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Original Article

Factors Influencing the Growth of Non-Performing Loans; Fresh Evidence from Rwanda, Autoregressive Distributed Lag Approach

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Abstract *- This study empirically examined the link between the quality of the loans and their determinants in the banking sector in Rwanda. The study used quarterly time-series data collected from the National Bank of Rwanda (BNR) and National Institute of Statistics of Rwanda (NISR) from Quarter1, 2012, to Quarter 4, 2021, in Rwanda. ARDL-ECM was used to estimate the long and short-run relationships between variables of interest. Several tests, such as Bound/Co-integration and Toda-Yamamoto Causality, were tested in this study. Impulse responses were also conducted. Empirical results indicated that both exchange rate, lending interest rate and inflation rate statistically affect the non-performing loans ratio in the short and long run.*

Furthermore, the analysis indicated that the Loans to Deposits Ratio and Capital Adequacy Ratio have no statistically significant effect on the Non-Performing Loans Ratio. The short-run impact of the Dummy of the COVID-19 pandemic introduced in the model was prevalent and found to be negatively correlated with NPLs in the long run, from which we recommend further studies to ascertain the direction of its causal effect. The results indicated that previous deviation or shock from the long-run equilibrium will be corrected in the current period. As policy implications, the study suggests that Banks should cut interest rates on loans to make them less expensive for borrower's to meet their commitments. Furthermore, the Regulatory Authority should put more effort into stabilizing the inflation and exchange rates, which were found to exert a strong and positive impact on the Non-Performing Loans Ratio.

Keywords *- Capital Adequacy Ratio, Lending Interest Rate, Loans to Deposits Ratio, ARDL, Non-performing loans.*

1. Introduction

It has been empirically and conceptually demonstrated that a failing financial system seriously undermines a nation's social cohesion and economic prosperity. The world has had multiple instances of banking sector crises in recent years (Patrick, 1997).

Beginning with the bankruptcy of the American financial institution, the global economic recession led to a global crisis, which in turn caused several bank failures in Europe and significant declines in the global market value of commodities and stocks.

Due to the nature of their business, commercial banks expose themselves to the risks of default from borrowers, and it only takes 90 days for a borrower who is not paying to become a non-performing loan.

Non-performing loans are defined as loans that are considered NPLs when they doot generate principal or interest rates for at least 90 days (IMF, 2005). Bad debts or Non-performing loans affect the lending institution, the borrower, the country, and the whole world. The below illustration compares non-performing loan figures from different regions of the world;

The figure compared NPL ratio figures for the USA, UK, China, Australia, South Africa and Rwanda, and it was evident that African figures represented by Rwanda and South Africa remain very high compared to other regions.

Furthermore, the median NPL ratio in Sub-Saharan Africa is 11.7 percent, which is more than double that of other regions, the sole exception being South Asia, with an NPL ratio of 8 percent (IMF, 2021).

Rwanda has a long-term financial Sector objective of becoming an international service center; however, one of the major challenges for Rwandan financial sector growth is the high inflation rates and interest rates fluctuations driven by mainly supply distress due to climate change, collapse in production and other consequences of the Genocide against TUTSI of 1994 (Ruzima Martin, 2015), also confirmed by (Nyabyenda and Gakuru, 2020)

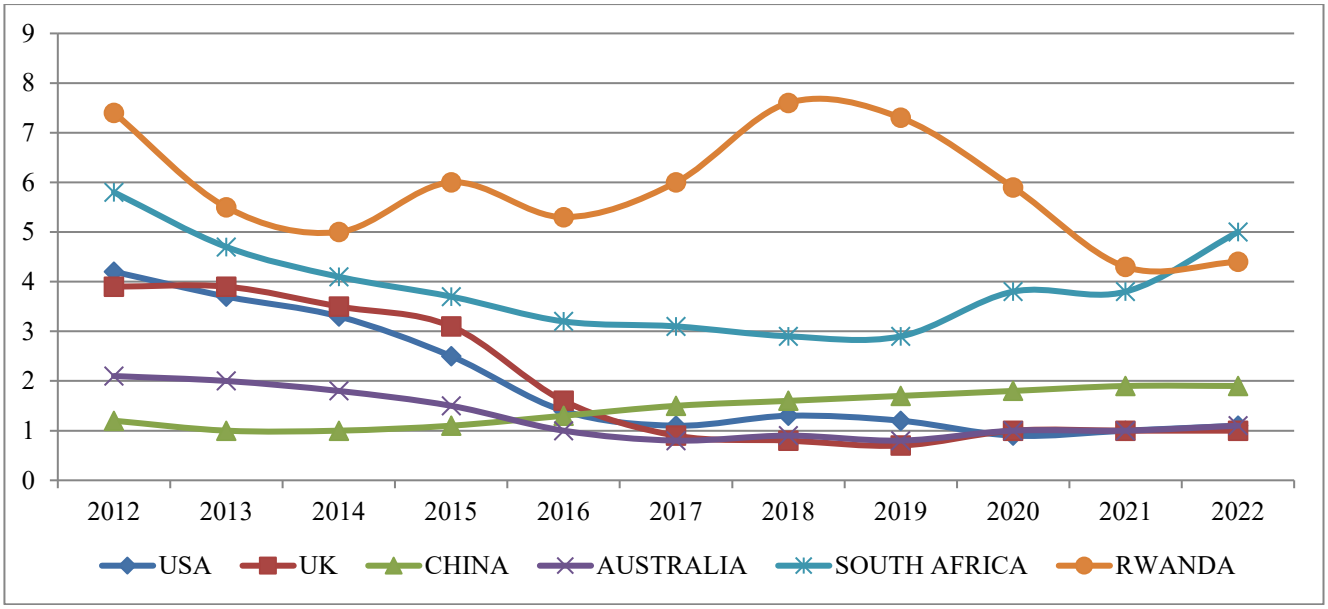

Fig. 1 Global history trend of non-performing loans

Source of Data: World Development Indicators, 2022 (World Bank)

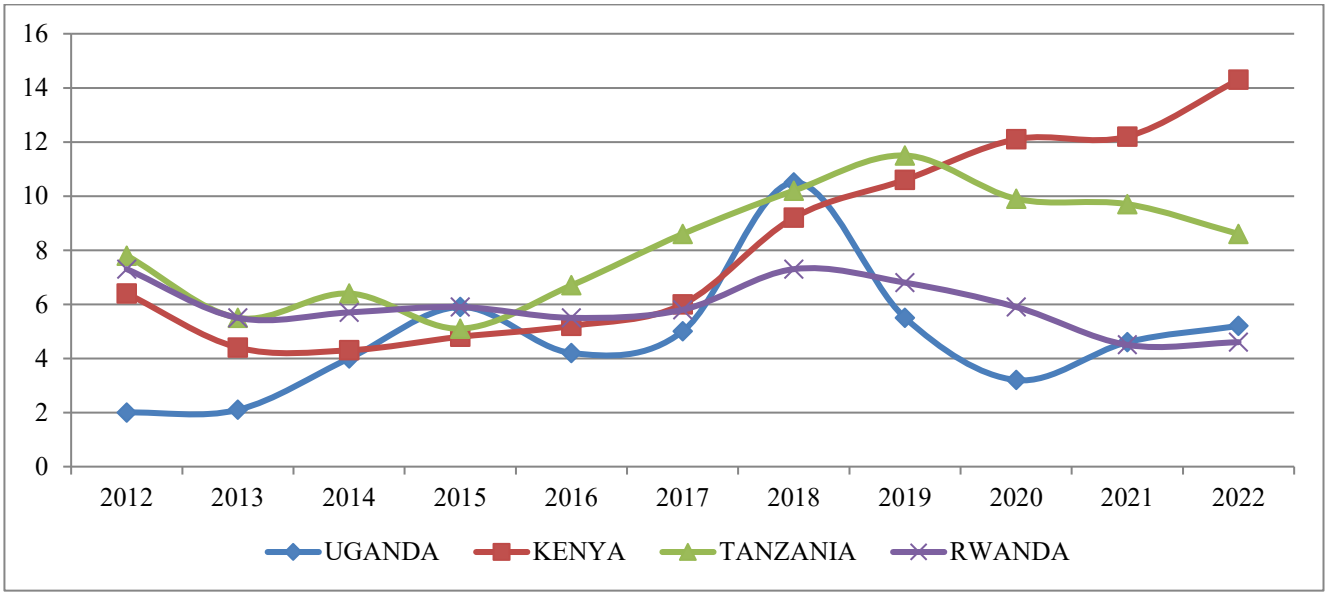

Fig. 2 Non-Performing loans trend in the east african region

Source of Data: World Development Indicators, 2022 (World Bank)

Economic conditions affect the demand for the financial system's services and borrowers' ability to repay their debts (Adam and Fiona, 2017). A number of factors can determine financial development; among them, macro-economic stability factors (interest rate, inflation, exchange rate and so on) remain critical factors in securing the financial sector development; hence, a stable macroeconomic environment is a fundamental condition for a healthy financial sector performance (Manoel, 2012) The country's financial performance can also be determined by comparing prices and quantities particularly interest rate spread and stock flow (Asratie, March 2021) Macroeconomic factors affecting Non-Performing Loans are believed to be diverse but would normally revolve around factors, such as the growth of domestic production, GDP, inflation, exchange rate, and changes in interest rates (Kure, 2017).

