. The NPL in both rich and developing countries is nearly equal (Dimitrios *et al.*, 2016). This trend has worsened in emerging countries' CBs, such as Tanzania, which relies heavily on banks as financial intermediaries. Previous research (see Aliu & Çollaku, 2021; Kuzucu & Kuzucu, 2019) has also shown that the issue of the effect of bank-specific characteristics on NPLs in CBs is still unresolved. Ghosh (2015) found that greater capitalisation, liquidity risk, poor credit quality, more significant cost inefficiency, and banking industry size influenced the level of NPLs for CBs.

Conversely, the study discovered that higher bank profitability reduces NPLs. In analysing the relationship between management efficiency and NPLs in the Chinese banking industry, Zhu *et al.* (2015) found that inappropriate revenue diversification was a factor. For the nine largest Greek banks, Louzis *et al.* (2012) analysed the drivers of NPL for each type of loan (mortgage, business, and consumer). According to this study, poor bank management was found to have a detrimental effect on NPLs. Aliu and Çollaku (2021) discovered that bank profitability and credit growth influenced the level of NPLs.

On the other hand, operating costs, income diversification, and capital sufficiency did not affect NPLs. Alexandri and Santoso, (2015) investigated the impact of bank determinants on NPLs. They discovered that return on assets was adversely significant, whereas non-interest income was favourably significant. Furthermore, Radivojevic and Jovovic (2017) looked at the influence of internal and external factors on NPLs in developing countries and found that the bank's management efficiency (ROA) has a substantial positive impact on NPLs. Contradictions in the research conclusions discussed above from various contexts have been discussed.

In Tanzania, there are 51 banks, with 74.51 per cent being CBs and 11.76 per cent being Community Banks. Microfinance banks account for 9.81 per cent of the total, while Development Finance Banks account for 3.92 per cent (BoT, 2020). CBs have been lending to both the commercial and public sectors and providing additional services such as deposits, insurance, guarantee, asset protection, and credit creation. They follow the basic rule of taking money from savers as deposits and allocating it to clients as advances or loans (Aliu & Çollaku, 2021). They pay depositors a set percentage of their promises to entice them to keep depositing while profiting from the loans they disburse to clients (BoT, 2018). During 2011-2020, the average NPLs in CBs was 8.34 per cent (BoT, 2020). The ratio was higher than the Bank of Tanzania's prudential requirement of 5%. The rise of NPLs, which deteriorates banks' asset quality, is thought to hurt the banking sector's strength and efficiency (Zhu e*t al.*, 2015). Given this significant influence, banking regulatory authorities must identify the variables

affecting NPLs in CBs, particularly in Tanzania, where the banking system is still heavily reliant. NPLs can be attributed empirically to bank-specific characteristics and macroeconomic issues (Ahmad & Bashir, 2013; Kauko, 2012). Policymakers can figure out the micro-prudential framework and uncover the effect of the NPLs ratio on CB lending behaviour by controlling for bank characteristics.

The paper contributes several new ideas to the body of literature. To the best of our knowledge, this is the first estimation of models designed to determine whether parameters related to a particular bank serve as leading indicators for NPLs in Tanzanian CBs. Second, the study used factors rarely used in studies on NPLs in Tanzania CBs, including return on assets, income diversification, bank operating efficiency, and capital sufficiency, along with controls such as age and the loan deposit-to-asset ratio. The results for the complete panel were calculated using a one-step difference and a one-step system generalised method of moments (GMM) for large and small bank categories. This study contributes empirical evidence to the little-studied area of bank-specific matters in commercial banks in Tanzania, an emerging market.

The remainder of the paper was organised as follows: section two reviews both theoretical and empirical literature that attempts to delineate the effect of bank-specific factors on NPLs, section three describes the methodology, section four considers the results and discussion of the findings, and section five concludes and discusses policy implications.

2. Literature Review, Theoretical Framework, and Hypotheses Development

The associations between bank-specific factors are conflicting, with some researchers finding positive relationships while others suggest negative ones (Kumar & Kishore, 2019; Koju *et al.*, 2018; Berger & Deyoung, 1997). Berger and Deyoung (1997) tested several bank management assumptions related to cost efficiency, loan quality, and capital efficiency. They proposed that the number of NPLs is explained by bad management, adverse selection, and moral hazard hypotheses. As a result, the bad management hypothesis indicates that poor managerial performance leads to insufficient returns. Because incompetent managers do not effectively screen and manage lending activities, worse cost efficiency is linked to larger NPLs (Kjosevski & Petkovski, 2021).

