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Abstract

Monetary policy goals in any country are to accomplish economic and social goals to achieve financial prosperity. The study determined the impact of monetary policy tools on bank's Credit Risk, which was previously unexplored. The analytical and econometrical design was adopted in this study. Descriptive statistics, correlation matrix, CD test, and DK regression were employed to determine the impact of monetary policy instruments on the bank's Credit Risk. Multivariate statistical techniques were used to evaluate balanced panel data from 22 banks currently operating in Pakistan cover the span of 2009-2021. Banks were declared cross-sectionally dependent. ROE was positively associated with MG, ROA was negatively linked with INF in the Correlation Matrix. The overall research explored that PR and MG had a positive impact on ROE and ROA, but SLR showed an inverse impact on Credit Risk. This research used a large number of banks as a novel component in Pakistan's context and filled a gap in the country's banking literature. The paper will assist the government, managers of the banking industry, monetarists, stakeholders, investors, academicians, and researchers. This study could be extremely helpful to regulators in formulating favorable policy rates that fulfill Pakistan's economic targets.

Keywords: credit risk, monetary policy, commercial banks

1. Introduction

The financial system of a country is a set of institutions engaged in finance-related activities like banks, insurance companies, and stock exchanges. There are different levels for the existence of a financial system it can be on a company level, regional level, and global level as well. This is the fact that banks operating in Pakistan are playing a vital role in the overall productivity of the financial system (Patiño and Gutiérrez, 2019; Hasan & Sadat, 2023). Monetary policy is a regulatory activity of the state to adjust the rate, supply of money, and credit availability to achieve social and economic goals. The goal of monetary policy is to stabilize aggregate prices and financial markets for the smooth functioning of the financial sector (CBN, 2011; Namadi, 2023; Ustaoglu & Yildiz, 2023). The basic aim of monetary policy is to grow the economy at a constant speed that is neither excessively rapid nor too slow. The state bank may hike lending interest rates to discourage consumption and reduce interest rates to encourage greater consumption and borrowing. The central bank sets the rates it charges the country's banks. Whenever SBP fluctuates its rates, all monetary organizations also change the interest rates they implement on their clients (Twinoburyo and Odhiambo, 2018). Tobal and Menna (2020) elaborated on the association between monetary policy and financial stability, with an emphasis on the challenges of developing nations.

Primarily, monetary policy is indeed the management of money and credit in the economy (stabilize money supply or rate of interest) with the hope of ensuring price as well as exchange rate stability and long-term growth. Efficient monetary policy helps to sustain a reasonable level of prices while also facilitating the development of the economy (Chakravarty, 2020; Nyudzor, 2023).

Credit risk management is a crucial pillar for success such as if credit risk are not handled efficiently, a bank will fail (Laryea et al., 2016; Syuvaya & Phommason, 2023). A high return on assets is linked with reduced credit risk as it represents stronger profit potential for growth and responsiveness to credit disruptions. He contends that banks with high profits have lower tendency to indulge in high-risk operations. As a result, the profitability of a bank is significantly connected with the risk of default (Ghosh, 2015).

Credit risk refers to the possibility of a loss incurred as a result of the debtor's failure to repay the loan or meet contractual obligations. It defined as the risk when creditor will not retrieve the owing principle and interest from borrowers. Risk of credit mostly resulting in the form of cash flow interruption (Naili and Lahrichi, 2022a). Capacity, conditions, capital, character, and collateral are the five Cs of credit and majority of lenders evaluate the big chunk of debtors information through these Credit C,s (Farooq and Jabbouri, 2015). Credit risk is the gamble of misfortune that might happen from the disappointment of any party related to repayment of interest and the principal amount of any credit agreement, primarily, the inability to make expected installments on advances because of any hurdle (Vouldis and Louzis, 2018). The finance literature reveals that Non-performing loans (NPLs) are loans and advances which are overdue for payment from 90 days or more. Mpofo and Nikolaidou (2018) emphasized the NPLs, are key cause of bank failures and provide signals for the start of a financial crises (Naili and Lahrichi, 2022b). The majority of the crises are triggered by the credit risk of banks, which primarily expressed by the proportion of non-performing loans (Cucinelli et al., 2018).

