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Monetary Policy Dynamics and Non- Performing Loans among Commercial banks in Tanzania

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Abstract

A high ratio of Non-performing loans (NPLs) in the banking sector, particularly in commercial banks (CBs), threatens financial stability, impedes the intermediation of funds from savers to borrowers, and reduces investment and economic growth. Monetary policy dynamics are viewed as potential drivers of NPLs. In this regard, the main objective of this study was to test the hypothesis that monetary policy dynamics influence NPLs in Tanzania. Using panel data from 2011 to 2020, the study used a one-step system generalized method of moments (GMM) approach to estimate the effects of monetary policy dynamics on the percentage growth of NPLs. The results are presented for both bank size and ownership category. The study found a significant positive impact of monetary policy dynamics on the growth of NPLs. The results indicate that the occurrence of monetary policy dynamics affects the lending decisions of CBs and borrowers' cash flows, leading to a decrease in the debt-paying abilities of bank customers. Therefore, the study recommends that banks pay more attention to the monetary policy dynamics to balance security, liquidity, and profitability when serving the real economy. Furthermore, the policymakers should create a stable monetary policy; in effect, this will help reduce the growth of NPLs, improve bank profitability, increase the financial intermediation capacity of banks, and subsequently boost economic growth in Tanzania.

Keywords: **Monetary Policy, Non-performing Loans, Commercial Banks, One-Step System GMM.**

1.0. Introduction

Monetary policy consists of government's formal efforts to manage the money in its economy to realize specific economic goals (Bech & Melkhozov, 2016). Three basic kinds of monetary policy decisions can be made: the amount of money in circulation, the level of interest rates, and the functions of credit markets and the banking system (Borio *et al.,* 2017). It's noted that higher volumes of monetary policy adjustment could lead to a decline in investment and employment by motivating banks and households to postpone investments for more specific times (Kang *et al.,* 2014; Bachmann *et al.,* 2013). This adjustment hurts stock returns (Bordo *et al.* 2016) as well as bank lending operations (Hu & Gong, 2019), leading to the accumulation of non-performing loans (NPLs). This is where a deliberate change in monetary variables influences the movement of many other variables in the financial sector (Jiménez *et al.,* 2009). Indeed, the monetary policy issued by the government often confuses participants like commercial banks (CBs) in business activities or prompts the government to oppose a policy's original intention when enforced; ultimately generating uncertainty shocks (Loannidou *et al.,* 2015).

High and rising levels of NPLs in many developing countries, including Tanzania, continue to negatively affect the bank's balance sheet, possibly adversely affecting bank lending operations. Furthermore, NPLs may also cause market risk that may, in turn, lead to a run-on deposit, significantly reducing the intermediation power of banks (Louri & Karadima, 2020; Dao *et al.,* 2020; Dimitrios *et al.,* 2018). NPLs are money lent to an individual who fails to honour his/her repayment obligation, and total principal and interest payments are no longer anticipated. Thus, the principal or interest is 90 days or more delinquent, the maturity date has passed, and repayment in full has not been made (Dell *et al.,* 2016; Louzis *et al.,* 2012). In Tanzania, the ratio of NPLs to total gross loans (NPL ratio) of commercial banks (CBs) increased to 9.3% in 2020, following an upward trend since its lowest of around 5.4% in 2011. Still, large diffusions remain across these banks, placing severe constraints on the lending capacity of banks, risking financial stability, creating a pressing need for recapitalization, and delaying economic growth (BoT, 2020).

The literature state that NPLs are affected by bank-related variables, such as market structure and unethical management, and macro variables, such as inflation, exchange rate, GDP growth, public debt, and unemployment (Anastasiou *et al.,* 2019; Beck *et al.,* 2015). In addition, different economic policies, for example, monetary policy set by the Central Bank, produce a variety of imbalances affecting banking stability; it has recently been found to affect credit risk as the frequent and vague changes to monetary policy may lead to misallocation of bank's credit resources or deterioration of borrower's firm's operations (Chi & Li, 2017). These frequent monetary policy adjustments can cause banks' operations to fluctuate, making their financial situations more unstable. This, in turn, shocks the debt-paying abilities of customer banks. Louri and Karadima (2020) argue that monetary policy dynamics have often been blamed for introducing and spreading NPLs.

Hada *et al.* (2020) make a similar argument, emphasizing that monetary policy indirectly affects banks through its impact on the private sector. Since banks are the most common source of financing for businesses, a decline in a bank's financial health or bankruptcy affects the sizes of NPLs and impacts CBs' operational performance. Asiama and Anthony (2018) reported that the private sector, described as an area of economic growth, had limited access to credit and faced high lending rates, necessary to instigate high ratio of NPLs. Narman and Serpil (2019) confirmed that the rising average of NPLs affects lending institutions worldwide, especially CBs. For instance, the average NPLs for the entire world was reported to be 6.78%; in Africa, it was 11.55%; and for Tanzania, the average NPLs between 2011 and 2020 was 8.34%. Both reported statistics exceed the acceptable 5% threshold for NPLs (BoT, 2018; World Bank, 2018).

Previous studies show that monetary policy dynamics influence NPL in large and small banks regardless of ownership status (Louri & Karadima, 2020; Adusei, 2018; Akinlo & Emmanuel, 2014; Rao & Jiang, 2013). Studies (Asiama & Anthony, 2018; Li & Yang, 2015; Prasanna, 2014; Akinlo & Emmanuel, 2014; Vo & Nguyen, 2014; Rao & Jiang, 2013) have shown that the dynamics of monetary policy aspects, including lending interest rates, credit to the private sector, the bank discount rate, all have a positive effect on NPLs, confirmed that adjustment had been a cause for initiating and spreading NPLs. However, other studies on monetary policy dynamics show that money supply m2

and m3, and credit to private sectors negatively affect NPLs (Caglayan & Xu, 2019; Zhang & Saffar, 2019; Radivojevic & Jovovic,2017; Bordo *et al*., 2016; Badar & Javid, 2013).

Further, studies (e.g., Louri & Karadima, 2020; Radivojevic & Jovovic, 2017; Rao & Jiang, 2013) support that NPLs benefit from high lending interest rates to customers. As a result, high default rates are typically expected in a country with frequent monetary adjustments like Tanzania, given such raised lending interest rates. In particular, Asima and Anthony (2018) found that rising NPL ratios due to high default rates among bank loan borrowers have hurt banks' ability to operate effectively. This inefficiency implies that banks may not direct loanable funds to more productive and dependable sectors. Moreover, a rise in NPLs lowers the value of private investment. Due to their increased risk of loan default, the private sector receives less credit (Borio *et al.,* 2017). Thus, the foregoing discussions imply that higher NPLs decrease credit to the private sector, whereas increasing credit to the private sector would cause NPLs to fall (Diana & Carla, 2014; Akinlo & Emmanuel, 2014).