According to the moral hazard concept, banks with a significantly lower quantity of capital tend to grow their loan portfolio in size and riskiness; as a result of moral hazard incentives, more problematic loans are made (Ghosh, 2015);Makri *et al.*, 2014;Berger & Deyoung, 1997). Thus, NPL increased due to the poor capitalisation of banks. On the other hand, (Menicucci & Paolucci, 2016);Kovachev & Goran, 2012) contrasted the moral hazard hypothesis on the bank-level data. Moreover, if management takes more risks by disbursing most of the deposits as loans, it contributes to the increase in NPL (Khan *et al.*, 2020). NPL is negatively associated with bank size, according to (Hu *et al.*, 2004). In a study conducted by Dao *et al.* (2020) discovered that high operating efficiency and return on assets have a negative connection with NPLs.

In contrast, capital adequacy and income diversification were unimportant. Both Dao *et al.* (2020) and Kumar and Kishore, (2019)found that NPL was negatively connected with ROA. Using panel data, Kjosevski and Petkovski (2021) examined the impact of NPLs on individual banks. The loan-to-total assets ratio and lagged NPLs were found to affect the level of NPLs in the study. The number of NPLs from the previous year, capital adequacy ratio, and return on equity (ROE) are all unsteady, according to Makri *et al.* (2014), who utilised the Generalised Method of Moments (GMM) to investigate the determinants of NPLs. From 2002 to 2006, Boudriga *et al.* (2010) discovered that highly capitalised banks had high levels of NPLs and that high portfolio growth is related to a lower level of NPLs. A similar result was also found by (Radivojević *et al.*, 2019). These studies were consistent with adverse selection theory

(Erdinc & Abaz, 2014); as a result, rapid portfolio expansion may be associated with lower credit worth as risk-taking rises during such periods, negatively impacting the level of non-performing loans (NPLs). It contrasts with Ahmad and Bashir (2013) and Kovachev and Goran (2012), who showed that quicker portfolio growth increases the level of NPLs because banks issue loans at lower costs of loan and credit standards to attract debtors. Dimitrios *et al.* (2016) studied the European banking sector from 1990 to 2015. They discovered that managerial efficiency, size of the bank, and deposit loan ratios (LTDs) reduce the proportion of NPLs, supporting Marco *et al.*(2008) findings. Lower bank efficiency in terms of expenses and revenues promotes higher bank risk of NPLs, according to Louzis *et al.* (2012) and Fiordelisi *et al.* (2011), corroborating the "poor management" concept. Hu *et al.* (2004) investigated the relationship between NPLs and income diversification in Taiwanese banks during 1996-1999 and found that only adequate income diversification reduces NPLs.

According to the asymmetric information theory, it may be challenging to discriminate between good and bad borrowers, leading to concerns about moral hazard and adverse selection (Auronen, 2003). According to market principles, the party with more excellent knowledge about the particular good being transacted—in this example, the borrower—is better positioned to communicate the best terms for the deal than the other party, the lender (Auronen, 2003). The party with less understanding of the same precise item to be transacted is more prone to make poor decisions than the other. When there is an adverse selection and moral hazard in a transaction, there is a significant increase in NPLs (Bofondi & Gobbi, 2003). However, banks' very existence is sometimes characterised by their remarkable ability to overcome three critical difficulties of information asymmetry, namely, ex-ante, interim, and ex-post (Auronen, 2003), and hence lower NPLs.

An increasing trend in the literature connects loan quality to external and internal variables, emphasising the role of bank factors in loan quality deterioration. The researchers in the literature have looked mainly at lagged NPLs, return on assets, capital sufficiency, income diversification, loan-to-asset ratio, bank size, age, deposit asset ratio, and operating efficiency, all considered proxies for bad management. Therefore, policymakers must understand the drivers of the NPLs ratio inside the individual bank-level data for the micro-prudential framework. Furthermore, policymakers must realise bank-specific elements to determine the impact of NPLs on respective banks' lending behaviour.