Non-performing loans originate when borrowers run out of money or confront circumstances which make it impossible for them to continue making loan payments (Partovi and Matousek, 2019). Numerous NPLs have been observed, and its concluded that due to NPLs even the most powerful economies appear vulnerable (Jabbouri and Naili, 2019). A bank has two choices if it is unable to recover non-performing loans, First is to possess collateralized assets of debtors and second is to sell the debts to collection agencies for recovery. When a balance sheet of a bank has several non-performing loans, it encounters liquidity problems and cash flows issue's and shows that credit operations of bank is no longer profitable (Hamza, 2017).

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Banks are required by law to disclose their non-performing loan to total loan ratio as a gauge of their credit risk and outstanding loan quality (Belás et al., 2018). Over a long period of time, low short-term interest rates lead to a significant increase in bank risk. Monetary policy is used by central banks to control the amount of money in circulation in an economy. The monetary policy of a central bank manipulates the credit circulation and money supply in order to keep inflation, development, and job growth on track (Bülbül et al., 2019).

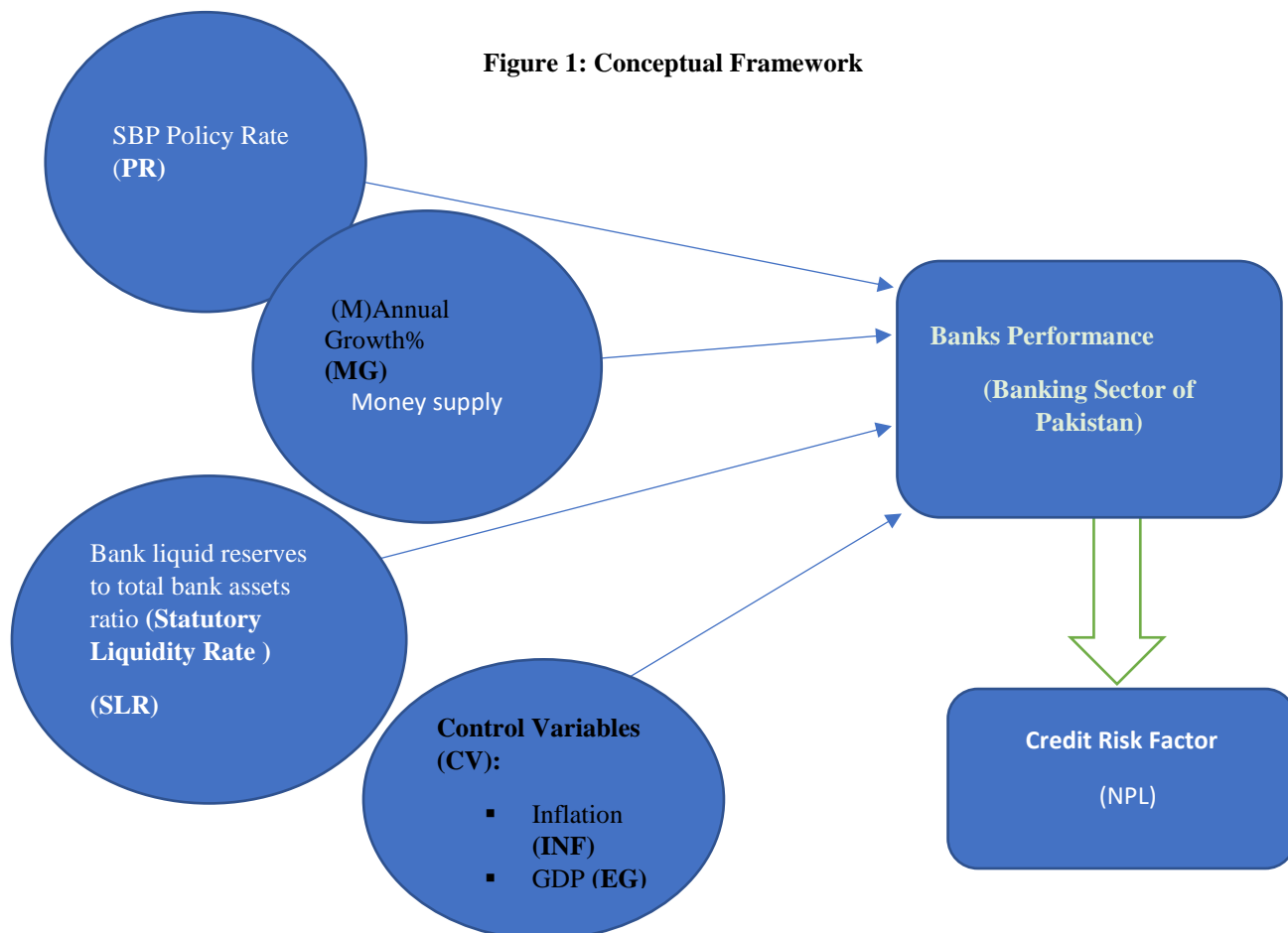
2. Literature Review

In finance literature the impact of monetary policy on credit risk is used to verify the existence of a risk-taking channel. Monetary expansion enables banks to take more risk, due to monetary expansion bank indebtedness and volatility increase many fold times (Angeloni et al., 2015). The assessment of “U.S. financial institutions “corporate loan pricing practices over the last two decades reveals that loan spreads for the riskier banks are lower during the periods of expansionary monetary policy as compared to contractionary monetary policy (Paligorova and Santos, 2017). Maddaloni and Peydró (2011) used statistics from the euro area credit survey to examine whether monetary policy has an impact on bank lending practices. They also explore supply and demand-related factors of credit practices. For both businesses and individuals’ borrowings, lower credit requirements result from monetary expansion.

Most of the existing research mainly focused on the role of banks in the transmission of monetary policy through lending practices, they only pointed out supply and demand function of credit. Several studies have been conducted to elaborate on the impact of monetary policy shocks in relation to other characteristics of banks and the economy such as corporate structure of bank, international banks specific indicators, risk takings of the banking sector, stock market reaction, financial collapse and global economic integration (Allen et al., 2017; Brei and Schclarek, 2015; Jeon and Wu, 2014; Scharler, 2008). However, the role of banking in the proper efficient functioning of monetary policy has not been fully investigated as the worth of this topic is necessitated. Baglioni (2007) described the approaches of monetary policy for different credit markets. He explored that monopolistic rivalry enhanced the impacts of monetary policy.