Bank discount rate is identified as one of the monetary policy changes that could increase NPLs. Excessive lending by CBs due to the discount rate offered by the central bank is often identified as an essential determinant of NPLs (Tarron and Sukrishnalall, 2016). The central bank attracts CBs to borrow at a low rate. These low-rate funds from central banks may encourage CBs managers to issue more loans to irresponsible customers (defaulters) leading to increased NPLs (Rao & Jiang, 2015). Furthermore, it is estimated that the rate of NPLs will rise during inflation because the central bank increases the cost of borrowing from banks (Diana & Carla, 2014). Those financing loans cannot service these debts because of their reduced income value. Such people are fixed-income earners with fixed interest rates on loans. Similarly, the level of NPLs in CBs could be influenced by changes in the broad and extended money supply (M2) (Adusei, 2018).

The effect of monetary policy adjustments has been the subject of research in the West (Hada *et al*., 2020; Vo & Nguyen, 2014; Jimenez *et al.,* 2024); however, emerging economies like Tanzania have received little attention. Sincere attempts in this area were made by Louri and Karadima (2020), Zhang and Saffar (2019), Asiama and Anthony (2018), Diana and Carla (2014), and Rao and Jiang (2013). Still, their research was conducted in contexts distinct from the current one, and they did not offer a complete picture of how monetary policy dynamics affect NPLs. To date, a study of this nature is not well documented in the Tanzanian context that has measured the influence of monetary policy dynamics on NPLs, taking bank value (total assets), loan-to-asset ratio, bank age, and gross Domestic Product (GDP) as control variables. Hence, the present study responds to this gap to broaden the scope of the existing knowledge on the subject concern. With more than 51 banks (38 CBs), analyzing the relationship between monetary policy dynamics and NPLs is critical for policy makers and bankers.

The present study is different from previous studies in many ways. First, it assesses the effect of monetary policy dynamics on NPLs in CBs through bank size and ownership categories. Second, it examines the impact of monetary policy dynamics on the one-step system generalized method of moments (GMM) model. The model used has time-invariant effects and contains the lagged dependent variables, which some previous Tanzania studies did not cover regarding their methodology. The rest of the paper is presented as follows: Section two reviews both theoretical and empirical literature that attempt to describe the effect of monetary policy 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.

2.0. Empirical Studies and Hypothesis Development

2.1. Review of the empirical studies

A series of studies on NPLs (Vo & Nguyen, 2014; Louzis *et al.*, 2012) focused exclusively on the role of country-specific or macroeconomic determinants and found that they exerted the most significant effect. In particular, Caglayan and Xu (2019), Asiama and Antony (2018), Adusei (2018), Gambacorta (2017), Chi and Li (2017), Reddy (2015), Akinlo and Emmanuel (2014), Jimenez *et al*. (2014), Rao and Jiang (2013), Badar and Javid (2013), Sofoklis and Eftychia (2011), Yener *et al.* (2010), and attempted to investigate the effect of monetary policy adjustments focused on variables such as interest rates, credit to the private sector, discount rates, and money supply (m2,

m3) in their regression estimations. The results have produced conflicting findings regarding the direction, intensity, and significance of monetary policy dynamics of NPLs. Furthermore, the findings are evident, not only in terms of the intensity and importance of individual factors in the occurrence and movement of NPLs but also in terms of signs.

Dimitrios *et al.* (2018) studied 138 core and 88 periphery banks within the Euro Area and employed fully modified ordinary least square (OLS) and Bayesian panel-cointegration vector autorepression techniques. The study found adverse and statistically significant effects on bank size and credit to the private sector for NPLs. Dimitrios *et al.* (2018) findings are in line with the later studies of Diana and Carla (2014) and Hu *et al*. (2004). In an attempt to extend the previous research, Asiama and Anthony (2018) examine the NPLs and monetary policy dynamics in Ghana between 2000 and 2016. They found evidence that lending rates, credit to the private sector, and discount rates positively influence the NPL growth of NPLs in the long run. However, in the short run, the influence is not significant. The other studies supported these findings (Nikola *et al.,* 2019; Prassana, 2014; Akinlo & Emmanuel, 2014). Louzis *et al.* (2012) investigated macroeconomic and bank-specific determinants of NPLs in Greece. The study found a positive correlation between GDP and lending interest rates, with NPLs in all categories of loans. On the contrary, Haniifah (2017) and Radivojevic and Jovovic (2017) found that lending interest rates and GDP had a significant negative relationship with NPLs.

Badar and Javid (2013) analyzed the impact of macroeconomic forces and NPLs on CBs in Pakistan between 2002 and 2011. The study found a strong negative long-run relationship between lending interest rate, GDP, money supply (m2 and m3), and NPLs. Also, Adusei (2018) finds a similar negative correlation between the money supply and the level of NPLs. On the contrary, Sofoklis and Eftychia (2011) found a positive and significant relationship between money supply and NPLs. The study by Caglayan and Xu (2019) and Jimenez *et al.* (2014) found that low interest rates reduce the probability of default on outstanding variable-rate loans by lowering the interest burdens of previous borrowers. In the medium term, however, due to higher collateral values and search for yield, banks tend to grant more risky loans to soften their lending standards: they lend more to borrowers with a bad credit history and with more uncertain prospects. Asiama and Anthony (2018) stated that there are conflicting signs of credit to the private sector. The sign may be negative or positive regarding the banks' preferences. Higher NPL could result, for instance, if increased economic credit is associated with riskier behavior. However, reduced NPLs are anticipated if it encourages more attention.

To investigate the effects of monetary policy, we control for a broad set of alternative factors that could impact risk-taking attitudes, including bank-specific characteristics (bank value, bank age, and bank deposit), macroeconomic conditions (gross domestic product-GDP) of interest to avoid bias (Yener *et al.,* 2010). Tarron and Sukrishnalall's (2016) research shows that NPL levels significantly impact GDP. This has been noticed to suggest that a growing economy helps to improve earnings (or income), which in turn improves borrowers' ability to pay off their debt and, as a result, lowers NPLs. In contrast, when the economy slows (as seen by low or negative GDP growth), banks' NPL portfolios will likely grow due to borrowers' decreased ability to service their loans.