Based on the findings above, the researcher developed the following hypothesis:

H1: Commercial banks' return on assets and NPLs have a negative association.
H2: Income diversification and NPLs have a negative relationship.
H3: Bank operating inefficiency has a negative relation with NPLs of commercial banks.
H4: There is a negative relationship between capital adequacy and NPLs.
H5: The loan-to-asset ratio and NPLs of commercial banks have a negative association.
H6: The deposit asset ratio and NPLs of commercial banks have a negative relationship.
H7: The age of commercial banks and their NPLs have a negative relationship.

3. Research Method

3.1 Data Selection and Collection Approach

The Bank of Tanzania (BoT) and individual commercial banks audited financial statements provided the study with bank-specific data, which was the NPL of commercial banks. Between 2011 and 2020, our sample spans 31 of the 38 commercial banks in the country. Based on the available data and the study's focus, which was on the rise of NPLs in Tanzania, exceeded the permitted level of not more than 5.0 per cent due to the slowing economy, the study's variables, banks, and time range were all chosen.

3.2 Measurement and Operational Variable Definition

The dependent variable is the ratio of NPL to total loans. Explanatory variables include bank-specific factors (lagged on NPLs, return on assets, income diversification, capital adequacy, bank operating efficiency, loan asset ratio, deposit asset ratio and age), as the literature suggests.

Profitability (Pf_{it}) is measured by the ratio of net income to total assets. Leverage (Lv_{it}) is calculated by total liability to total assets ratio. Company size (Sz_{it}) is determined by natural logarithm of total assets. Liquidity (Lq_{it}) is computed by current assets to current liability ratio.

3.2.1. Non-performing loans (NPLs)

Most previous studies calculated NPLs as a proportion of the total loan portfolio. (Khan *et al.*, 2020; Kuzucu & Kuzucu, 2019; Dimitrios *et al.*, 2016 ; Mondal, 2016; Selma Messai & Jouini, 2013). Similarly, the ratio of NPLs to total loans was used to calculate the level of NPLs among Tanzania CBs in this study.

3.2.2. The lagged on NPLs

The first lagged bank NPL to total gross loans (asset quality) was employed to measure NPL persistence. The prior year's asset quality must impact the current NPL number. NPLs have a high level of endurance, according to previous research. As a result, non-performing loans have a long-term influence on the banking system in any economy, and decreasing them takes time(Aliu & Çollaku, 2021; Dao *et al.*, 2020; Ghosh, 2015).

3.2.3. Return on assets (ROA)

The return on assets (ROA) measures a bank's ability to profit from its investments and reflects management efficiency (Abel & Le Roux, 2016). The ratio of a bank's net profits to its total assets in the same year is known as the return on assets (ROA) (Khan *et al.*, 2020; Kumar & Kishore, 2019; A -Homaidi *et al.*, 2018; Dimitrios *et al.*, 2016; Ekanayake & Azeez, 2015). The return on assets (ROA) measures a bank's ability to transform its assets into net profits.

3.2.4. Income diversification (ID)

Interest on loans, mainly from lending activities, and non-interest revenue from trading and derivative transactions are banks' primary sources of income (Ekanayeke & Azeez, 2015; Ghosh, 2015; Hu *et al.*, 2004). According to the existing literature, banks with more diversified income (other than interest income) are more cautious and take fewer chances in higher-risk lending activities. Nevertheless, because bank income diversification depends heavily on the NPL level of NPLs, ID cannot link lower NPL levels of NPLs.

3.2.5. Bank Operating Efficiency (BOE)

Poor spending management raises the levels of NPLs, according to studies (Ekanayeke & Azeez, 2015; Louzis *et al.*, 2012; Berger & Deyoung, 1997) in the domain of NPLs. On the other hand, efficient cost containment, which retains a low level of NPLs, leads to higher profits and thus improves capital positions. According to Rashid and Jabeen, (2016), operational efficiency is the proportion of operating expenses to interest income. According to the literature, BOE is produced by managers who cannot control their operating costs and manage their loan portfolios appropriately. This study defines BOE as the ratio of non-interest expenses to non-interest revenue (Al-Homaidi *et al.*, 2018; Ekanayeke & A,zeez 2015).

3.2.6. Capital adequacy (CA)

The equity-to-total-assets ratio calculates CA (Khan *et al.*, 2020). It determines a bank's capital strength (Abel & Le Roux, 2016; Alper & Anbar, 2011). These studies

assumed that Managers of banks with substantial capital bases have a more flexible credit policy since they know the banks are less likely to go bankrupt and are too big to fail and vice versa.