Furthermore, the impacts of COVID-19 have been highly unequal within and between countries, and its consequences include high levels of unemployment, increase in sovereign debts, supply-chain challenges and rising inflationary pressures (World Bank, 2022). From a financial perspective, in the wake of the COVID-19 pandemic, the Basel Committee on Banking Supervision and various national supervisors have taken several measures to prevent a banking crisis. However, regardless of the measures taken, a significant number of studies affirmed that the COVID-19 crisis has affected different nations' banking systems in one way or another (World Bank, 2022).

However, in Rwanda, non-performing loans (NPLs) are gradually above the Central Bank's medium-term target of 5 percent and have been identified as a major challenge contributing to credit risk for the banking sector. A glance at non-performing figures for the last decade in Rwanda shows a fluctuating move of the NPL Ratio, averaging 6.4 percent with a minimum of 4.37 percent in 2020 and a maximum of 7.6 percent in 2016. Though Rwanda's figures are outstanding compared to the figures of other neighboring countries such as Uganda, Kenya and Tanzania, the average figure remains very high compared to the Central Bank regulatory advisable limit on NPL of 5 percent as well as the world average NPL ratio in 2020 which was 5.86 percent based on figures of 102 countries worldwide. Furthermore, a review of local studies revealed a range of studies, including (Gasheja, 2020), (Celestin, 2019), (Adeline, 2019), (Nabonobo, 2011), and (Roselyn, 2019) were conducted to assess the impact of Non-Performing Loans on financial performance which empirically ascertained a positive relationship between the two variables. However, little attention was drawn to the impact that various macro-economic variables and bank-specific factors exert on non-performing loans rise over time. This study provided more insights by including a large sample and using a different methodology. The novelty of this study lies in providing a deep understanding of the overtime (short-run and long-run) dynamics influencing NPLs through the ARDL model and impulse response. The study comprises the following sections: Section 2: Empirical Literature, Section 3: Methodology, Section 4: Empirical Results and Section 5: conclusion and Policy Suggestions.

2. Empirical Literature

Although there is just some existing research on the factors determining non-performing loans, there is no study conducted in the Rwanda context, especially involving both macroeconomic factors and bank-specific factors with an emphasis on COVID-19 effects. Historical references provide clear evidence that global crises have alerted economists and policymakers that financial instability can tremendously affect the overall health of any country's economy. Theories and various research have shown that Bank-specific factors cannot be left behind while examining the factors affecting non-performing loans.

Many economists emphasized Bank specific factors such as Capital Adequacy Ratio (CAR), Loans to Deposits (LTD) Ratio, as well as Bank Size (BS) exert significant effects on Non-Performing Loans ((Saurina, 2002) & (Zeng, 2012)). Capital adequacy, earning ability, and bank sizeere also emphasized as significant determinants of bank non-performing loan level(Langrin, 2001). Furthermore, asset quality and the size of a bank significantly determine the levels of non-performing loans. On the other hand, higher bank liquidity may influence a bank's non-performing loans for two reasons. Foremost, a high liquidity ratio sends a positive signal to the depositors that the bank is liquid and subsequently improves the depositors' confidence. However, a lower liquidity ratio signals a bank is not in a good situation. Secondly, higher liquidity may also imply the inefficient utilization of resources, suggesting weak financial investment activities (Musau, 2014).

Any sudden market change can bring about changes in the loan market by affecting how much money people can take as loans and make payments Bloem and Gorter (2001). Referring to the aforementioned theories, a healthy and growing macro-economic environment is the most necessary for a stable financial sector with a reducing credit risk. Banks are vulnerable to the wrong behaviour of their borrowers. MacDonald and Koch (2003) suggest that in good economic conditions, both borrowers and lenders are confident about investment project and their ability to repay their loans. Furthermore, each bank's policy choices, such as the emphasis on improving efficiency and risk management, along with the typical features of the banking sector, are expected to influence the evolution of NPLs (Abid et al., 2014).

Economists argue that there exist many ways and frameworks to explore the key determinants of Non-Performing Loans in a country's banking sector, whereby some have factors only relied only on macro-economic factors to explain the variability in NPLs while others have relied on both macro-economic and bank-specific factors. For this study, we have used the framework from a study conducted by Shawleen, Tasnova and Nawar in 2022 to explore the determinants of non-performing loans. A high inflation rate results in the instability of business profits because of its unpredictability nature. Consequently, this variability manifests in the rates of increase in the price of the particular goods and services that make up the overall price index, which can cause individuals or companies to suffer losses, hence decreasing their ability to honour their debt obligations towards lenders. Thus, it is likely to increase the NPLs (Sheefeni, 2015). On the other hand, high inflation can boost the borrower's capacity by reducing the real value of the outstanding debt (Farhan et al., 2012).

Lending Interest Rate is believed to significantly affect debt servicing capabilities, especially in the case of floating interest rates. An increase in interest rate worsens the debt burden as a result of increased interest payments, resulting in a high number of NPLs (Gezu, 2014). A higher level of real interest rate causes more burden for borrowers to repay the loan. Many studies, such as (Makri et al., 2014) and (Nkusu, 2011) have empirically evidenced that that there is a significant and negative relationship between real GDP and Non-Performing Loans. The relationship between GDP and non-performing loans can be interpreted by an increase in the level of actual GDP growth, which positively influences the level of profits in line with the decrease in NPLs. In this situation, the repayment capacity of the borrower is increased, thus directly solving the bad debt issues. On the contrary, a collapse in the economy, decrease or adverse growth of GDP leads to unsettled debts (Zainol et al., 2018).

The exchange rate measures the domestic currency's worth with another currency (Zameer and Siddiqi (2010); furthermore, banks' specific factors such as Capital adequacy, bank size and Loans to Deposits were found to exert a significant influence on any country's level of defaulting loans (Salas and Saurina, 2002). The Loan to Deposit Ratio states how far the bank's ability to repay the depositors' funds withdrawals by relying on the credits given as a source of liquidity (Berge, 2007). The higher the LDR of a bank, the higher the probability of problem credibility that will occur because this ratio indicates one of the bank's liquidity ratings (Yulianti, 2018)

This research study contributes to a growing body of literature on the financial sector between Rwanda and the rest of the world. Many studies on the macroeconomic determinants of non-performing loans have been conducted in many developing countries, including African countries. However, when it comes to Rwanda, the studies are still few. A review of local studies revealed that a range of studies was conducted to assess the impact of Non-Performing Loans on financial performance, which empirically ascertained a positive correlation between the two variables. However, little attention was drawn to the impact that various macro-economic variables and bank-specific factors exert on non-performing loans rise over time (Twesige and Gasheja, 2020), (Celestin, 2019), (Adeline, 2019), (Nabonobo, 2011), and (Roselyn, 2019).

A similar study was conducted by Economists Karuhanga, Maniraguha and Hakuzwimana in a study titled "Determinants of Non-Performing Loans in Rwandan Banking Sector" by estimating a fixed effect panel model that looked at both bank-level and macroeconomic indicators over the period 2012 quarter 1 to 2017 quarter which is around 5 years. The study's findings revealed that an increase in real economic growth, bank size, return on assets, or growth of loans leads to a decrease in NPLs.