Karsten and Lenno (2019) found that GDP negatively affects NPL levels. This has been interpreted to mean that an expanding economy contributes to an improvement in earnings (or income), which in turn enhances the debt-servicing capacity of borrowers and, consequently, lower NPLs. Conversely, when there is a slowdown in the economy (as reflected by low or negative GDP growth), the NPL portfolios of banks are likely to increase due to the lower debt-servicing capacity of borrowers. The empirical evidence relating to the impact of bank size, age, and loan-to-deposit ratio on NPLs appears to be mixed. For instance, some studies report a negative association between NPLs and bank value (Biekpe, 2011; Hu *et al.,* 2004). According to these studies, the inverse relationship means that significant bank value has superior risk management strategies that usually translate into an outstanding loan portfolio vis-à-vis their smaller counterparts. Chaibi and Ftiti (2015) and Louzis *et al*. (2012) reported controversial findings on bank size. The loan-to-deposit ratio (LTD), on the other hand, is anticipated to have a positive correlation with non-performing loans (NPLs), as a more significant proportion of loans to deposits indicates easier loan giving, a risk-loving attitude, and, thus, a greater possibility of creating NPLs (Zampala *et al.,* 2017).

A positive association between lagged NPLs and current NPLs was also discovered by Dao *et al*. (2020) and Nikola *et al*. (2019). This shows that the banking sector would probably be affected if NPL suddenly increased, unlike Berna and Ibrahim (2020), who stated that the lagged NPLs negatively affected NPLs.

2.2. Hypothesis development

The literature review generally shows inconsistent results on the effects of monetary policy dynamics and NPLs. All in all, further research is needed to gain deeper insight into this area, given the different opinions expressed by various researchers. Therefore, based on the literature, the researcher developed the following hypotheses:

Ho_1: Lending interest rates and NPLs at CBs have a positive association.

Ho_2: Money supply (M2) and NPLs have a positive relationship.

Ho_3: Discount rates have a negative relationship with the NPLs of CBs.

Ho_4: There is a negative relationship between Credit to the private sector and NPLs

3.0. Research Methodology

3.1. Data selection and collection approach

This study used a quantitative research design as it utilised quantitative data. Adeola & Ikpesu (2017) assert that a research design based on a quantitative approach is independent of the researcher. The study further postulates that quantitative research uses thorough processes and procedures that help reduce the researcher's bias. In this case, it makes the final result of the research more reliable and representative of the population on which the study is based. The dataset for NPLs is fetched from audited financial reports from 2011 to 2020 in 31 CBs. It is further collected from the Bank of Tanzania (BoT) and National Bureau of Statistics (NBS) database, which supplies all information regarding all banks working in Tanzania. It is considered the most common and authenticated database for banking system information. The study's variables, banks, and periods were chosen based on the data from BoT and particular CBs. The study focused on the rising NPLs in Tanzania that exceeded the permissible limit of not more than 5% (BoT, 2020). The base year used was 2011, as the average percentage of NPLs in the country increased from 5.4% at the end of 2011 to 11.5% in 2017 before falling to 9.3% in 2020 (BoT, 2020).

3.2. Model specification

The study used the generalized method of moment (GMM) model proposed by Arellano and Bond (1991) to investigate the effect of monetary policy dynamics on NPLs. The study adopts a model similar to that explored by Asiama and Amoah (2019) and Altunbas *et al*. (2012), with some changes made suitable for Tanzania. The study uses this model because it considers the time persistence of NPLs and accounts for possible correlations between independent variables (Altunbas *et al*., 2012). Moreover, in the presence of a lagged dependent variable, the use of traditional panel data models such as pooled OLS, fixed effect, and random effect become biased and inconsistent due to the introduction of the first lag of the dependent variable on the right- side of the equation (Dorgan & Eksi, 2020; Ameni *et al.,* 2017). In addition, the GMM model generates correct standard errors and p-values, provided that the specified moment conditions are valid. It is based on the simple idea that the estimations of parameters are done by solving a set of moment conditions. Furthermore, the strength of the GMM model resides in the fact that it requires the use of instruments. These instruments correlate with the dependent variable but not with the error term (Ameni *et al.,* 2017). In this regard, an instrumental variable test was applied to address the endogeneity problem in this study. The model specification used to investigate the relationship between monetary policy dynamics and NPL results was as follows:

$$NPL_{i,t}=\propto+\beta 1NPL_{i,t-1}+\beta 2LIR_{i,t}+\beta 3CPS_{i,t}+\beta 4DRT_{i,}t+\beta 5M2_{i,t}+\varphi AGE_{i,t}+\varphi DGDP_{i,t}+\varphi BV_{i,t}+\varphi LTD_{i,t}+\varepsilon_{i,t} \quad (1)$$

Where NPL is the ratio of non-performing loans to total loans as a proxy for the dependent variable, NPL-1 refers to the first lag of the bank NPL to total gross loans, LIR_{it} means the lending interest

rate in CBs, CPS_{it} stands for credit granted to the private sectors, DRT_{it} refers to the discount rate per year, $M2_{it}$ stand for intermediate money which comprises m1 plus highly liquid deposits. AGE_{it} stands for the number of years from the date of establishment as CBs, GDT_{it} refers to the gross domestic product, BV_{it} stands for total assets, LTD_{it} refers to the loan to deposit ratio, ε_{it} is the error term. Letter D represents the first difference value of the variable in the equation (GDP). Furthermore, the subscript *i* refers to different CBs (31CBs), and *t* is the time covered (2011-2020).

3.3. Measurement and operational variable definition

The ratio of NPL to total loans is a dependent variable. The explanatory variables for monetary policy include lending interest rates, money supply (M2), bank discount rates, and loans to the private sector. Furthermore, the study includes GDP, bank age, loan-to-deposit ratio, and bank value as control variables. The lagged NPLs were also considered as part of the independent variables.

3.3.1. Non-performing loans (NPLs)

The dependent variable is the ratio of Non-performing loans to total loans. Following Ameni *et al*. (2017) and Ghosh (2015), our study's usual measure of NPLs is the sum of non-accrual loans and all loans past due for 90 days or more. As suggested by Kazucu and Kazucu (2019), non-accrual loans are loans not earning the predetermined interest rate either because the complete accumulation of principal is uncertain or the payment of interest has not been completed.