Adams and Amel (2005) were the first who used business small loan initiation data from the US banking sector spanned between 1996 to 2002 to investigate the effect of local banking market dynamics on the monetary transmission mechanism. This study focused to look at how banks react to monetary policy shocks in competitive markets (Gunji et al., 2009).

Amidu and Wolfe (2013) employed data representing 978 banks in 55 countries to explore the role of banking competition (assessed by the Lerner Index) on monetary policies through the credit channels. They demonstrated that banking competitive pressure reduces the impact of monetary policy shocks on bank credit.



Past empirical study revealed that not only liquidity determines the fluctuations in monetary policy and bank credit, but some other factors also influenced the monetary policy such as capitalization and size of bank (Ehrmann et al., 2003). Ullah et al. (2013) explored

that reserves, inflation and exchange rates are essential tools that can be used for boosting the economy and research reveals that there exists a long significant relationship between growth and monetary tools.

Literature of finance explored that repo rate, money supply and liquidity rate are monetary policy tools to evaluate its impact on numerous financial organizations (Precious and Makhetha-Kosi, 2014). Money supply is positively associated with growth of GDP, however the relationship is limited (Ogunmuyiwa and Ekone, 2010). But Ibrahim (2005) emphasized that real impacts of monetary policy shocks are substantially important. Monetary policy have influence on the bank credit practices such as Geng and Zhai (2015) elaborated that expansionary monetary policy increased bank risk takings.

López et al. (2011) explored the relationship between expected default frequencies (NPLs) and monetary policy in Europe. Basically he represents the role of monetary policy in environment of low interest rates (Altavilla et al., 2018), on the other hand create ideal grounds for the risk taking channel of monetary policy (Borio and Zhu, 2012). Brana et al. (2019) demonstrated that expansionary monetary policy can hamper bank risk-taking, but this relation is non-linear, when interest rate indicators are below a specified threshold then it showed a higher significant negative relationship between bank risk and monetary policy. Genay and Podjasek (2014) alternatively, contends that interest rate fluctuations have a significant short-term effect on small banks as compared to larger banks because larger banks have ability to tackle such kind of variations.