3.2.7. Loan asset ratio (LAR)

The total loan portfolio to total assets ratio determines how much CBs use their finances for lending. This percentage illustrates how successfully banks concentrate on lending to private and public investments as their primary activity. The lending activities mentioned to be the most profitable activity to banks. According to (Towo *et al.,* 2019), an increased focus on lending improves a bank's income flow and profitability, which may result in a reduction in non-performing loans (NPLs).

3.2.8. Deposit-to-asset ratio (DAR)

Previous studies have often employed the ratio of total deposits to total assets to measure the percentage of the deposit (Al-Homaidi *et al.*, 2018; Menicucci & Paolucci, 2016). According to these findings, banks with more deposits are less likely to borrow from other banks than banks with lower deposits.

3.2.9. Age (AGE)

This is the number of years the bank has been in operation. According to (Ayayi, 2010), when banks mature, they gain experience in banking operations, which increases their chances of minimising NPL risks by providing effective services. Meanwhile, due to their activities' complicated and specialised nature, Almansour *et al.* (2020) pointed out that the usual links between age and reputation are not always followed in the banking industry.

Table 1. Summary of variables and their measurement

Variable	Acronym	Measurement
Dependent variable		
Non-performing loan ratio	NPL	$\frac{\text{Non} - \text{performing loan (t)}}{\text{Total loans}}$
Independent variables		
Return on assets	ROA	$\frac{\text{Net profits}}{\text{Total assets}}$
Income diversification	ID	$\frac{\text{Non} - \text{interest income}}{\text{Total income}}$
Bank operating efficiency	BOE	$\frac{\text{Non} - \text{interest expenses}}{\text{Non} - \text{interest income}}$
Capital adequacy	CA	$\frac{\text{Total equity}}{\text{Total assets}}$
Control variables		
Loan asset ratios	LAR	Total loan portfolio/Total assets
Deposit asset ratios	DAR	Total deposits/Total assets
Age	AGE	The natural logarithm of the number of years since the company was founded as CBs

3.3 Data Analysis

A One-step Generalized Method of Moments (GMM) is used to evaluate the model since it is less biased when applied to smaller sample numbers. An instrumental variable technique is used to solve the endogeneity issue, specifically the one-step GMM estimator described by Areliano and Boverb (1995). Since this estimator converts model variables into first differences, it also addresses the presence of unobserved heterogeneity (Radivojevic & Jovovic, 2017). The main benefit of using a dynamic panel is that the lagged values of the model's dependent variables are both observable among the explanatory variables of the model. As the lagged dependent variables are associated with the error term in cases where lagged dependent variables are used in the fixed effect and random effect models, the predictions produced with the fixed and random effects models and the estimators reached are inconsistent. This problem has also been noted in the literature in the study by (Béjaoui & Bouzgarrou, 2014). One-step GMM was employed in this study to overcome these issues.

We run the Sargan test of over-identification constraints to evaluate the general validity of the instruments employed in our model. Under the null hypothesis that the instruments are valid, this test provides a statistic distributed $\chi 2$ (Arellano & Bond, 1991). The Sargan test is designed to confirm the validity of all instruments; thus, there is no correlation between the residuals and the models' instruments. The Sargan test must be applied to ensure the consistency of the GMM estimators. We also use the Arellano-Bond autocorrelation tests, AR (1) and AR (2), which assess the residuals' first- and second-order autocorrelation in the differenced equation. The GMM estimator assumes that there is no serial correlation between error components. The serial correlation of the error terms at the level implied that under the null hypothesis, there is no second-order autocorrelation of the residuals in the differenced equation. This suggests that the GMM estimator is inconsistent (Arellano & Bond, 1991). In light of this, one should accept the null hypothesis of AR (1) and reject the null hypothesis of AR (2) according to the Arellano-Bond technique. Table 6 displays the one-step difference and one-step system GMM estimation outcomes of the dynamic model (3). The following are the econometric specifications for bank size (large and small banks):

$$NPL_{i,t} = \alpha + \beta_i X_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$\text{With } \varepsilon_{i,t} = \eta_i + \upsilon_{i,t} \quad (2)$$

Where i represent CBs (i = 1,2,3,.....31) in year t, which takes a value of 2011 to 2020, NPL i,t is the ratio of non-performing loans, βi is 1xk vector of parameters, Xi,t is the 1xk vector of explanatory variables, εi,t is the error term, which has two orthogonal components: ηi are the unobserved individual effects and υi,t is the observed specific errors.