3.3.2. The lagged NPLs (NPL-1)

NPL persistence was measured using first-lagged bank NPL to total gross loans (asset quality). The asset quality from the previous year tends to affect the current NPL level. Previous research has demonstrated that NPLs are persistent and that reducing them requires time (Dao *et al.,* 2020; Ghosh, 2015). The lag of NPLs is included as part of the GMM approach, so the coefficients on this lag are expected to be positive. This is because previous NPLs add to the stock of NPLs for the current period.

3.3.3. Lending interest rates (LIR)

Since lending interest rates directly impact the borrower's repayment capacity and equally affect banks' interest profits, they are regarded as a determinant of NPLs and have a significant and favourable effect on them (Jimenez *et al.,* 2014; Rao & Jiang, 2013). Thus, high lending rates produce an additional burden and increase the level of NPLs. Other studies also have demonstrated that high interest rates considerably impact NPLs (Dao *et al.*, 2020; Nikola *et al*., 2019). Therefore, an increase in interest rates raises the cost of doing business for borrowers, which raises the credit risk and ultimately raises the possibility that they will not be approved for a loan because they are less able to pay off their debts (Vo & Nguyen, 2014). As interest rates decline, the cost of borrowing and the chance of defaulting decrease; hence, the lending interest rate covariance is expected to be negative.

3.3.4. Credit to private sectors (CPS)

Higher NPLs could result from increased risk-taking behavior, which is implied by increased loans to the economy's private sector. But if it increases carefulness, reduced NPLs are anticipated (Zhang & Saffar, 2019; Akinlo & Emmanuel, 2014). Moreover, a rise in NPLs lowers the value of private investment. It increases the risk of loan default for the private sector, which results in less Credit being extended to them (Asiama & Anthony, 2018). The coefficients of CPS are expected to be negative as part of a priori expectations because we believe that a productive sector will eventually be able to create enough money to pay off its loan commitments.

3.3.5. Discount rate (DRT)

As the lender of last resort, the central bank induces CBs to borrow money at low rates through a discount window. These low rates encourage CBs to extend more loans to customers at low rates, and the reverse is also true (BoT, 2020; Yener *et al.,* 2010). Also, when there is inflation, the central bank raises the bank rate, ultimately raising the cost of borrowing money from the bank because

other banks and CBs increase their discount rates for the general public in response to the higher rate. Because lowering the bank rate should also result in lower lending rates, which will reduce the cost of borrowing and the probability of default, the coefficient of the bank rate is anticipated to be negative.

3.3.6. Money supply (M2 growth rate)

Monetary policy influences the money supply through its effects on banks' intermediation activity (BoT, 2020). However, most changes in money occurring in the economy result from developments in how banks conduct their business (Yener *et al*., 2010). Changes in the money supply can have an impact on the economy through two general transmission channels. The first channel rests on the effect of the availability of credit in the economy, and the second one on the impact of liquidity on the allocation of asset portfolios. These channels are not mutually exclusive but rather complement each other. A country's money supply significantly affects its macroeconomic profile, particularly concerning interest rates, inflation, business cycle, and NPLs (Jimenez *et el*., 2014). The coefficient of money supply on NPLs is expected to be positive as part of prior expectations since growing living expenses (inflation) may make it harder for people to repay their debts and may even raise the possibility that they would default (Adusei, 2018; Sofoklis & Eftychia, 2011).

3.3.7. Age (AGE)

This is how long the bank has been open for business. Ayayi and Sene (2010) contend that as banks mature, they accumulate experience in banking operations, increasing their potential to reduce NPL risks by offering efficient services. Almansour *et al.* (2019) noted that the traditional relationships between age and reputation are not always observed in the banking business due to the complex and specialized nature of their activities.

3.3.8. Gross domestic product (GDP)

Economic growth increases borrowers' ability to repay loans and is linked to increased household income (Narman and Serpil, 2019). As a result, NPLs are inversely correlated with GDP growth. According to Ahlem and Fathi (2013), more substantial positive GDP growth is often accompanied by increased income, which enhances the borrower's capacity to repay debts and lowers the level of NPLs.

3.3.9. Bank value (Total assets)

Because a bank with more significant overall assets may be risk-loving or risk-averse, the sign of bank value is contradictory (Dimitrios *et al*., 2018). Like Chaibi and Ftiti (2015), the natural logarithm of the bank's total assets is used to determine the institution's size. For instance, a large bank may extend loans to riskier borrowers and expand its financial leverage more effectively. It might also feel "too big to fail" and decide to forego taking on additional risk in the understanding that there is only potential for advantage, or it might be risk-averse. Due to its size, which may be too large to preserve, use caution. According to Louzis *et al*. (2012), bank size positively influences NPLs. In contrast, according to the explanation of the diversification by bank size, Biekpe (2011) and HU *et al.* (2004) discover that a bank's size negatively influences the amount of non-performing loans it has.

3.3.10. Loan-to-deposit ratio (LTD)

Credit, scaled by bank deposit, shows the bank's use of warranties (credit) and indicates the bank's riskiness. Credit is a risky output, according to Berna and Ibrahim (2020); there is always a chance that the bank will have loan delays or a default issue. Dimitrios *et al.* (2018) concluded that LTD is expected to be positively related to NPLs because a higher ratio of loans concerning deposits means easier loan granting, a risk-loving attitude, and, therefore, a higher probability of rising NPLs.

3.4. Theoretical framework

The theoretical framework under this study assumes that the nature of the firm (herein referred to as CBs) is based on profit maximization (Primeaux & Stieber, 1994). Since profit has always been the top priority of banking operations over the years, CBs maximize the net interest margin by charging more interest to the borrowers and offering lower interest to the depositors. Their

aggressive lending strategies can sometimes result in credit risk, moral hazard, and NPLs. Moreover, the central bank provides directives on CBs lending interest rates to support the growth of private sectors as part of implementing monetary policy (Asiama & Anthony, 2018). Such orders limit or empower CB's position to credit creation. As a result, trends of NPLs are also affected. The bottom line is that central banks' directives may increase or decrease the CB's lending interest, affecting current and previous loan portfolios. The effect on the current and previous loan portfolios may increase or reduce the default rates among borrowers, impacting the NPLs in CBs (Vo & Nguyen, 2014). Furthermore, the changes in discount rates may also affect the portfolio of CBs by increasing the profitability or default rates among borrowers. This implies that CB's interest rate on credit will also fall if the central bank discount rate falls. Such grounds will motivate the private sector, which is believed to be the device of economic growth. On the contrary, the rising level of monetary policy indicators, particularly on bank rates, lending interest rate, and money supply M2 will increase NPLs, demoralising the private sector borrowing and stifling potential economic activity. Table 1 below presents the pre-hypothesized sign effects of the independent variables on NPLs