In contrast, an increase in real interest rate, inflation or exchange rate depreciation leads to poor bank asset quality. However, this study used a very small sample and an analysis method that is different from ARDL, which is able to examine the long-term relationships and dynamics among variables. This study fills this gap by assessing factors affecting Non-Performing Loans using quarterly time series data from 2012 to 2021 on both macroeconomic and bank-specific data.

3. Methodology

3.1. Data

The study used published quarterly time series secondary data from quarter one of 2012 till quarter four of 2021. The data set was collected from the National Bank of Rwanda (BNR) and the National Institute of Statistics of Rwanda (NISR). The time series data that were used in this study are Non-Performing Loans Ratio (NPL), Gross Domestic Product (GDP), Lending Interest Rate (LIR), Inflation Rate (INFL), Exchange Rate (EXC), Capital Adequacy Ratio (CAR), Bank Size (BS), Loans to Deposits Ratio (LTD) as well as COVID-19 as a dummy variable. The choice of using quarterly data is based on the fact that it takes a whole quarter for a performing loan to become non-performing, and a month is too short a period for the NPL ratio to react. At the same time, a year is too long a period where many changes could be made.

This study used a correlational research design and attempted to find out cause-effect relationships among the variables of interest. The target population was the entire banking sector in Rwanda, which is composed of 10 commercial banks, 1 development bank, 1 cooperative bank, and 3 microfinance banks as of current. Those commercial banks include Access Bank Rwanda Plc, Bank of Africa Rwanda Plc, Bank of Kigali Plc, Bank Populaire du Rwanda, merged with KCB Bank Rwanda Plc, Cogebanque Plc, Ecobank Rwanda Plc, Equity Bank Rwanda Plc, Guaranty Trust Bank Rwanda Plc, I & M Bank Rwanda Plc and NCBA Bank Rwanda Plc. Development Bank includes Development Bank of Rwanda Plc, and Cooperative Bank includes Zigama CSS and Microfinance Banks involving AB Bank Rwanda Plc, Unguka Bank Plc and Urwego Bank Plc

3.2. Model Specification

The study used the log-linear functional form to estimate the relationship between the variables of interest. The variables were Non-Performing Loans Ratio (NPL), Gross Domestic Product (GDP), Lending Interest Rate (LIR), Inflation Rate (INFL), Exchange Rate (EXC), Capital Adequacy Ratio (CAR), Bank Size (BS) as well as Loans to Deposits Ratio (LTD).

The study used the following model as per the two objectives, which are "assessing the effect of macro-economic variables (Gross Domestic Product, Exchange Rate, and Inflation rate) on non-performing loans" and "assessing the effect of bank-specific factors (Capital Adequacy Ratio, Lending Interest Rate, Loans to Deposit Ratio, and Bank Size) on non-performing loans". The Dummy variable of the COVID-19 pandemic was added to the model.

$$NPL_t = \beta oLIR_t^{\beta 1} INFL_t^{\beta 2} GDP_t^{\beta 3} EXC_t^{\beta 4} CAR_t^{\beta 5} BS_t^{\beta 6} LTD_t^{\beta 7} DCOV_t^{\beta 8} e^{ut} \quad (1)$$

Where NPL_t stands for Non-Performing Loans Ratio at the time (t), LIR_t, Lending Interest Rate at the time (t), $INFL_t$ inflation rate at the time (t), GDP_t Gross Domestic Product at the time (t), EXC_t represents Exchange rate between Rwandan currency and US dollar at the time (t), CAR_t represents Capital Adequacy Ratio at the time (t), BS_t represents Bank Size at time (t), LTD_t represents Loans to Deposits at time (t), $DCOV_t$ represents the value of the Dummy of COVID-19 at time (t), e natural logarithm and U_t error term.

Based on our function, the econometric model, to obtain estimates of the parameters, the model was transformed into a linear one by introducing a natural logarithm; thus, the model became as follows;

$$LogNPL_t = Log\beta o + \beta_1 LogLIR_t + \beta_2 LogINFL_t + \beta_3 LogGDP_t + \beta_4 LogEXCt + \beta_5 LogCARt + \beta_6 LogBS_t + \beta_7 LogLTD_t + \beta_8 DCOV_t + U_t \quad (2)$$

Assuming that $ln\beta o = \alpha$

The equation becomes:

$$LogNPL_t = \alpha + \beta_1 logLIR_t + \beta_2 LogINFL_t + \beta_3 LogGDP_t + \beta_4 LogEXCt + \beta_5 LogCARt + \beta_6 LogBS_t + \beta_7 LogLTD_t + \beta_8 DCOV_t + U_t \quad (3)$$

3.3. Estimation Techniques

In evaluating the relationship between non-performing loans and their macroeconomic determinants and to find out the answers to research questions, this study adopted a model used by (Harris, 2003), the Autoregressive Distributed Lag Method, which was revealed to be very good in terms of small sample size and for time series data integrated of different orders. The process is outlined in the next subsection. The data were processed using E-views 12 software.

3.3.1. Descriptive Statistics

In this study, summary statistics were generated to describe the data in the sample. Measures of distribution, central tendency and variability were conducted.

3.3.2. Test for a Unit Root

Considering the fact that the study employed time-series data, the first step to begin with, was to test for stationarity. This required testing the order of integration in the data set (unit root test).

For the purpose of this study, Augmented Dickey-Fuller (ADF) (1979) was used for the unit root test due to its ability to control the effect of autocorrelation between variables.

3.3.3. Testing for Co-Integration

There are various methods of testing for co-integration. This study used the Bound Test to test the presence of a long-run relationship between the variables. The choice of this approach is based on the fact that the study used the ARDL method; hence, the Johansen co-integration test cannot be performed.

3.3.4. ARDL Model Specification

Generally, the ARDL (p, q) model is specified as flow:

$$Y_t = \gamma_{0i} + \sum_i^p \delta i Y_{t-i} + \sum_{i=0}^q \beta i x_{t-i} + \varepsilon_t \quad (4)$$

Where Y't is a vector and the variables in X't should be $I(0)$ and $I(1)$ or co-integrated, δ and β are coefficients, γ is constant, i = 1.2…k and, p, q are optimal lag order (p number of lags for dependent and q number of lags for independent variables) εt is a vector of the error term. The dependent variable is a function of its lagged values, the current and lagged values of explanatory variables in the model.

To perform the bound test for co-integration, the conditional ARDL (p, q) the following hypotheses.

Hypotheses

Ho: $\beta_{1j} = \beta_{2j} = \beta_{3j} = \beta_{4j,\ldots\ldots\ldots} = 0$ (where j=1, 2, 3, 4,….,) that means the long run relationship does not exist

H1: $\beta_{1j} \neq \beta_{2j} \neq \beta_{3j} \neq \beta_{4j}$;,,,,,,,,,,,,,,$\neq 0$ the long run relationship exists

If the computed F-statistic falls below the lower bound critical value, the null hypothesis of no-co-integration cannot be rejected. On the contrary, if the computed F-statistic lies above the upper bound critical value, the null hypothesis is rejected, implying a long-run co-integration relationship amongst the variables in the model. Nevertheless, the inference is inconclusive if the calculated value falls within the bounds**.**

If there is no co-integration, the ADRL is supposed to be specified as follows:

$$\Delta LogNPL_t = \alpha_{01} + \sum_{i=1}^k \delta 1i\, \Delta LogNPL_{t-i} + \sum_{j=1}^k \delta 2i \Delta LogLIR_{t-j} + \sum_{m=1}^k \delta 3i \Delta LogNFL_{t-m} + \sum_{n=1}^k \delta 4i\, \Delta LogGDP_{t-n} + \sum_{i=1}^k \delta 5i\, \Delta LogEXC_{t-p} + \sum_{i=1}^k \delta 6i \Delta LogCAR_{t-p} + \sum_{i=1}^k \delta 7i\, \Delta LogBS_{t-g} + \sum_{i=1}^k \delta 8i Log\Delta LTD_{t-z} + \sum_{i=1}^k \delta 9i DCOV_{t-r} + e_{1t} \quad (5)$$