Credit risk and profitability can be associated by a bilateral causal connection with monetary policy, as per earlier researches (Athanasoglou et al., 2008). The research sample of international banks reveals that profitability and yield curve have positive relation with short term interest rate. It also indicates, with the passage of time low interest rate and flattened structure abrade banks profitability (Borio et al., 2017) .

3. Model specification

The model specification Equation for the Research study is given below

$$BCR_{it} = \beta_0 + \beta_1 PR + \beta_2 SLR + \beta_3 MG + \beta_4 INF + \beta_5 EG + \epsilon_{it}$$

In above given equation no of banks indicated by i and time represented by t and ROA, ROE, are proxies of BCR (Banks Credit Risk) and β_0 is constant term.

BCR= Banks Credit Risk, ROA = Return on Assets, ROE = Return on Equity, PR = Policy Rate, SLR = Statutory Liquidity Rate, MG = Broad Money Growth Rate (Money Supply), INF = Inflation Rate, EG = Economic Growth Rate (GDP Growth), ϵ_{it} = Error Term, β_0 = Intercept, $\beta_1\beta_2\beta_3\beta_4\beta_5$ = Slope Coefficients

The link between predictor, control, and predicted variables was expressed by the aforementioned equations.

4. Research Methodology.

4.1. Research Design

Descriptive statistics, a correlation matrix, the cross-sectional dependence (CD) test, and the Driscoll-Kraay test were used to analyse the study's data. Panel data were used in this study. The study's variables' relationships are determined by the correlation matrix and descriptive statistic. Dependency and integration within a data collection were tested using the CD test and cointegration test. The impact of monetary policy on banks credit risk was examined using second-generation Dk regression due to its significant dependence.

4.2. Scope and sample of the study

The study spanned from 2009 to 2021, a total of thirteen years. The banks with the most comprehensive and reliable data were the focus of our investigation. This study highlighted the most significant issue plaguing the banking industry by using a panel dataset technique. Five Islamic banks, thirteen private commercial banks, three public sector commercial banks, and one specialized scheduled bank were among the twenty-two Pakistani institutions that were included in the study from 2009 to 2021.

4.3. Data Sources and Description

For the study data was gathered from different sources such as SBP's official website, The world Bank and annual reports of the selected banks. The bank-profitability indicators were taken from income statements and balance sheets of the banks. Data on monetary policy instruments were gathered from financial statistical reports of state bank.

5. Empirical Analysis and Results

5.1. Trend Analysis

Trends of different monetary policy tools were analyzed to determine the policy movements to predict future tendencies. Trend analysis forecasts the long-term direction of financial sentiments by using past data such as price movements and fluctuations in various rates. A summary of long-term data to look at variability at different points in time and to see how the policies and rates change over time. These graphs were evaluated through Ms excel. This graphical representation of monetary policy helped to examine SBP policy movements during past few years.

5.2. SBP Policy Rate Trends

The figure 2 shows the discount rate in Pakistan from the year 2008 to 2021. It indicates the fluctuations in the policy rate. From 2008-2010, it remained in the range of 12 to 14 percent.

From 2010 until 2016 it was gradually lowered to a level of 6 percent and showed declining trend but rising trend started from 2016 to onward. This graph represents a fluctuating trend. The basic reason for the drop-in policy rate was to control inflation and revive private investment by declining lending rates. In 2019 due to the overall fiscal deficit and shortfall in revenue collection policy rate increased and moved upward then dropped in 2020 and remained the same in 2021 at 8% due to covid 19 crisis (Pakistan Economic Survey, 2019-2020). The state bank implied a convenient and lenient policy by lowering the discount rate to combat financial crises (covid impact).