Table 1. Variable measurement and expected signs

Variables	Measurement	Expected sign	Source/literature
	Dependent variable		
NPLs	NPL/total loans		Dao *et al*. (2020), Karsten & Lenno, (2019),
	Independent variables		
NPL-1	The first lag of bank NPLs to total gross loans	+	
LIR	The lending interest rate at year-t	+	Mahrous et al. (2020), Adusei (2018), Diana & Carla (2014)
CPS	Credit to the private non-financial sector (% of GDP)	-	Asiama & Anthony (2018), Akinlo & Emmanuel (2014)
DRT	Cost of borrowing to CBs at year t	-	Asiama & Anthony (2018), Vo & Nguyen (2014), Yener *et al.* (2010)
M2	Intermediate money. Comprises M1 plus highly liquid deposits	+	Adusei (2018), Sofoklis & Eftychia (2011)
	Control Variables		
AGE	The natural logarithm of the number of years from the date of establishment as CBs	-	Towo (2019), Ayayi & Sene (2010)
BV	The natural logarithm of the banks' total assets	-	Warue (2013), Boudriga *et al*. (2010), Hu *et al.* (2004)
LTD	Scaled by the bank's deposit, this indicator of bank riskiness depicts how the bank uses deposits.	+	Al Masud & Mohammed (2020), Dimitrios et al. (2018)
GDP	Annual change in the percentage growth of GDP	-	Karsten & Lenno (2019), Ahmad & Bashir (2013)

Source: Developed based on the literature

3.5. Panel unit root test

All other variables are also expressed in their logarithmic forms. We performed the Fisher and Levin-Lin panel unit root test that assumes a standard unit root process (Mondal,2016; Choi, 2001). This unit root test aimed to analyze the level and then differentiate to determine the order of integration of each variable. The results show that GDP was not stationary at this level. Yet, upon the first differencing, this non-stationary variable became stationary (see Table 2). The unit root test has two implications. First, the presence of a unit implies that the estimating technique cannot use Ordinary least squares (OLS). Using OLS as an econometric approach for an estimate when a panel has a unit root test may result in an over- or underestimation of the parameter's value and

the parameter's sign being in the incorrect location. Second, the economic implication is that the presence of a unit root in a data panel causes a shock to have a lasting effect (Adusei, 2018).

Table 2. Unit Root Test (Test for Stationarity)

	Fisher-type unit-root test		Levin-Lin-Chu unit-root test	
Variable name	Statistic	p-value	Statistic	p-value
NPLs	122.5683	0.0000***	-4.6636	0.0000***
NPLs-1	113.7443	0.0001***	-5.2442	0.0000***
LIR	44.8421	0.9277	0.3818	0.6487
M2	158.4558	0.0000***	2.8799	0.0000***
DRT	17.2693	1.0000	6.5638	1.0000
CPS	32.4074	0.9993	-5.0443	0.0000***
Size	299.7988	0.0000***	-14.6811	0.0000***
Age	2234.7065	0.0000***	-20.9548	0.0000***
LTD	212.5111	0.0000***	-21.9294	0.0000***
DGDP	572.0579	0.0000***	3.7409	0.0020**

Note: **and *** represent 5% and 1% significance levels, respectively.

4.0. Results and Discussion

4.1. Bank category

CBs were categorized as small or large depending on the extent of their assets. Assets between 711,259 and 75,591 million TZS were held by 22 small and nine large banks, respectively (BoT, 2020). There were 31 commercial banks (CBs) in operation, 13 banks being locally owned and 18 owned by foreign entities. Figures 1 and 2 depict trends in non-performing loans among Tanzanian CBs from 2011 to 2020 by bank size and ownership categories.

4.1.1. NPLs Trends by Bank Size

Figure 1 presents NPL trends for bank size category among CBs in Tanzania from 2011 to 2020.

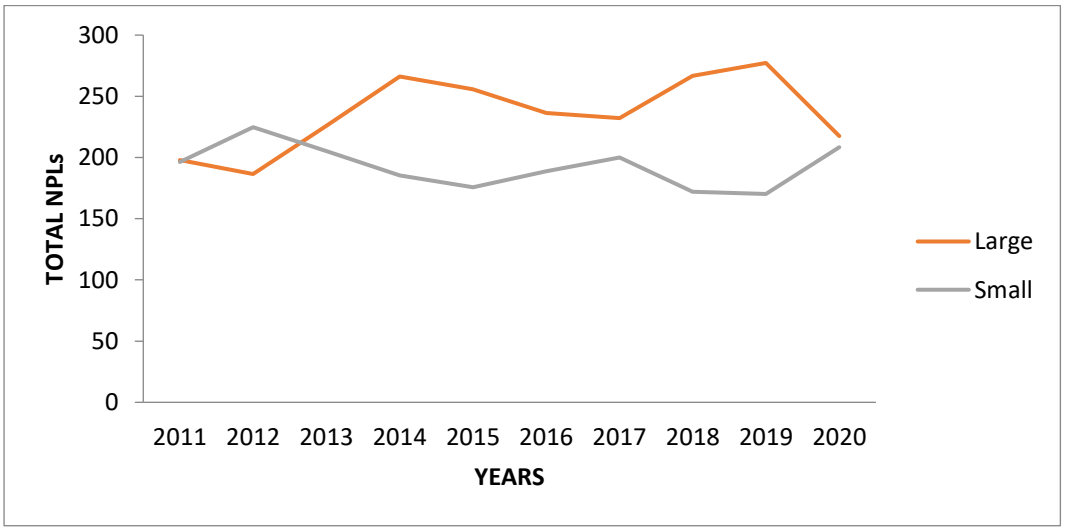

Figure 1: NPL trends for bank size category among CBs in Tanzania from 2011 to 2020.

According to Figure 1, in 2020, small banks had a growing trend of NPLs, while large banks depicted a decreased level of NPL. The increased level of NPLs in small banks is attributed to a number of factors including striving for market share by offering loans with lax screening requirements and diminished incentive programs designed to encourage borrowers to pay their debts (Budotela *et al.,* 2022; Warue, 2013).

4.1.2. NPLs trends by bank ownership

Figure 2 depicts the trends in NPLs per CBs ownership between 2011 and 2020.