If there is co-integration, the Error correction model (ECM) will be specified as follows;

$$\Delta LogNPL_t = \alpha_{01} + \sum_{i=1}^k \delta 1i\, \Delta LogNPL_{t-i} + \sum_{j=1}^k \delta 2i \Delta LogLIR_{t-j} + \sum_{m=1}^k \delta 3i \Delta LogNFL_{t-m} + \sum_{n=1}^k \delta 4i\, \Delta LogGDP_{t-n} + \sum_{i=1}^k \delta 5i\, \Delta LogEXC_{t-p} + \sum_{i=1}^k \delta 6i \Delta LogCAR_{t-p} + \sum_{i=1}^k \delta 7i\, \Delta LogBS_{t-g} + \sum_{i=1}^k \delta 8i Log\Delta LTD_{t-z} + \sum_{i=1}^k \delta 9i DCOV_{t-r} - \lambda ECT_{t-1} + e_{1t} \quad (6)$$

Where, $\delta 1, \delta 2, \delta 3, \delta 4, \ldots\ldots$ are the short-run coefficient, $\boldsymbol{\lambda}$ is the speed of adjustment parameter, and ECM is the error correction term.

3.3.5. Post Estimation Test

The results of the estimation technique were backed and subjected to the post-estimation technique, which presents the major statistical assumptions of the ARDL model analysis. Normality Test: Assuming that the residuals or error terms are normally distributed. This assumption was checked using the histogram. Homoscedasticity: There is an assumption that the variance of error terms is similar across the values of the independent variables (Farrar and Glauber (1967). This was tested using the Breusch-Pagan-Godfrey Test. No autocorrelation: Autocorrelation shows the degree of similarity between a given time series and a lagged version of itself over successive time intervals. No or Little Multicollinearity: It is the occurrence of high inter-correlations among independent variables. The model assumes that those independent variables should not be highly correlated with each other.

The study conducted by Donald and Robert confirms that the more your VIF increases, the less reliable your regression results are going to be accurate (Farrar and Glauber (1967). Generally, a VIF above 10 indicates a high correlation. Stability Test: Considering the fact that this study used time series data to ascertain whether our

coefficients in the model are stable, the model stability was primarily investigated by the cumulative sum of recursive residuals (CUSUM) test.

4. Empirical Results

4.1. Descriptive Statistics

Table 1 presents descriptive statistics for variables used in the estimation, shows that all the series display a high level of consistency as their mean and median values are perpetually within the maximum and minimum values of the series. The descriptive statistics results confirm the validity of adopting the study's estimation techniques.

4.2. ADF Unit Root Results

Before any other estimation was made, the stationarity of the variables in both their level and first difference were conducted, as shown in Tables 2 and 3, respectively.

Ho = There is a unit root/the series is not stationary

H1= Time series is stationary

Decision Criteria: reject Ho if the test statistics of a variable are greater than the critical value in absolute terms.

Table 1. Descriptive statistics

	NPLR	GDP	INFL	EXC	LIR	BS	CAR	LTD
Mean	6.370	1855.650	3.814	800.692	16.913	2596.655	23.237	93.221
Median	6.315	1811	3.578	812.775	17.110	2405.102	23.192	94.202
Maximum	8.200	2930	8.975	1008.210	17.526	5063.930	26.600	100.800
Minimum	4.470	1114	0.206	606.750	15.700	1123.250	20.800	81.400
Std.Dev	0.915	511.721	2.590	124.708	0.488	1120.959	1.396	4.662
CV	0.14	0.28	0.68	0.16	0.03	0.43	0.06	0.05
Skewness	-0.070	0.304	0.408	-0.009	-0.756	0.552	0.276	-0.805
Kurtosis	2.513	1.954	2.023	1.715	2.747	2.374	2.501	3.147
Jarque-Bera	0.427	2.439	2.700	2.750035	3.926	2.689	0.925	4.365
Probability	0.80	0.295	0.259	0.252835	0.140	0.260	0.629	0.112
Sum	254.815	742260	152.574	32027.69	676.546	103866.2	929.492	3728.852
Sum Sq.Dev	32.677	10212493	261.756	606532.6	9.309	49005381	76.100	847.80

Source: Authors' computation

Table 2. Results of augmented dickey fuller unit root test of time series

Variables	ADF Test Statistics and Probability		Critical Values at I(0)			Critical Values at I(1)			Order of Integration
	I(0)	I(1)	1%	5%	10%	1%	5%	10%	
Log NPLR	T-St: 2.13 Prob: 0.51	T-St: 8.01 Prob: 0.00	4.21	3.53	3.19	4.21	3.53	3.19	**I(1)**
Log GDP	T-St: 4.23 Prob: 0.00	-	4.21	3.52	3.19				**I(0)**
Log EXC	T-St: 1.64 Prob: 0.75	T-St: 4.38 Prob: 0.00	4.21	3.53	3.19	4.21	3.53	3.19	**I(1)**
Log INFL	T-St: 3.89 Prob: 0.02	T-St: 6.51 Prob: 0.00	4.23	3.54	3.20	4.21	3.53	3.19	**I(1)**
Log LIR	T-St: 2.39 Prob: 0.37	T-St: 8.42 Prob: 0.00	4.22	3.53	3.20	4.22	3.53	3.20	**I(1)**
Log CAR	T-St: 3.25 Prob:0.08	T-St: 6.92 Prob: 0.00	4.21	3.52	3.19	4.21	3.53	3.19	**I(1)**
Log LTD	T-St: 4.92 Prob:0.00	-	4.21	3.52	3.19				**I(0)**
Log BS	T-St: 2.35 Prob:0.39	T-St: 6.67 Prob:0.00	4.22	3.53	3.20	4.22	3.53	3.20	**I(1)**

Source: Authors' computation

As indicated in Table 4, the null hypothesis of a unit root is only rejected for Gross Domestic Product (GDP) and Loans to Deposits Ratio (LTD) at the level; hence, they are stationary at the level or integrated of order zero, i.e. I (0). However, the NPL ratio, Exchange Rate (ER), Inflation Rate (IR), Lending Rate (LR), Capital Adequacy Ratio (CAR) and Bank Size became stationary at first difference or integrated of order One, i.e. I (1). Since the variables are either I (0) or I (1) and none is I (2), the Autoregressive Distributive Lag (ARDL) is an appropriate model to use for analysis (Pesaran, 2001).

4.3. Test for Multicollinearity

The classical linear regression model (CLRM) assumes no exact linear relationship among the Regressors (Independent Variables). If there are one or more such relationships among the Regressors, we call it multicollinearity or collinearity. In this study, the issue of multicollinearity was assessed by the Variance Inflation Factor (VIF) value. The VIF estimates how much the variance of a regression coefficient is inflated due to the presence of multicollinearity in the model. To interpret VIF, the thumb rule will be used. For VIF=1, this indicates not correlated; for VIF between 1 and 5, it is moderately correlated, and if it is greater than 5, it is highly correlation (Greene, 2012).

Table 3. Variance inflation factors result to test multicollinearity

VARIABLE	COEFFICIENT VARIANCE	UNCENTERED VIF	CENTERED VIF
LOGNPLR	0.038939	785.1486	4.374702
LOGCAR	0.121963	7054.488	2.206898
LOGEXC	1.126188	294742.5	153.6164
LOGINFL	0.000501	5.333623	2.477411
LOGLIR	0.545807	25600.32	2.684807
LOGBS	0.053552	19098.08	57.55627
LOGGDP	0.271773	89753.63	114.6060
LOGLTD	0.120728	14572.23	1.517358
DCOV	0.004978	6.734305	5.180235
C	18.57927	108926.0	N/A

Source: Authors' computation

The results of VIF showed that Bank Size, Exchange Rate, and Gross Domestic Product variables exhibit a high level of structural multicollinearity, which can mislead our regression and interpretation of coefficients, denoting that those variables are highly correlated. One variable can explain the other in the model.

Regarding the remedial of multicollinearity, we opted for the dropout techniques and two variables, namely Bank Size and Gross Domestic Product, have been dropping out to remove the multicollinearity. Below is the result after removing the three mentioned variables.