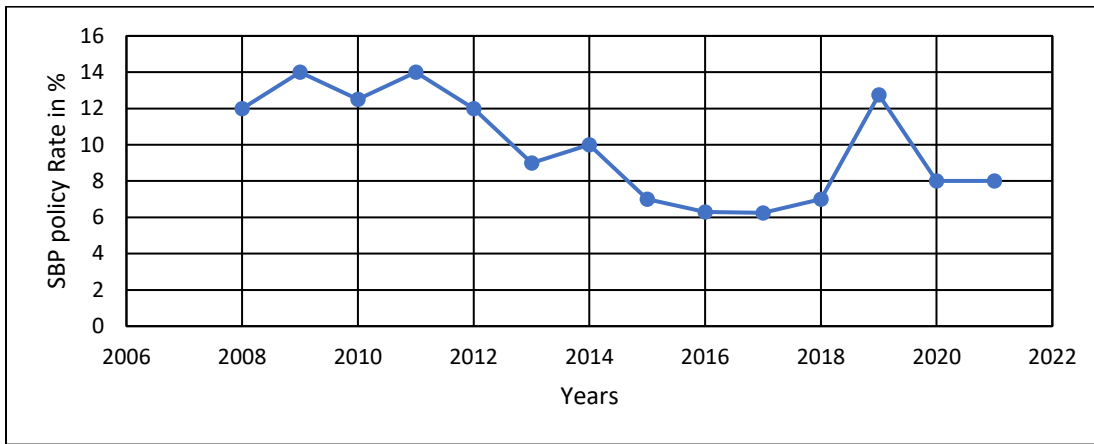


Figure 2: Trends in SBP Policy Rate in Pakistan (2008-2021)

5.3. Money Supply Growth Rate Trends

The line of money supply provides an oscillating trend. Due to the worldwide financial crisis of 2008 which influenced the global financial structure that's why M2 rate falls. This graph presents swings in growth patterns from 2008 to 2018. A central bank sometimes issues bonds and other government-backed securities for creditors to purchase in order to lower the supply of M2 in the economy.

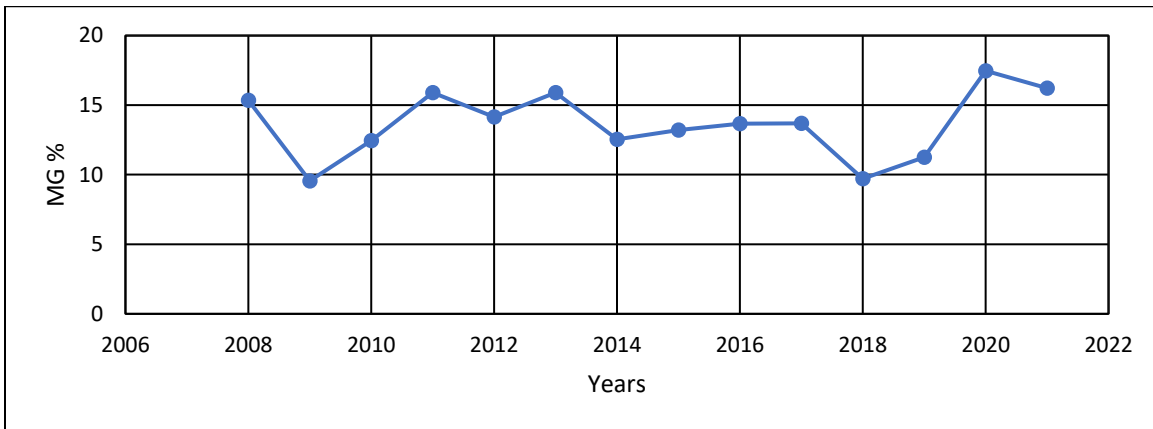


Figure 3: Trend in Money supply growth rate in Pakistan (2008-2021)

The basic reason of fluctuating trend is system's overall inefficiencies, along with the misappropriation of financial resources, resulted in a lower rate of money supply and economic growth. From 2018 to 2021 there was a gradual and substantial upward trend in broad money growth %. The reasons for this growth directly concerned with aggregate economic activity which significantly contributed to M2 growth (Pakistan Economic Survey, 2020-2021). To combat the recession spurred on by the COVID pandemic, the SBP increased the money supply by eliminating bank reserve requirements and empowered them to lend more money.

5.4. Bank Liquid Reserve Ratio Trends

The liquid reserve ratio produced a fluctuational trend line. The liquid reserves rate helps to deal with unexpected withdrawals. Graph represents an upward trend between 2008-2013, then suddenly declines in 2014.