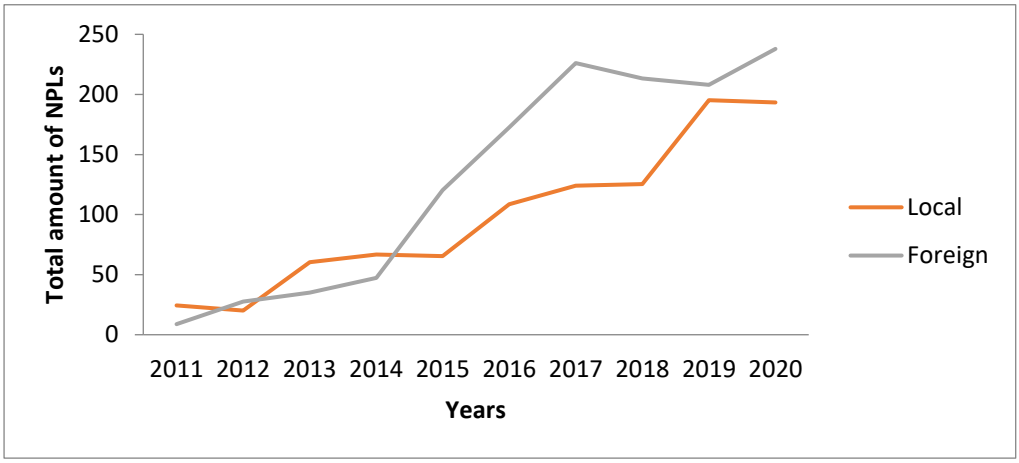

Figure 2: PLs per CBs ownership between 2011 and 2020.

From Figure 2, NPL performance under bank ownership categories shows that foreign banks had the highest NPLs, followed by locally owned banks. Both local and foreign banks showed an overall rise in NPLs. The struggle to gain market share may have contributed to the increase of NPLs by employing techniques with lesser encouragement to persuade borrowers to pay debts regardless of their financial situation. This scenario was similar to observations made in bank size analysis, as shown in Figure 1.

4.2. Descriptive statistics

Tables 3(a) and 3(b) present descriptive statistics on variables overviewing bank size and ownership categories. This table displays each variable's mean, minimum, maximum, and standard deviation.

Table 3(a). Overall descriptive statistics

Variable	Mean	Std	Min	Max
NPLs	1.81	1.03	-2.66	4.19
Lagged NPLs	1.67	1.11	-2.30	4.17
LIR	1.73	1.04	-2.66	4.19
M2	10.76	4.22	3.8	17
DRT	11.58	4.17	5	16
CPS	11.73	7.66	1.7	24.8
Age	3.06	1.02	0	4.82
Size	13.88	3.84	0	20.85
LTD	4.37	0.45	2.03	5.93
DGDP	6.60	0.92	4.8	7.9

Table 3(b). Descriptive statistics of variables across bank size and bank ownership

Variable	3(bi) 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
LIR	1.81	1.27	-2.66	4.19	1.67	0.82	-1.27	3.14
M2	10.88	4.21	3.8	17	10.63	4.23	3.8	17
DRT	11.66	4.11	5	16	11.49	4.26	5	16
CPS	11.85	7.67	1.7	24.8	11.59	7.68	1.7	24.8
Age	3.02	1.09	0	4.74	3.11	0.94	0	4.82
Size	11.47	2.98	0	13.45	16.76	2.57	13.49	20.85
LTD	4.42	0.49	2.03	5.93	4.31	0.39	2.39	5.52
DGDP	6.6	0.95	6.57	7.9	6.63	0.88	4.8	7.9

3b(ii)Bank Ownership

Variable	Local (n = 130)				Foreign (n = 180)			
	Mean	Std.	Min	Max	Mean	Std.	Min	Max
NPLs	1.8	0.9	-2.3	3.9	1.8	1.1	-2.7	4.2
Lagged NPLs	1.6	1.1	-1.6	3.9	1.7	1.1	-2.3	4.2
LIR	1.8	0.9	-2.3	3.9	1.7	1.1	-2.7	4.2
M2	10.8	4.2	3.8	17	10.8	4.2	3.8	17
DRT	11.6	4.2	5	16	11.6	4.2	5	16
CPS	11.7	7.7	1.7	24.8	11.7	7.7	1.7	24.8
Age	2.7	0.9	0	4.6	3.3	1.0	0	4.8
Size(TOTAL ASSET)	13.7	4.9	0	20.8	14.0	2.9	10.4	20.4
LTD	4.4	0.4	2.3	5.6	4.3	0.4	2.0	5.9
DGDP	6.6	0.9	4.8	7.9	6.6	0.9	4.8	7.9

Note: Tables 3(a) and 3 (b) present the descriptive statistics in general and across bank size and ownership categories for the variables in the study. The variable definitions are provided in Table 1.

The study used the mean to describe the central tendency of the data while the standard deviation was used to explain the dispersion within the data. The data set's proxies for bank size to total assets showed that large banks and foreign banks had the highest mean ranges, respectively. The highest mean values and comparatively high levels of dispersion were found in the ratios of credit to private sectors, M2, and discount rate, which had respective standard deviations of 7.66, 4.22, and 4.17 (see Table 3(a)), respectively and in bank size and ownership categories of 7.7, 4.23, and 4.26 (see Table 3(bi) and 3(bii)), respectively. Lending interest rate, age, bank deposits, and GDP measurements all showed standard deviations between 0.39 and 1.27 and mean values between 1.67 and 6.63. The bank lending interest rate showed the lowest degree of dispersion, with a standard deviation of 1.04.

4.3. Pearson Correlation analysis

The correlation matrices were used to evaluate how the variables interacted. Table 4 shows strong correlations of 0.638 and a minimum value of 0.0003. The correlation coefficients between the explanatory factors are moderate (Isik & Ince, 2016). NPLs were discovered to correlate with LIR, M2, and LTD positively. In contrast, it is found that there is a negative and statistically significant correlation coefficient between NPLs and M2, DRT, CPS, BV (total assets), bank age, and GDP.