Based on Eq. (1) and (2), an empirical model to examine the effect of bank-specific factors on NPLs:

$$\sum_{j=1}^{8} \delta NPLit = \delta 1\text{NPL } 1it + \delta 2\text{ROAit} + \delta 3\text{IDit} + \delta 4\text{CAit} + \delta 5\text{BOEit} + \delta 6\text{LARit} + \delta 7\text{DARit} + \delta 8\text{AGEit} + \varepsilon it \quad (3)$$

3.4. Diagnostic test

Choi (2001) noted that the assumption of stationarity must be met to make the results accurate and appropriate. The only stipulation is that the study used a Fisher-type test in unit root to check the variables' stationarity. According to unbalanced panel data, the panel unit root test by Fisher type is the best test statistic for stationarity (Choi, 2001). For the Fisher a trial, the null hypothesis is that all panels have unit roots, while the alternative idea is that at least one panel is stationary. When the P-value ≤ 0.05, the null hypothesis is rejected for all variables, according to (Biorn, 2017). Table 2 summarises the unit root test.

Table 2.
shows the results of Fisher-panel PP's unit root test

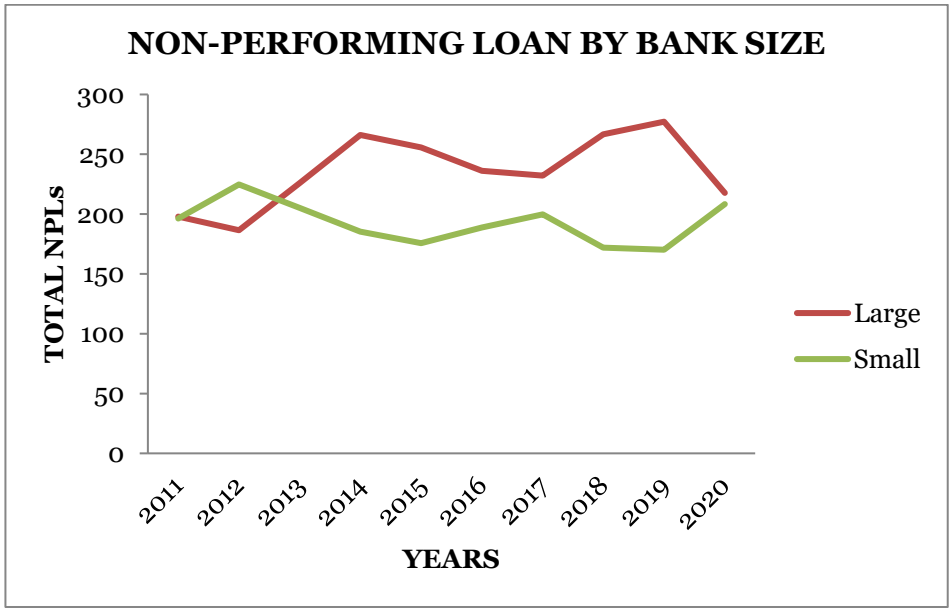
Variable	Criteria	Critical value	p-value
NPL	Level	2.127	0.9833
	1st difference	3.383	0.0004
ROA	Level	3.216	0.0007
	1st difference	-1.746	0.0404
ID	Level	-6.098	0.0000
	1st difference	-3.548	0.0002
BOE	Level	-4.519	0.0000
	1st difference	-1.695	0.0451
CA	Level	-3.143	0.0008
	1st difference	-1.146	0.1258
LAR	Level	3.188	0.0007
	1st difference	-3.803	0.0001
DAR	Level	-5.717	0.0000
	2nd difference	-3.053	0.0011
AGE	Level	-	-
	1st difference	-5.568	0.0000

4. Results

4.1. Bank Size Category NPLs Trends

For this study, the size of banks (large and small) was categorised based on their asset size (IMF, 2016). Banks category with assets above Tanzanian shillings (TZS) 711 259 million as large banks, while banks with assets below TZS 711 259 million as small banks. Figure 1 displays NPLs trends for bank size categories (CBs) in Tanzania from 2011 to 2020. From figure 1, trend lines for NPL performance in bank size indicate that small banks had the highest NPLs trend between 2011, 2012, 2016, 2017, 2019 and 2020, as shown in figure 1. Between 2014, 2015, 2018, and 2019, large banks had the most outstanding amount of NPLs. However, after 2019, the average value for NPLs for large banks showed downward trends, while small banks showed a definite upward trend in 2019. The level of NPLs could be a possibility that these banks are issuing more loans to increase their market share, hence the highest NPL performance trends in small banks.