The centered VIF figures are now all below 10, highlighting a very low correlation between the remaining variables in the model; hence, none explains the others in the model.

4.4. Lag Selection order

ARDL analysis approach gives the advantage of selecting the optimal lag length that is suitable for each of the variables. The optimal lag length can be selected using the Akaike Information Criterion (AIC), the Schwarz Bayesian Criterion (SBC) or the Hannah-Quin Criterion (HQC) estimation (Raza, Shahbaz, & Nguyen, 2015). The results obtained using the AIC are shown in Table 5.

Table 4. Variance inflation factors result after remedial of multicollinearity

VARIABLE	COEFFICIENT VARIANCE	UNCENTERED VIF	CENTERED VIF
LOGNPLR	0.035691	595.2199	3.316454
LOGCAR	0.138573	6629.300	2.073884
LOGEXC	0.036350	7868.535	4.100990
LOGLIR	0.640447	24845.24	2.605619
LOGINFL	0.000328	2.887046	1.341002
LOGLTD	0.137376	13714.57	1.428053
DCOV	0.005712	6.392153	4.917041
C	12.93241	62709.82	N/A

Source: Authors' calculation

Table 5. Results from lag selection

Serial No.	Variable Name	Lags Selection
1	LogNPLR	**1**
2	LogEXC	**1**
3	LogCAR	**0**
4	LogINFL	**2**
5	LogLIR	**2**
6	LogLTD	**0**
7	DCOV	**0**

Authors' computation

Table 6. Results from the bound f-test for cointegration

F-statistic	Critical Values					
5.47	1%U-bound	1%L-bound	5%U-bound	5%L-bound	10%U-bound	10%L-bound
	4.43	3.15	3.61	2.45	3.23	2.12

Source: Authors' computation.

4.5. Bounds F-test for Cointegration

The stationarity test confirmed that the variables of interest are integrated in different orders, whereby some are I (1) while others are I (0). Therefore, performing a bound F-test is necessary to establish whether the long-run relationship exists or not. The bound test for cointegration was performed to see if there exists a long-run relationship between the dependent variables and independent variables.

Ho: No cointegration equation
H1: Ho is not true

Conclusion: Reject the null hypothesis (Ho) if the F-statistics is greater than the critical values (10%, 5%, 1%) for the upper bound, I (1).

The bounds test results confirm the existence of a level relationship among the variables since the F-statistic is above the upper bound value at all levels of significance, suggesting the rejection of the null hypothesis of no level relationship.

The result illustrates that the value of the F-statistic of 5.47 is larger than the critical value of both lower and upper bounds at 10%, 5% and 1% level of significance by using unrestricted intercept and no trend, which confirms the presence of a long run relationship between the dependent variable (Non-Performing Loans Ratio) and independent variables.

4.6. The ARDL Regression Models (Short-Run and Long-Run)

ARDL results in Table 7 show that the exchange rate statistically significantly impacts Non-Performing Loans in the long run, with a coefficient of 0.42. This implies that a 1 percent increase in exchange rate increases NPLs by 0.42 percent, holding other factors constant.

These results support the argument that increases in real effective exchange rates reduce the competitiveness of the country's exports, which reduces their debt repayment capacity.

These results are in line with literature and past studies in Rwanda whereby (Karuhanga & Hakuzwimana, 2017) found out that exchange rate depreciation has a highly positive and significant role in explaining the occurrence of NPLs in Rwanda due to the fact depreciation of the Rwandan franc would mean that imported goods become costly for traders, leading to the decline in domestic demand and consequently reduction of the loan servicing capacity as importers who took loans from banks to engage into trading businesses incur losses.

This result is in agreement with the findings of (Kure, 2017), (Ofori, 2016) and (Karuhanga & Hakuzwimana, 2017) Low lending rates reduce borrowing costs and lead to an increase in entrepreneurial investments in the economy with a resulting decline in loan default rates (Boyd, 2005). Compared to other variables in the model, the impact of the lending interest rate is very significant and very strong, looking at its coefficient and probability value.

Furthermore, the results show that the inflation rate has a statistically significant impact on Non-Performing Loans in the long run, both at 10%, 5% and 1% confidence levels. The positive impact is that a 1 percent increase in the inflation rate increases Non-Performing Loans Ratio by 0.09 percent, holding other factors constant. This is as expected: an increase in the inflation rate will impede positive long-run NPL growth (De Gregorio, 1993). In the long run, a bank's capital adequacy ratio and Loans to deposit ratio are found to be statistically insignificant even though they all have the expected relationship. The results are consistent in the short run and draw curiosity for further future studies and the usage of different analysis methods to affirm this relationship.

In the short run, the estimated error correction coefficient has a negative sign, as expected and is highly significant, ensuring that the adjustment process from the short-run deviation is very high. More precisely, it indicates that 90 percent of the disequilibrium in Non-Performing Loans from the previous period's shock will converge back to the long-run equilibrium in the current period. In the short run, the relationship between Non-Performing loans, the bank's capital adequacy ratio and Loans to deposits is not prevalent. All the other variables considered in the model are found to be statistically significant, hence affecting Non-Performing Loans in Rwanda in the short run.

The impact of the Dummy variable of COVID-19 was not prevalent in the short run, and this is the effect of the moratorium on loans that were introduced, which saved many loans from being classified as low-quality. This is in line with another study that was recently conducted (Amila Žunić, 2021). The COVID-19 coefficient is statistically and negatively significant, which means that when the standard deviation decreases by one unit, it will lead to an increase in NPLs Ratio by 0.18. It actually has an indirect relationship with NPLs Ratio since the pandemic has disrupted the market conditions mainly in terms of production whereby people have spent around 5 months in lockdown, and people were unemployed, which increased consumption prices and hence reduced savings.

Table 7. The ARDL Dynamic Regression for Short-run and Long-run Estimates

Selected Model: ARDL (1,1,0,2,2,0,0)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
Long-Run Equation				
LOGEXC	0.424156	0.189500	2.238291	0.0343**
LOGCAR	0.101493	0.376605	0.269496	0.7898
LOGINFL	0.091979	0.027614	3.330871	0.0027***
LOGLIR	3.354704	1.173032	2.859857	0.0084***
LOGLTD	-0.234351	0.362156	-0.647101	0.5235
DCOV	-0.184718	0.076240	-2.422857	0.0230**
Short-Run Equation				
C	-8.849848	1.283404	-6.895608	0.0000***
D(LOGEXC)	-3.673691	1.873404	-1.960971	0.0611*
D(LOGINFL)	0.008227	0.016002	0.514099	0.6117
D(LOGINFL (-1)	-0.048269	0.017029	-2.834607	0.0090***
D(LOGLIR)	1.269941	0.646898	1.963125	0.0608*
D(LOGLIR (-1)	-1.802676	0.660878	-2.727698	0.0115**
CointEq(-1)*	-0.909584	0.131977	-6.891979	0.0000***

"***", "**" and "*" represent statistical significance at 1%, 5%, and 10%, respectively

4.7. Toda-Yamamoto Causality Test

The model variables are integrated into different orders; hence, we decided to use the Toda-Yamamoto Causality test since the normal Pairwise Granger causality test might become fragile in the case of an integrated series.

Ho: no Granger causality
H1: the null hypothesis is not true
Reject the null hypothesis if the probability values of the Chi-square probability are ≤ 5% or 10%
The Toda-Yamamoto Causality Test showed that lending interest rate granger caused Non-Performing Loans Ratio at both 5% and 10% significance levels while the latter only granger caused lending interest rates at 10% significance level. The inflation rate granger causes the Non-Performing Loans Ratio, while the latter does not granger cause the Inflation Rate. Therefore, it was confirmed that there was unidirectional causality between the Non-Performing Loans Ratio and Inflation Rate while there is bidirectional causality between the Non-Performing Loans Ratio and lending interest rate; hence, inflation rate and lending interest rate are useful for predicting changes in Non-Performing Loans.