Table 4. The Pearson correlation matrix

Variables	NPLs	NPLs-1	LIR	M2	DRT	CPS	Size	Age	LTD	DGDP	VIF
NPLs	1.0										
NPLs-1	0.797	1.0									2.15
LIR	0.657	0.707	1.0								2.15
M2	0.234	0.267	0.181	1.0							4.06
DRT	-0.208	-0.197	-0.267	0.368	1.0						1.56
CPS	-0.294	-0.317	-0.273	0.638	0.422	1.0					5.56
Size	-0.022	-0.047	-0.067	0.007	-0.004	0.004	1.0				1.02
Age	-0.034	-0.008	-0.006	-0.093	-0.102	-0.117	0.098	1.0			1.05
LTD	0.109	0.106	0.027	0.054	-0.037	0.030	-0.048	-0.115	1.0		1.05
DGDP	-0.0003	-0.028	-0.078	-0.178	0.328	-0.004	0.062	-0.031	-0.092	1.0	1.29

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

The correlation test results indicate no multivariate multicollinearity issue because all VIF values are less than 10, and this limit was proposed by Isik & Ince (2016). Variables with negative signs indicate a decline in NPLs; thus, when these variables rise, NPLs fall. On the other hand, variables with positive signs implied the increase of NPLs, meaning that as these variables increase, NPLs also increase.

4.4. Regression results

To test the overall validity of instruments used in the model, the study conducted the Sargan test of over-identification constraints to examine the general validity of the instruments used. This test provides a statistic distributed $\chi 2$ under the null hypothesis of the validity instruments (Arellano and Bond, 1991). It's essential to use the Sargan test to make sure the GMM estimators are reliable. The Arellano-Bond autocorrelation tests AR (1) and AR (2), the first-order and second-order autocorrelation of the residuals in the differenced equation are also used given the GMM estimator's assumption that there is no serial correlation between error terms. The null hypothesis that there is no second-order autocorrelation of the residuals in the differenced equation is rejected because it implies that the error components are serially correlated at the level and may, thus, indicate that the GMM estimator is inconsistent (Arellano and Bond, 1991). According to the Arellano-Bond technique, one should reject AR's (1) null hypothesis and accept AR's (2) null hypothesis.

With smaller sample sizes, the one-step system GMM estimator is preferred over the two-step GMM because it is less likely to be biased (Ameni *et al.,* 2017; Umanto, 2017). The results of the one-step system GMM estimates for the dynamic model in Eq (1) on the entire sample (baseline model, bank size, and ownership) categories are shown in Table 5.

Table 5: Estimation results of monetary policy variables and NPLs

Variables	Baseline model	One-step system GMM			
		Bank ownership		Bank size	
		Foreign	Local	Small	Large
NPLs-1	0.520***	0.733***	0.789***	0.805***	0.690***
LIR	0.241***	0.476***	0.699***	0.281**	0.475***
M2	0.002**	0.006*	0.011*	0.00**	0.005**
DRT	-0.029***	-0.006*	-0.002	-0.005*	-0.003*
CPS	-0.048***	-.030**	-0.018**	-0.007**	-0.003*
Bank value (size)	-0.011*	0.002**	-0.015*	-0.010*	-0.005**
AGE	-0.059*	-0.005**	-0.027*	-0.001**	-0.005**
LTD	0.004**	0.022*	0.014*	0.016*	0.048*
DGDP	0.055*	0.049*	0.146*	0.014*	0.037*
Test for AR(1)	z = -15.62(0.000)	z=-0.28(0.778)	z=0.71(0.477)	z= 0.63(0.526)	z=-0.94(0.348)
Test for AR(2)	z = 0.55(0.579)	z=-0.85(0.398)	z=0.41(0.680)	z = -1.64(0.101)	z= 0.90(0.367)
Sargan test	chi2(49) = 77.43(0.006)	chi2(53) = 177.38(0.000)	chi2(24) = 43.65 (0.008)	chi2(53) = 166.85(0.000)	chi2(56) = 171.67(0.000

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

The regression results indicate that CBs in the country are affected by changes in monetary policy. As shown in Table 5, the coefficient of the lagged dependent variable was positive and statistically significant on both baseline, bank ownership, and bank size. These findings suggest that a shock to NPLs will likely have a prolonged effect on the banking system because of delinquent loans. The results are similar to the previous study by Dao *et al.* (2020) and Karsten and Lenno (2019). The coefficient value for the relationship between lending interest rates and NPLs is positive and significant. This result suggests that increase in interest rates results in an increased NPLs ratio, supported by the findings of Mahrous *et al*. (2020) and Diana and Carla (2014). The theoretical justification of these results is that a rise in lending interest rates (i.e., floating interest rates) increases the value of borrowers' debt and makes debt servicing more expensive. This will increase loan defaults and, hence, NPLs. Moreover, more significant interest rate uncertainty due to monetary policy dynamics affects banks' source of funds, influencing loan growth and NPLs (Ghosh, 2015).

Concerning the money supply (M2) variable, the effect is statistically significant and positively related to NPLs. This is expected and supports the H2 hypothesis. The positive relationship between M2 and NPL suggests that growth in money supply (M2) creates inflation in the country, and the outcome after that is high default rates. Moreover, high inflation passes through to nominal interest rates, reducing borrowers' loan-servicing capacity thus negatively affecting their real income when nominal wages are sticky. If the income does not increase in line with inflation caused by M2, a rise in inflation increases costs (for both households and corporations), thus lowering the amount of available funds for debt repayment. These results are supported by Skarica (2014) and Sofoklis and Eftychia (2011).

The co-efficient value for the relationship between discount rate (DRT) and NPLs is negative and significant. The justification of this result is that, with an increase in the bank rates (discount rate), CBs also reduce the lending rates. On the contrary, when the central bank lowers the bank discount rate, the spot interest rate increases and expected long-term interest increases lead to decreased investment and consumption (Vo & Nguyen, 2014). Furthermore, it contributes to reduced income and ability to repay the loan, which amounts to bank NPLs.

The results in Table 5 provide a negative significant relationship between NPLs and credit to the private sector and are consistent with the findings of existing studies (Asiama & Anthony, 2018; Akinlo & Emmanuel, 2014). The results suggested that increasing credit to private sectors decreases the level of NPLs in the economy. This is because when loans are granted to productive industries, they can generate income to satisfy their loan obligation over time. Defaulting is less significant when loans are given to productive sectors. Other things being equal, when the central bank allows CBs to issue more credits to private sectors, it is expected to boost private investment, stimulating more economic activities. This is expected to produce a positive performance on the

previous CB's loan portfolios, reducing the possibility of defaults and, hence, lower NPLs (Prasanna). In the same vein, as NPLs rise, the value of private projects declines, and the private sector becomes more prone to loan defaults, which reduces the amount of credit available to them.