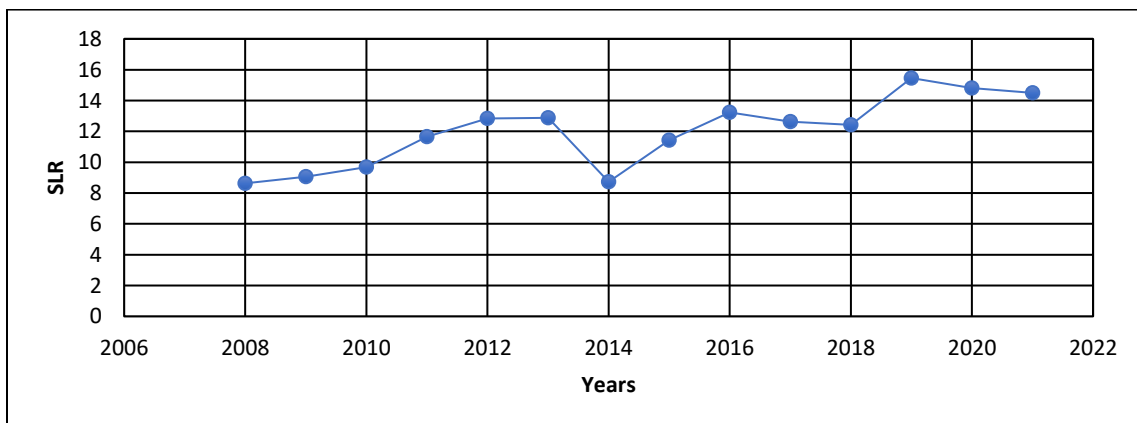


Figure 4: Trends in Bank Liquid Reserve Ratio in Pakistan (2008-2021)

In order to avoid taxes, the presence of large unorganized sector stimulates cash transactions rather than transactions using bank instruments such as checks or bills. Banks are then required to maintain high liquid reserves in order to meet repeated substantial

cash demands. The weighted average of the cash and liquidity reserve requirements depends on different time and demand liabilities which determine the actual reserve requirements for a specific period (Muhammad et al., 2014). During covid 19, in 2019 SLR sharply increase to tackle the covid impacts due to lockdown, unexpected withdrawals increased manifold times that why the liquidity rate reached at 15.46 and then stabilize after the pandemic era.

5.5. Econometrical Analysis

5.5.1. Descriptive Statistics of Credit Risk (NPL)

The average value of the dependent variable NPL is 10.247 with 0.17 highest and 51.56 lowest value range. The DV non-performing loan had the highest variability because it had a high SD value of 7.175. The total number of observations is 273 in the descriptive statistics of the credit risk model. In a collection of numbers, the mean is the average or most prevalent value. It is a measure of a probability distribution's central tendency along with the standard deviation and min max values in statistical analysis.

Table 1: Descriptive Statistics of Non-Performing Loans, Monetary policy tools and control variables

Variable	Mean	Std.Dev.	Min	Max
NPL	10.247	7.175	0.17	51.56
PR	9.754	2.831	6.25	14
MG	13.515	2.36	9.56	17.47
SLR	12.254	2.044	8.72	15.46
INF	8.328	3.486	2.52	13.64
EG	3.313	1.98	-93	5.83

In statistical interpretation, a mean is a single number that describes the data's midpoint and common value, which is used to summarize an entire dataset. It is often referred to as the arithmetic average, but it is one of the numerous central tendency measures. The mean is a metric that illustrates the center of a stochastic variable's distribution. The mean value of PR, MG, SLR, INF, EG are 9.754, 13.515, 12,254, 8.328, 3.313 respectively. The Table 4.19 also shows the high low-value range of all variables including DV, IVs, CVs. The GDP growth indicator represents the lowest deviation from the mean value it has 1.98 SD value with minimum variability. The standard deviation of all independent variables PR, MG, SLR are 2.831, 2.36, 2.044 respectively and lower than the SD of NPL. The mean and SD of control variables represents the following figures inflation has mean value 8.328 and SD 3.486, but economic growth depicts the average value 3.313 and SD value 1.98. After NPL the second-highest variational value is the SD of inflation which is 3.486 and its deviation was greater than all other indicators present in the model and statistical analysis.

5.5.2. Correlations Matrix of Credit Risk Indicator (NPL)

This correlation matrix helps in analyzing the correlation among non-performing loan ratio, monetary policy tools, and control variables. To evaluate the impact of monetary policy on NPL this Matrix will help to determine the correlation. The above-given correlation matrix spans 2009 - 2021. The NPL and policy rate were weakly positively correlated with $p=0.199$ and SLR $P=-0.202$ was weakly negatively associated with the dependent variable NPL these results were significant at 0.01 level. NPL and INF had a weak correlation with $p= 0.126$ at a 0.05 significance level. The Pearson correlation coefficient is a measure of the linear relationship between two variables and can be used to analyze the relationship. Its value ranges from -1 to 1.