Table 8. Toda Yamamoto Causality Test Results

Null Hypothesis	Chi-square	Probability	Granger Causality
NPLR does not granger cause INFL	0.28	0.86	No causality
INFL does not granger cause NPLR	3.5	0.1	Causality at 10%
NPLR does not granger cause LIR	4.3	0.1	Causality at 10%
LIR does not granger cause NPLR	5.8	0.05	Causality at 5% and 10%
NPLR does not granger cause EXC	1.21	0.54	No causality
EXC does not granger cause NPLR	0.81	0.6	No causality
NPLR does not granger cause LTD	2.29	0.31	No causality
LTD does not granger cause NPLR	1.14	0.56	No causality
NPLR does not granger cause CAR	3.09	0.21	No causality
CAR does not granger cause NPLR	2.37	0.30	No causality

Source: Authors' computation

4.8. Model Diagnostic

Diagnostic tests are often used in empirical research to assess the compliance of the model to the assumptions of the Classical Linear Regression Model (CLRM). The study conducted a number of diagnostic tests to evaluate if the model appropriately represents the data. One of the assumptions of the classical linear regression model about the Heteroscedasticity test is that the series must be homoscedastic. Breaking the assumptions implies that the Gauss-Markov theorem does not apply. Therefore, the estimators are not the Best Linear Unbiased Estimators (BLUE), and their variance is not the lowest of all other unbiased estimators. The null hypothesis here is that the error variance is homoscedastic. We used the Heteroscedasticity test: Breusch–Pagan-Godfrey to test our variables. If the computed Chi-Square statistic has a lower p-value than 5%, we can reject the null hypothesis of homoscedasticity. The result below shows that chi-square has a high p-value of 0.22, suggesting we can maintain the null hypothesis of homoscedasticity. Therefore, there is no heteroscedasticity in our regression. This means that the variance of the disturbance term of our model is the same over time. Therefore, we can confirm that our variables do not exhibit the volatility clustering property. About Serial Correlation LM Test: Serial Correlation LM was conducted to check respectively if there was a relationship between

errors and if the variance of errors is constant. The null hypotheses state that there is no serial correlation between the errors. As indicated by Table 9, the probability value of the Chi-Square of both tests is above the 5% significant level, which confirms that we failed to reject the null hypotheses and concluded that there is no serial correlation between the errors and errors are homoscedastic that, means there is no heteroscedasticity.

Regarding the misspecification test, in Table 9, the Ramsey RESET test shows that the p-value of about 78% is greater than the critical value of 5%.

This shows no apparent non-linearity in the regression equation, and it can be concluded that the linear model is appropriately specified. The following table summarizes the diagnostic test results:

Table 9. The diagnostic test results

Test	Techniques used	Metrics	Values
Heteroscedasticity test	Breusch–Pagan-Godfrey	Prob. Value Chi-Square	0.22
Serial Correlation LM Test	Breusch-Godfrey	Prob. Value Chi-Square	0.97
Misspecification test	Ramsey Reset Test	Likelihood ratio	0.68
Normality test	Jarque-Bera	Probability	0.79

Source: Authors' calculations

4.8.1. Stability Test

The study conducted a stability test to check the stability of the model. The result is presented in the following figure respectively. The figures plot the CUSUM and CUSUM of squares. It is obvious that the CUSUM plot stays within the critical 5% bounds that confirm the long-run relationship between variables and the stability of coefficients. However, the CUSUM of squares statistics exceeds the 5% critical bounds of parameter stability, thus indicating a slight instability of coefficients.

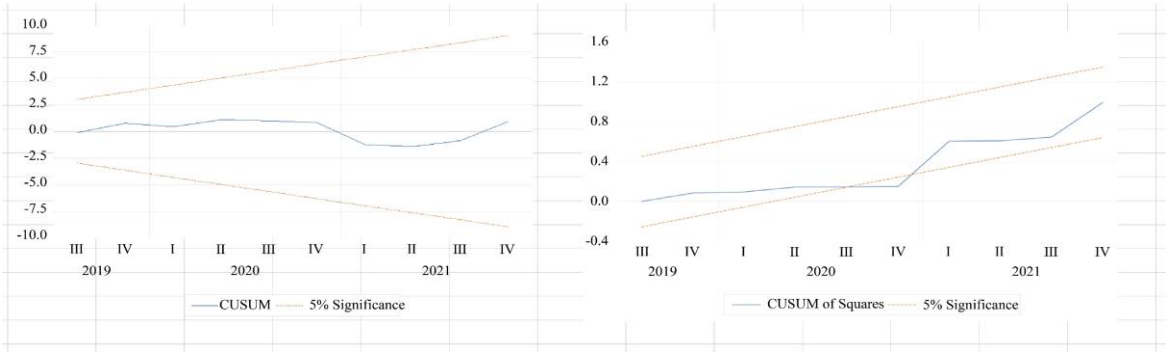

Fig. 3 Stability/Cusum Test

Source: Authors' presentation

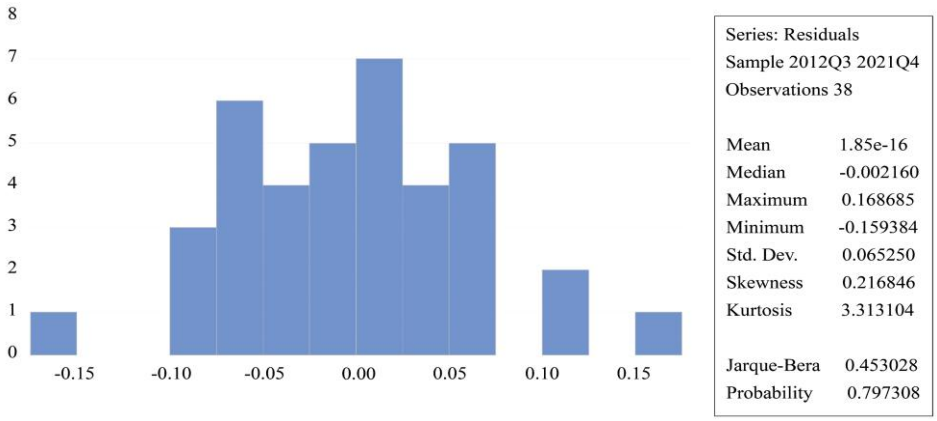

Fig. 4 Normality Test

Source: Authors' computation

4.8.2. Normality Test

The statistics in Figure 4 reveal that the series are symmetric and relatively normal, as the kurtosis value is slightly above 3.0. The skewness value is close to zero, the kurtosis value is close to 3, the Jarque-Bera value is less than 6, and the p-value is greater than 0.05, suggesting the failure to reject the null hypothesis of normal distribution at a 5 per cent significance level.

4.9. Impulse Response Analysis

Impulse response analysis was employed in this study to examine the effect of a one-time shock to one of the innovations on the current and future values of the endogenous variable. The results of impulse responses show that the Non-Performing Loans Ratio respond differently depending on the explanatory variables and the time of the shock duration.

Response of LogNPLR to log CAR: Non-Performing Loans Ratio responded positively to the shock of Capital Adequacy Ratio both in the short-run and in the long-run, but the impact slightly decreased from period 3 to period 4 but then picked up again to become constantly positive in the long run. This long-run behavior is in line with initial expectations and the economic theory.

Response of LogNPLR to log EXC**:** In the short run, the Non-Performing Loans Ratio asymmetrically responded to the shock of the Exchange Rate, and after that, it exhibited a negative trend from period 6 and reached a negative and stable state in the long run. This response of the dependent variable is inconsistent with the economic theory.

Response of LogNPLR to log INFL: Non-Performing Loans Ratio responded negatively to the shock of Inflation Rate in the short-run. The impact sharply increased and became positive to be consistently positive in the long-run. This long-run behavior is in line with initial expectations and the economic theory.

Response of LogNPLR to log LIR: Non-Performing Loans Ratio responded positively to the shock of Interest Rate both in the short-run and the long-run, but the impact became steady from period 4. This behavior is in line with initial expectations and the economic theory.