The control variables of bank value (total assets), bank age, loan-to-deposit ratio, and GDP were also analyzed similarly on the GMM model and found significant in explaining bank NPL variations. For instance, bank value significantly influenced NPLs in local and small banks, suggesting that bank value (total assets) significantly negatively affects decreasing NPLs. The theoretical justification for the negative association is that larger banks have more resources and are more experienced in dealing better with defaulters' borrowers, hence the low NPLs ratio. On the contrary, small banks may be exposed to adverse selection problems due to the lack of sufficient competencies and experience to assess the credit quality of borrowers effectively. The adverse finding is consistent with the literature (Biekpe, 201; Hu *et al.,* 2004).

The study found a negative and significant relationship between NPLs and bank age. The negative relationship suggests that as banks mature, they accumulate experience in banking operations, increasing their possibility of reducing NPL risks by offering efficient services.

The co-efficient value for the relationship between NPLs and loan to deposit ratio is positive. The positive results were expected because a higher proportion of loans concerning deposits means easier loan granting and, therefore, a higher probability of developing NPLs. Additional justification of this finding is that when banks have more deposits, management provides more loans at lower interest rates and maintains low credit standards to capture the market share. Such poor credit standard increases the possibility of borrowers' default. On the other hand, banks adopt a 'liberal credit policy' by extending new loans to insolvent borrowers so that borrowers keep repaying old loans so those loans do not turn bad.

The co-efficient value for the relationship between NPLs and GDP is positive and statistically significant. The theoretical justification for the important positive relationship is that the high demand for loans due to economic expansion caused banks to give more loans without making proper customer credit ratings. So, some less creditworthy customers get the loan, which leads to increased NPLs. This finding is in line with the study by Beck *et al*. (2015). Moreover, banks reduce their credit conditions in the boom period, leading to the deterioration of the bank assets' quality. In contrast, this finding contradicts that obtained by Ahlem and Fathi (2013), who found the inverse relationship between the GDP and NPLs. This negative result has been interpreted to mean that an expanding economy contributes to an improvement in income, which in turn enhances the debt-servicing capacity of borrowers and, consequently, lower NPLs.

4.4.1 Different measures for bank NPLs

Also, the one-step difference GMM was applied to test and confirm the consistency of the outcomes obtained by one one-step system, as shown in Table 5. Results obtained by one one-step system may not be sufficient to capture specific properties of NPLs that build up over a longer time frame. Equation (1) was rerun using the one-step difference GMM approach to address this. The results in Table 6 are similar to those for the baseline model. This implies that the baseline model results were valid and reliable to represent the total population of Tanzania banks.

Table 6: Estimation results of monetary policy variables and NPLs

Variables	One-step difference GMM				
		Bank ownership		Bank size	
	Baseline model	Foreign	Local	Small	Large
NPLs-1	0.002**	0.000***	0.001***	0.0002***	0.004***
LIR	0.014*	0.003**	0.000***	0.001**	0.000***
M2	-0.002	0.011*	0.008	-0.020*	0.004**
DRT	-0.024**	-0.002**	-0.006*	-0.005*	-0.004**
CPS	-0.000***	-.003*	-0.000***	-0.002*	-0.001**
Bank value (size)	-0.001**	-0.005**	-0.007**	-0.004**	-0.009*
AGE	-0.023*	-0.048*	-0.031*	-0.006*	-0.001**
LTD	0.047*	0.031*	0.042*	0.041*	0.054*
DGDP	0.047	0.033*	0.016*	-0.013*	0.025*
Test for AR(1)	z = -7.11(0.000)	Z=-0.17 (0.866)	z=0.81(0.417)	z= 1.03(0.304)	z = -0.96(0.338)
Test for AR(2)	z = -0.00(0.998)	Z= -1.26 (0.208)	z 0.31(0.758)	z= -1.52(0.129)	z = -1.10(0.270)
Sargan test	chi2(25) = 44.24(0.010)	chi2(24) = 77.96(0.000)	chi2(25) = 77.43(0.000)	chi2(51) = 200.34(0.000	chi2(25) = 75.86(0.000

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

5.0. Conclusions, Implications, Recommendations, and Limitations

Like many emerging markets, Tanzania's economy has been growing very fast in recent years; however, the economy, especially of firms is highly dependent on banks for credit. Even though the role of bank lending channels in monetary transmission has been widely studied in developed economies, little attention has been given to investigating this issue in Tanzania. This study investigates the effect of monetary policy on non-performing loans among commercial banks in Tanzania. We suggest that it is essential to consider discount rate, lending interest rate, credit to the private sector, reserve requirements, and other inflation and bank size when analysing the functioning of the bank lending channel of monetary policy.

To study the effect of monetary policy on NPLs, we used the dynamic panel GMM model. The results show that the relationship between monetary policy indicators and NPLs is positive and statistically significant. Thus, increased lending interest rates due to policy rate changes to the upside help explain why there are more NPLs in the banking sector (CBs). This is because raising the lending interest rate stresses borrowers severely, increasing the possibility of defaulted and non-performing loans. Hence, the central bank in the country needs to decrease the lending interest rate at an affordable level to reduce the effect of monetary policy on NPLs. The interest rate channel for the policy rate must work practically to reduce the trends in the growth of NPLs. Using lending rates as policy instruments to influence NPL would effectively change the level of NPL.

The analysis also reveals that money supply (M2) was positive and significant, affecting country trends in NPLs. More specifically, the effect on NPLs becomes more important when the central bank supplies the money in circulation due to the inflation rate. Additionally, monetary policy supports the private sector through credit, which has an essential effect on the country's NPLs. This finding supports the need for tighter controls on expectations and inflation. While doing this, policymakers must consider that the private sector leads the effort to reduce NPLs in the country by helping to provide an attractive environment for it to operate in and helping it establish a strong credit profile.

The results of this study can help the bank supervisor and government to enhance their banking system stability and economic policies. The main policy implication drawn from the study's findings is that policymakers in the country need to adopt a suitable monetary policy according to the risk appetite of the country's monetary authority. They should consider the effect of their policies on the NPLs in the banking system and other considerations like economic stability and inflation. Further, the study concluded that the government should create stable financial circumstances. This can be done by reducing banks' borrowing and operating costs, decreasing the difference between interest rates and bank rates, and allowing the private sector to participate actively in development. The Tanzania Reference Rate should be implemented to ensure transparency in the calculation of the commercial interest rate because it reflects the relationship between the bank rate, the interest rate on commercial loans, and, ultimately, NPLs. As a result, more credit will be made available to the private sector and other borrowers, the risk of default

and NPLs will be lower, a more productive industry will be drawn to the financial market, recognition of viable projects will grow, and Tanzania's economic development will be improved.

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