Figure 1.
Non-Performing Loan by Bank Size



4.2 Variable Descriptive Statistics

Table 2 shows the mean, standard deviation, maximum and minimum values of 31 CBs in Tanzania from 2011 to 2020 and descriptive data for the variables.

Table 3. Descriptive statistics of variables

variable	PANEL: BANK SIZE							
	Small (n=168)				Large (n=142)			
	Mean	**Std**	**Min**	**Max**	**Mean**	**Std**	**Min**	**Max**
NPLs	1.87	1.22	-2.66	4.19	1.76	0.84	-1.27	3.87
NPLs-1	1.78	1.26	-1.61	4.17	1.58	0.96	-2.30	3.85
ROA	0.42	0.97	-4.61	1.86	0.26	0.97	-3.51	1.56
ID	23.03	15.32	0.78	98	25.97	10.76	0	57.66
BOE	5.73	0.85	3.97	8.79	5.52	0.57	4.53	10.28
CA	2.79	0.53	1.04	4.60	2.65	0.30	2.18	4.33
LAR	49.47	16.66	0	88	56.17	10.19	3	79
DAR	11.66	4.11	5	16	11.49	4.26	5	16
AGE	3.02	1.09	0	4.74	3.11	0.94	0	4.82

Note: table 3 presents the descriptive statistics of bank size category for the variables in the study. The variable definitions are provided in table 1

The study employed the mean to represent the data set's central tendency and the standard deviation to explain the data's dispersion. The data set's proxies for total loan portfolio to total assets (LAR) showed that large and small banks had the highest mean ranges of 56.17 and 49.47, respectively. The highest mean values and comparatively high levels of dispersion were found in income diversification (ID), total deposits to total assets (DAR), and bank operating efficiency (BOE), which had respective standard deviations of 15.32, 4.26, and 0.85. return on assets (ROA), capital adequacy (CA), and Age measurements all showed standard deviations between 0.26 and 0.97 and mean values between 0.26 and 3.11. The bank size category's total equity to total assets ratio showed the lowest degree of dispersion, with a standard deviation of 0.30.

4.3 Test of Multicollinearity

Table 4 displays the Pearson correlation matrix, which shows no extreme correlation between the examined variables, indicating no signs of multicollinearity issues. A multicollinearity challenge arises when the two independent variables have a correlation greater than 0.8 (Dao *et al.,* 2020; Saunders *et al.*, 2009). That also applies to the current Heteroskedasticity testing level using Inflation Factor 10 and under variance (VIF). The impacts of explanatory factors are shown in Table 5, and the VIF coefficient does not exceed the maximum limit.

Table 4. The Pearson correlation matrix

	NPL	**NPL_1**	**ROA**	**ID**	**BOE**	**CA**	**LAR**	**DAP**	**Age**
NPL	1								
NPL_1	0.73	1.00							
ROA	-0.29	-0.29	1.00						
ID	0.00	0.12	-0.09	1.00					
BOE	-0.07	0.17	-0.29	-0.19	1.00				
CA	0.01	0.09	-0.40	-0.13	0.46	1.00			
LAR	-0.03	-0.24	0.33	-0.18	-0.25	-0.21	1.00		
DAR	0.20	0.01	-0.11	0.08	-0.11	0.08	0.36	1.00	
Age	-0.15	-0.02	0.21	0.14	-0.15	-0.15	-0.01	-0.04	1

Note: table 4 presents the correlation matrix for variables in the study. The variable definitions are provided in table 1

Table 5. Heteroskedasticity test

Variable	VIF	1/VIF
Lag1_NPL	1.13	0.88
DAR	1.84	0.54
LAR	1.53	0.66
CA	1.49	0.67
ROA	1.31	0.76
ID	1.3	0.77
BOE	1.26	0.79
Age	1.14	0.87
Mean VIF	1.38	

4.4. Regression results

With smaller sample sizes, the one-step GMM estimator is preferred over the two-step GMM because it is less likely to be biased. The results of the one-step system and one-step difference GMM estimates for the dynamic model in Eq (3) on the entire sample of bank size (large and small banks) categories are shown in Table 6. The collection of explanatory factors in the model included lagged dependent variables.