Response of LogNPLR to log LTD: Non-Performing Loans Ratio responded negatively to the shock of Loans to Deposits Ratio in the short-run up to period 2 and then started picking up to the positive side reached at period 3 and then reduced to be asymmetric from period 4 to the long run. This behavior is inconsistent with initial expectations and the economic theory, which suggests that an increase in LTD leads to an increase in NPLs (Yulianti, 2018). The following figure describe the impulse responses examined during this study;

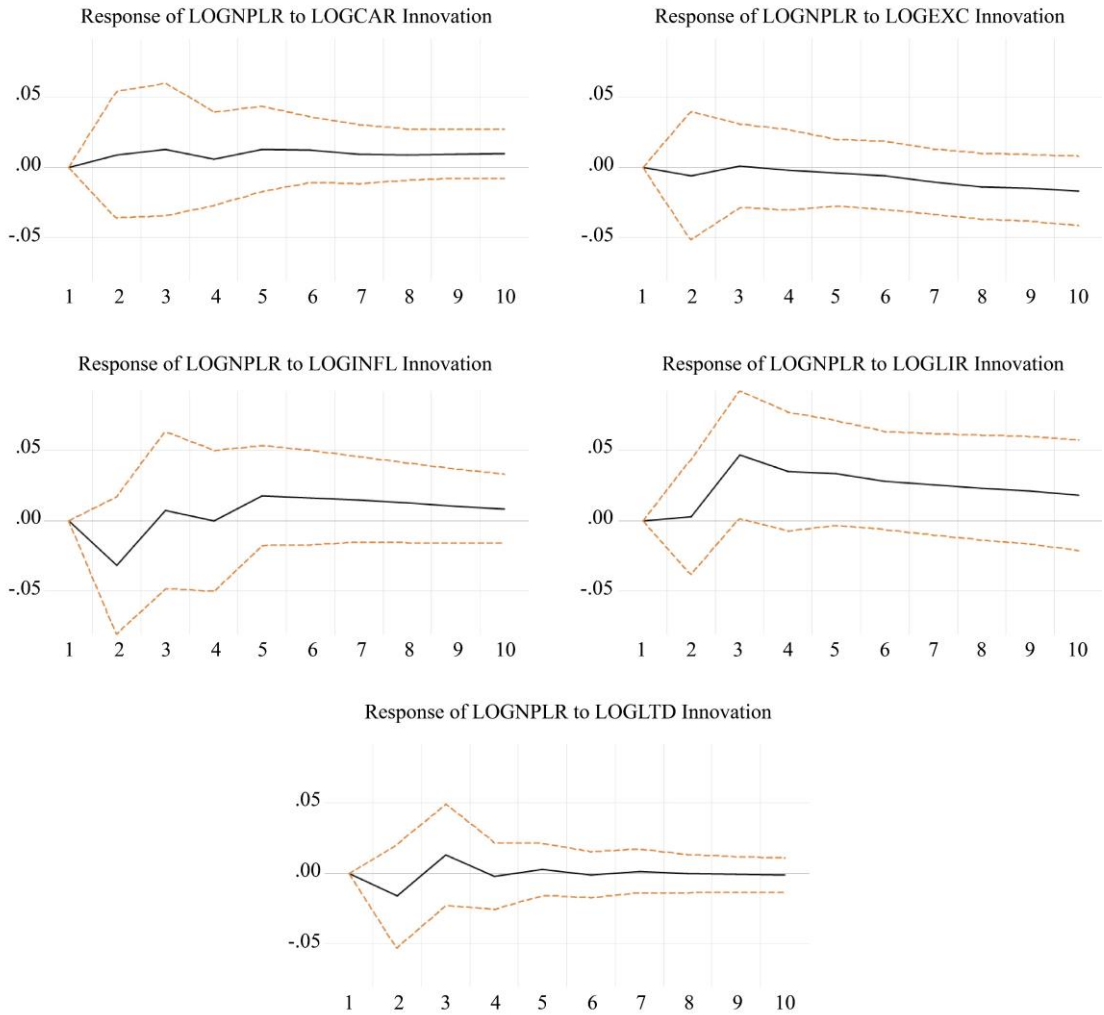

Fig. 5 Responses of the dependent variable to one standard deviation structural shock on each explanatory variable

Source: Authors' presentation

5. Conclusion and Policy Recommendations

This study examined the factors affecting Non-Performing Loans in the Rwandan banking sector whereby we argued that NPLs in Rwanda's banking industry are influenced by both bank-specific (Capital adequacy ratio, Bank Size, Lending Interest rate and Loans to Deposits Ratio) and macroeconomic factors (Inflation rate, Gross Domestic Product and exchange rate). The Dummy variable of the COVID-19 pandemic was also introduced in the model to account for the difficulties that COVID-19 could have brought regarding Banks' assets quality management. All variables were found to be stationary, some at the level and others become stationary upon first difference; hence, series are integrated of order zero, i.e. I (0) and order one, i.e. I (1). Before applying the Co-integration techniques, the classical linear regression model (CLRM) assumptions have been verified, and corrections made accordingly. During the verification of assumptions, we found multicollinearity between variables; to correct this, Bank Size and Gross Domestic variables were dropped from the analysis. Applying the F-Bound Cointegration technique, we found the existence of a long-run relationship between Non-Performing Loans Ratio, Inflation Rate, Exchange rate and lending interest rate.

The coefficient of the Error Correction Term (ECT), which shows the speed of adjustment toward long-run equilibrium, indicated that the previous deviation or shock in explanatory variables from the long-run equilibrium is to be corrected in the current period at an adjustment speed of 90% every which implies almost 5-months period of time until the shock dies away completely. The Bound co-integration test confirmed the existence of a long-run relationship between our variables, and the ARDL-Error Correction Model (ARDL-ECM) results indicated the positive effects of the exchange rate, lending interest rate and inflation rate as well as lag 1 of lending interest rate and inflation rate on the level of Non-Performing Loans Ratio in Rwandan Banking Sector. Furthermore, the impulse response analysis indicated a positive response of the NPLs Ratio in the short run and long run to one-time shocks on the inflation rate, capital adequacy ratio and lending interest rate variables while exhibiting a negative response to one-time shock on Loans to Deposits ratio in the short-run and a negative response to one-time shock on the exchange rate in the long-run. As limitations, in this study, due to the unavailability of Bank-Specific data, only 40 observations in terms of quarters were used to which we associate the issue of multicollinearity found between Gross Domestic Product, Bank Size and Exchange Rate and resulted in the drop of Gross Domestic Product and Bank Size variables. Therefore, we highly recommend that another study should be conducted with a large sample and include all the variables that were inconveniently left out.

The study found that lending interest rates significantly influence NPLs; henceforth, we recommend reducing the lending interest rates both by individual banks and the Supervisory Authority through a reduction of the Central Bank Rate. Banks should do well to reduce interest rates on loans. Reducing interest rates on loans makes loans less expensive, thus reducing the risk to borrowers' ability to pay the interest due to an increased ability of borrowers to meet their obligations. This reduces the number of loan defaults and hence boasts loan performance. Besides, policymakers should endeavor to keep a low inflation environment that will render the Bank of Rwanda to revise the policy rate downward.

Furthermore, we recommend that Banks should opt for portfolio diversification by focusing on sectors which are less likely to suffer from exchange rate rise and the monetary authority keep their eye on local currency appreciation efforts.