- A perfect negative linear correlation between two variables is represented by the number -1.
- A value of 0 means that two variables have no linear relationship.
- A complete positive linear correlation between two variables is shown by a number of (one) 1.

A stronger association consider between the two variables if the correlation coefficient is further away from zero and near to 1. The independent variable policy rate was weakly negatively correlated with other independent variables MG, SLR $P=-0.214$, -0.333 respectively. But PR was significantly highly correlated with the control variable INF $p=0.872$ and PR was negatively linked with EG $p= -0.433$ at a 1% level of significance.

Table 2: Pairwise Correlations Matrix of Non-Performing Loans

Variables	NPL	PR	MG	SLR	INF	EG
NPL	1.000					
PR	0.199*	1.000				
MG	0.021	-0.214*	1.000			
SLR	-0.202*	-0.333*	0.449*	1.000		
INF	0.126**	0.872*	-0.004	-0.163*	1.000	
EG	0.015	-0.433*	-0.369*	-0.330*	-0.710*	1.000

Significance levels 0.01, 0.05, 0.10 represented with *, **, *** respectively.

The independent variable MG was positively associated with SLR because $p=0.449$ and negatively linked with EG with $p= -0.369$ at a 0.01 significance level. The independent variable SLR was weakly negatively associated with the control variable INF and EG because $p=-0.163$ and -0.330 at 1% significance level. The Correlation matrix elaborated that the control variable INF was highly negatively associated with EG at a 1% level with $p=-0.710$.

Except for PR and INF, which had a $p=0.872$ correlation, all of the variables had less than a 0.7 correlation. But only the pair of INF and EG had a strongly negative link because $p=-0.710$. In Table 4.20 in the matrix of correlation 1 pair was highly positively correlated and 1 pair was strongly negatively associated. This result demonstrated multicollinearity between these two pairs of

variables. But all other pairs indicated that there was no multicollinearity among indicators because the correlation is less than 0.7 among all other variables. Only the policy rate and inflation had a strong positive link and inflation and economic growth had a high negative link. This matrix validated that non-performing loans were based on the policy rate, inflation, and statutory liquidity rate. Monetary policy rate and inflation had a deep linkage if the policy rate increase, then inflation will also increase.

5.5.3. (CD) Cross-Sectional Dependence Test

The CD test is recommended in the research work of (Liu et al., 2018) as a basic and preliminary test of cross-sectional dependence before proceeding to other analysis. According to the results of Cross-section Dependence testing (CD), Banks are cross-sectionally dependent. As a result, traditional panel unit root tests are ineffective for determining the sequence of integration (Hafeez et al., 2019). A cross-sectional dependence test was used to determine whether first-generation or second-generation panel unit root testing should be used. The Pesaran Cross-sectional Dependence were used to achieve this goal (CD).

5.5.4. Equation of CD

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{\rho}_{ij} \right) \sim N(0,1)$$

Table 3: Cross-Sectional Dependence Test

Variables	ROE	ROA	PR	MG	SLR	INF	EG
CD-Stats	6.747	5.561	52.249	52.249	52.249	52.249	52.249
Prob. P value	0.000	0.000	0.000	0.000	0.000	0.000	0.000

When T is constant and N is large, then CD method will apply. If N is large in comparison to T and the model is static, then any of the xtcsd tests may be appropriate (2nd generation tests). The P-values near zero indicate that data are correlated across panel groups under the null hypothesis of cross-section independence. Pesaran test for cross-sectional dependence known as Pesaran's statistic it is based on a normal distribution and can handle both balanced and unbalanced panels (Pesaran et al., 2004). Banks and monetary policy are cross-sectionally interconnected, according to the results of CD tests.

5.6. Westerlund Cointegration Test Credit Risk Indicator (NPL)

a. NPL and PR

Table 4.21 illustrated the results of Westerlund (2007), which explicitly state the existence of a high long-run interaction among variables. The null hypothesis, "no co-integration," was falsified in this econometric model relying on the Westerlund panel co-integration results. As per the conclusions, a crucial factor, co-integration interaction, was identified in the panel data set.