Table 6. Estimation results of bank-specific variables and NPL by bank

Variables	one-step difference GMM		one-step system GMM	
	Large Coeff(P-value)	Small Coeff(P-value)	Large Coeff(P-value)	Small Coeff(P-value)
NPLs-1	0.587(0.000)	0.652(0.000)	0.658(0.000)	0.643(0.000)
ROA	-0.047(0.111)	-0.064(0.038)	-0.045(0.007)	-0.013(0.370)
ID	0.005(0.207)	-0.003(0.459)	-0.005(0.000)	-0.001(0.569)
BOE	-0.108(0.410)	-0.064(0.193)	-0.133(0.015)	0.002(0.903)
CA	0.128(0.326)	0.246(0.126)	0.249(0.000)	0.218(0.000)
LAR	-0.004(0.148)	0.002(0.470)	-0.001(0.594)	-0.002(0.053)
DAR	-0.002(0.553)	0.003(0.605)	-8.340(0.998)	0.008(0.017)
AGE	0.298(0.020)	0.155(0.248)	0.031(0.041)	-0.003(0.841)
Test for AR(1)	z = -0.99(0.321)	z = -0.85(0.396)	z = -0.84(0.404)	z = 0.11(0.913)
Test for AR(2)	z = -1.07(0.284)	z = 0.49(0.625)	z = -1.13(0.258)	z = 0.22(0.826)
Sargan test	chi2(43) = 61.18(0.035)	chi2(20) = 34.01(0.026)	chi2(89) = 122.66(0.010)	chi2(34) = 67.78(0.001)

=" p<0.05 ** p<0.01 *** p<0.001"*

4.5. Discussion of Findings

The coefficient of lagged NPLs on large and small banks for both one-step difference and one-step system GMM was positive at a 1% level of significance, as shown in table 6, which is consistent with the findings of prior banking studies (see Dao *et al.*, 2020; Radivojević *et al.*, 2019). These results contradict a study by Berna and Ibrahim (2020), which found a negative and statistically significant lagged NPL in the relationship between the board of directors' traits and risk and bank performance. The return on assets (ROA) results showed that on one-step difference and one-step system GMM, there is a negative and statistically significant association between small and large banks at 5% and 10%, respectively. The outcome is consistent with Hypothesis 1 (H1), which proposed a negative relationship between return on assets and NPLs. These results line up with those of the study, as can be seen by (Dao *et al.*, 2020; Selma Messai & Jouini, 2013). A bank with a high ROA has less incentive to make profits and is consequently less constrained to engage in riskier activities, such as providing risky loans, according to the negative sign of ROA. This makes sense since when banks are

profitable, they can do proper management tasks, including managing everyday operations and keeping an eye on loan portfolios. Instead, risky lending decisions are made by weak institutions, which results in a significant amount of bad loans.

In large banks, the association between income diversification and NPLs is negative and significant at the 1% level, which supports Hypothesis 2 (H2). We anticipate a negative correlation between income diversification and NPL because income diversification reduces credit risk in banks and is related to loan quality (Dimitrios *et al.*, 2016). The negative result of this variable suggested that banks with more varied sources of income (aside from interest income) are more conservative and manage their risks by avoiding engaging in high-risk loan activities. Because of their higher loan performance, these banks support the idea that NPLs and the income diversification ratio are inversely related (Ghosh, 2015). The study contradicts the evidence against income diversification (see (Hu *et al.*, 2004).

Under the one-step system GMM, we find that the bank operational efficiency (BOE) coefficient is negative and statistically significant at the 10% level for large banks, supporting Hypothesis 3 (H3). Efficiency shows that banks operate their commercial operations at comparatively minimal costs. In addition, the negative relationship implies that efficient cost management is a prerequisite for improving the profitability of the Tanzanian CBs. The most profitable banking institutions have lower operational costs meaning they maintain lower expenses for a given output level. According to (Berger & Deyoung, 1997) "skimping hypothesis," banks will be more cost-effective if they allocate fewer resources to monitoring loan risks. But, in the future, we will have a more significant number of NPLs. This suggests that efficiency hurts NPLs. On the other hand, Louzis *et al.* (2012) discovered a positive and significant link between operating efficiency and NPL.