References

[1] Lobna Abid, Med Nejib Ouertani, and Sonia Zouari-Ghorbel, "Macroeconomic and Bank-Specific Determinants of Household's Non-Performing Loans in Tunisia: A Dynamic Panel Data," *Procedia Economics and Finance*, vol. 13, pp. 58-68, 2014. [CrossRef] [Google Scholar] [Publisher Link]

[2] Adam Cagliarini, and Fiona Price, "Exploring the Link between the Macroeconomic and Financial Cycles," *RBA Annual Conference-2017*, 2017. [Google Scholar] [Publisher Link]

[3] Jonathan Hambur, and John Simon, 'Monetary Policy and Financial Stability in a World of Low Interest Rates," *Proceedings of a Conference*, *Reserve Bank of Australia*, Sydney, 2017. [Google Scholar] [Publisher Link]

[4] Teshager Mazengia Asratie, "Determinants of Financial Development in Ethiopia: ARDL Approach," *Cogent Economics & Finance*, vol. 9, no. 1, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[5] Berge Tor Oddvar, and Boye Katrine Godding, "An Analysis of Banks' Problem Loans," *Economic Bulletin*, vol. 78, pp. 65-76, 2007. [Google Scholar] [Publisher Link]

[6] Adriaan M. Bloem, and C. Gorter, *The Treatment of Nonperforming Loans in Macroeconomic Statistics*, International Monetary Fund. Statistics Department, vol. 1, pp. 1-17, 2001. [Google Scholar] [Publisher Link]

[7] Mbonigaba Celestin, "Panoramas and Experiments in Financial Performance of Commercial Banks in Rwanda: Lesson from Non-Performing Loan Management," *International Journal of Science and Business*, vol. 3, no. 6, pp. 250-270, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[8] Muhammad Farhan et al., "Economic Determinants of Non-Performing Loans: Perception of Pakistani Bankers," *European Journal of Business and Management*, vol. 4, no. 19, pp. 87-99, 2012. [Google Scholar] [Publisher Link]

[9] Donald E. Farrar, and Robert R. Glauber, "Multicollinearity in Regression Analysis: The Problem Revisited," *The Review of Economic and Statistics*, vol. 49, no. 1, pp. 92-107, 1967. [CrossRef] [Google Scholar] [Publisher Link]

[10] Gadise Gezu, "*Determinants of Non-performing Loans: Empirical Study in Case of Commercial Banks in Ethiopia*," Thesis, Jimma University, Ethiopia, 2014. [Google Scholar] [Publisher Link]

[11] William H. Greene, *Econometric Analysis*, Prentice Hall, pp. 1- 1198, 2012. [Google Scholar] [Publisher Link]

[12] Adriaan M. Bloem, and Russel Freeman, "*The Treatment of Nonperforming Loans*," International Monetary Fund, Annual Report, 2005. [Google Scholar] [Publisher Link]

[13] Luc Eyraud et al., "*Resolving Nonperforming Loans in Sub-Saharan Africa in the Aftermath of the COVID-19 Crisis*," International Monetary Fund, pp. 1-84, 2021. [Google Scholar] [Publisher Link]

[14] Karuhanga K. Wilson, Maniraguha Faustin, and Hakuzwimana Alfred, Determinants of Non-Performing Loans in Rwandan Banking Sector, *BNR Economic Review*, vol. 12, pp. 33-57, 2018. [Online]. Available: https://www.bnr.rw/news-publications/publications/economic-review/?tx_bnrdocumentmanager_frontend%5B%40widget_0%5D%5BcurrentPage%5D=2&cHash=c82ff473bfbb146b447d6a813fe5b2dc

[15] E. Kure, M. Adigun, and D. Okedigba, "Non-Performing Loans in Nigerian Banks: Determinants and Macroeconomic Consequences," *Central Bank of Nigeria*, *Economic and Financial Review*, vol. 55, no. 3, pp. 1-24, 2017. [Google Scholar] [Publisher Link]

[16] Langrin Ranse Brian, "*The Determinants of Banking System Distress: A Microeconomic and Macroeconomic Empirical Examination of the Recent Jamaican Banking Crisis*," Thesis, The Pennsylvania State University, 2001. [Google Scholar] [Publisher Link]

[17] Timothy W. Koch, and Steven Scott MacDonald, *Bank Management*, South-Western, pp. 1-888, 2003. [Google Scholar] [Publisher Link]

[18] Vasiliki Makri, Athanasios Tsagkanos, and Athanasios Bellas, "Determinants of Non-Performing Loans: The Case of Eurozone," *Panoeconomicus*, vol. 61, no. 2, pp. 193-206, 2014. [CrossRef] [Google Scholar] [Publisher Link]

[19] Manoel Bittencourt, "Financial Development and Economic Growth in Latin America: Is Schumpeter Right?," *Journal of Policy Modeling*, vol. 34, no. 3, pp. 341-355, 2012. [CrossRef] [Google Scholar] [Publisher Link]

[20] Musau Emmanuel Munyao, "*Modeling Non-Performing Loans in Kenya Commercial Banks*," Unpublished Master's Thesis, University of Nairobi, Nairobi, 2014. [Google Scholar]

[21] Musengamana Adeline, "*Non-Performing Loans and Financial Performance of Microfinance Institutions in Rwanda. Case Study of Umurenge SACCO (2016-2018)*," Ph.D Thesis, University of Rwanda, 2019. [Google Scholar] [Publisher Link]

[22] Albert Nabonobo, "The Impact of Non-Performing Loans on the Performance of Commercial Banks in Rwanda," 2011. [Google Scholar] [Publisher Link]

[23] Patrick Honohan, "Banking System Failures in Developing and Transition Countries: Diagnosis and Prediction," 1997. [CrossRef] [Google Scholar] [Publisher Link]

[24] Munyana Roselyn, "*Credit Risk Management and Profitabability of Commercial Banks in Rwanda*," Thesis, University of Rwanda, 2019. [Google Scholar] [Publisher Link]

[25] Ruzima Martin, and P. Veerachamy, "A Study on Determinants of Inflation in Rwanda from 1970-2013," *International Journal of Management and Development Studies*, vol. 4, no. 4, pp. 390-401, 2015. [Google Scholar] [Publisher Link]

[26] Vicente Salas, and Jesús Saurina, "Credit Risk in Two Institutional Regimes: Spanish Commercial and Savings Banks," *Journal of Financial Services Research*, vol. 22, no. 3, pp. 203-224, 2002. [CrossRef] [Google Scholar] [Publisher Link]

[27] Johannes Peyavali Sheefeni, "The Impact of Macroeconomic Determinants on Non-Performing Loans in Namibia," *International Review of Research in Emerging Markets and the Global Economy*, vol. 1, no. 4, pp. 612-632, 2015. [Google Scholar] [Publisher Link]

[28] Irena Szarowska, "Effect of Macroeconomic Determinants on Non-Performing Loans in Central and Eastern European Countries," *International Journal of Monetary Economics and Finance*, vol. 11, no. 1, pp. 20-35, 2018. [CrossRef] [Google Scholar] [Publisher Link]

[29] Daniel Twesige, and Faustin Gasheja, "Effect of Macro-Economic Variables on Profitability of Selected Commercial Banks in Rwanda," *Journal of Asian Economics, Accounting and Finance*, vol. 1, no. 2, pp. 181-198, 2020. [Google Scholar] [Publisher Link]

[30] COVID-19 and Non-Performing Loan Resolution in the Europe and Central Asia region, Lessons Learned from the Global Financial Crisis for the Pandemic, World Bank, 2022. [Online]. Available: https://thedocs.worldbank.org/en/doc/460131608647127680013002 2020/original/FinSACCOVID19andNPLPolicyNoteDec2020.pdf

[31] Rwanda Economic Update; Boosting Regional Integration in the Post-COVID Era, World Bank, 2022. [Online]. Available: https://www.worldbank.org/en/news/press-release/2022/02/02/rwanda-economic-update-regional-integration-in-post-covid-era#:~:text=In%20its%20special%20focus%20on,middle%2Dincome%20country%20by%202035.

[32] Eka Yulianti, Aliamin Aliamin, and Ridwan Ibrahim, "The Effect of Capital Adequacy and Bank Size on NonPerforming Loans in Indonesian Public Banks," *Journal of Accounting Research, Organization and Economics*, vol. 1, no. 2, pp. 205-214, 2018. [Google Scholar] [Publisher Link]

[33] Jalis Md Zainol et al., "Macroeconomics Determinants of Non-Performing Loans in Malaysia: An ARDL Approach," *International Journal of Academic Research in Business and Social Sciences*, vol. 8, no. 10, pp. 692-706, 2018. [CrossRef] [Google Scholar] [Publisher Link]

[34] S. Zameer, and M.W. Siddiqi, "The Impact of Exports, FDI and External Debt on Exchange Rate Volatility in Pakistan," *International Journal of Contemporary Research in Business*, vol. 2, no. 7, pp. 337-354, 2010. [Google Scholar]

[35] Shihong Zeng, "Bank Non-Performing Loans (NPLS): A Dynamic Model and Analysis in China," *Modern Economy*, vol. 3, no. 1, pp. 100-110, 2012. [CrossRef] [Google Scholar] [Publisher Link]