The results analysis showed that hypothesis 4 (H4) is not supported and that there is a positive and statistically significant relationship between capital adequacy and NPLs at the 1% level on both large and small banks using the one-step system GMM approach. The positive indicator suggests that management at banks with high capital bases adopt a lax lending policy when extending credits because they are confident that the banks are "too big to fail" and less likely to go bankrupt (Rajan, 1994). As a result, these banks are involved in high-risk loan activities, which supports the idea that bank capital and the NPL ratio are positively correlated. On the other hand, Sinkey *et al.*, (1991) discovered that banks with an acceptable capital ratio have lower NPL rates. Using a one-step system GMM, the loan-to-asset ratio (LAR) variable is negative and highly significant at the 10% level for small banks, confirming Hypothesis 5 (H5). According to the findings, banks' income flow and profitability are improved when they focus on private and public investment lending, which lowers their NPLs. A study by Towo *et al.* (2019) provides evidence for this conclusion.

We discovered a positive and significant correlation between the deposit-to-asset ratio (DAR) and the ratio of non-performing loans (NPLs) at a 10% level for small banks. This outcome was unexpected and contradicted Hypothesis 6 (H6). The likelihood of a bank borrowing from another bank is higher for banks with lesser deposits. NPLs predicted to be very high. The findings are consistent with research by (Menicucci & Paolucci, 2016), which discovered a positive correlation between NPLs and the bank's deposit-to-asset ratio. On the other hand, the deposit-to-asset ratio was found to have a negative correlation with bank NPLs by (Gul *et al.*, 2011). Finally, age has a 10% positive and significant relationship with NPLs on large banks' one-step difference and one-step system GMM. This unexpected result opposes Hypothesis 7 (H7). According to the conclusion, banks' chances of generating NPLs increase as they become more specialised and complex in their banking operations. In contrast to the findings of (Al-Homaidi *et al.*, 2018), this result is similar to that of Ayayi (2010).

5. Conclusion, Implication and Limitation

The research examined how non-performing loans were affected by bank-specific factors in Tanzanian commercial banks. The study discovered that NPLs are associated with bank-specific parameters such as age, return on assets, loan-to-asset ratio, deposit-to-asset ratio, income diversification, operational efficiency, and capital sufficiency. These results imply that NPLs in banking sectors such as CBs can be reduced by increasing asset returns, improving expense management, loan-to-asset ratio, and well-bank diversification opportunities. These findings highlight the importance of micro-prudential supervision on banks' lending practices to control the level of non-performing loans.

According to empirical findings on return on assets (ROA), policymakers should demand that banks have sufficient earnings to be financially sound. By doing this, banks can carry out appropriate credit management procedures, such as underwriting, monitoring, and controlling, ultimately decreasing the number of impaired loans in the bank's portfolio. In addition, banks must increase oversight of credit management procedures in the banking industry because interest income makes up most of the bank's earnings. The central bank might set a particular minimum standard need for bank profits to ensure that banks can cover their operating expenses. Diversification makes offsetting losses in certain items easier with gains in others, theoretically lowering risk-taking. The financial system should be made more conducive by the government to give banks possibilities for diversification. By exploring non-interest sources of income, it may be possible to overcome the potential losses on the loan business (financial revenues and capital gains). NPLs should be lower for banks with better non-interest income diversification than those with less (poor) diversification.

The government is putting in place several efforts to deal with the NPL issue, and the CBs must implement them all. Thus, banks should obey the central bank's advice to forbid insider loan issuance, renewal, and rollover. Banks must also effectively account for loan losses to reflect their realistic positions in credit risk in their portfolio and enhance risk management through stress testing. It is time to tighten the legislative framework for credit reference bureaus to help the banking industry better manage credit risk. The credit reference system would help in handling disobedient customers.

Despite this study contributing significantly to the NPL literature, prospective studies must delineate certain limitations. First, this study does not consider mortgages, business loans, and consumer loans. Future studies can examine how different loan types impact the number of NPLs in CBs. This task may involve a particular strategy. Second, this study did not consider bank ownership categories and focused primarily on the period of CBs on bank size categories, which spans from 2011 to 2020. Study on the effects of bank-specific factors on NPLs, prospective studies should extend the time frame of the analysis and increase its reach while concentrating on various bank ownership types. Yet, the abovementioned limitations do not impair this study's findings and their practical and theoretical implications concerning NPLs.

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