Table 4: Westerlund cointegration test of NPL and PR

Statistic	Value	Z-value	P-value
Gt	-3.698	-9.431	0.000
Ga	-18.781	-11.874	0.000
Pt	-10.028	-7.015	0.000
Pa	-13.475	-15.502	0.000

The z value and value columns simply showed probabilistic statistical values, but the results were dependent on the p-value column, demonstrating that NPL and PR are co-integrated. Based on the findings of the Westerlund co-integration approach, it can be stated that a change in PR may have an impact on banks' non-performing ratios in the long run. At the 1% level of significance, robust P-values provide compelling evidence against the null hypothesis. It was postulated that PR and credit risk indicators had a long-term relationship.

b. NPL and MG

The panel data set described about the econometric analysis (Westerlund, 2007) which revealed the highest quantitative co-integration result. Throughout the Table 4.22, the p-value is 0.000, proved that NPL and MG were co-integrated. It was fair to conclude that the results of the co-integration estimation reported in the current model clarify the overtime relationship between the non-performing loans and the money growth rate.

Table 5: Westerlund cointegration test of NPL and MG

Statistic	Value	Z-value	P-value
Gt	-3.698	-9.431	0.000
Ga	-18.781	-11.874	0.000
Pt	-10.028	-7.015	0.000
Pa	-13.475	-15.502	0.000

A change in the money supply growth rate would have a strong negative impact on bank non-performing loans in the long term. As a result, there's a strong possibility that the variables are intertwined. Cross-sectional data was displayed by Gt and Ga, while panel statistics were signified by Pt and Pa. As a consequence, the variables appear to be cointegrated. We used the robust P-value to arrive

at conclusion. The findings discovered that there was a significant long-run relationship between the MG rate of monetary policy and the NPLs of a specific group of banks operating in Pakistan.

c. NPL and SLR

The co-integration analysis Table 6 displays that SLR and NPL were significantly linked and integrated. Noteworthy cointegration was indicated by a probability value of 0.000. The robust P-value was used to display our final result. The study discovered a substantial long-run interaction between the statutory liquidity rate of monetary policy and non-performing loans of identified public and private banks. As per the observations, a statistically valid co-integration phenomenon was identified in the panel data set. Westerlund employed four EC-based statistics to test the use of cointegration theory. The Gt, Ga, Pt, and Pa tests give statistical results, whereas z values give probability results (Bayazit and Genc, 2019). The long run relationship between NPL and SLR depicted that modification in policy and variation in liquidity rate can affect the infection ratio (NPL) because co-integration was prevailed between them.

Table 6: Westerlund cointegration test of NPL and SLR

Statistic	Value	Z-value	P-value
Gt	-3.698	-9.431	0.000
Ga	-18.781	-11.874	0.000
Pt	-10.028	-7.015	0.000
Pa	-13.475	-15.502	0.0

5.7. Driscoll kraay analysis of Monetary policy and Credit Risk Factor: (Non performing Loans)

a. NPL and PR, INF, EG

The coefficients stated that if the SBP policy rate is increases by 1% the non-performing loans ratio will move upward with the average of 0.74%. Due to the statistically significant positive impact between PR and NPL. The t statistic was computed by dividing the coefficient by its standard error. It's used and see whether the relationship between the response variable and the predictor variables is linear. T value was 4.17 in this model which described that there existed linear relation between variables. The significant positive relationship between NPL and PR prevailed but on condition that other factors remains constant. The p-value of 0.0013 represented the high significance level of model at $p < 0.05$. lower value of RMSE 7.0215 showed better fitness of data. The researcher generally hypothesized that larger banks are much more secure from the risk.

Table 7: Driscoll kraay pooled OLS regression for NPL and PR, INF, EG

Dependent Variable: NPL	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
PR	.7472672	.1792333	4.17	0.000	.3733931	1.121141
INF	-.122336	.2215088	-0.55	0.587	-.5843953	.3397234
EG	.3640299	.2933477	1.24	0.229	-.2478826	.9759424
Constant	2.770639	3.106539	0.89	0.383	-3.709489	9.250766
RMSE			7.0215			
F-Stats			7.67			
Probability Value (P-value)			0.0013			
No of banks			21			
Observations			273			
No of groups			13			

At 5% significance level

The results under the condition of other factors remains constant. The significant impact of policy rate on NPL exposed that if state bank of Pakistan increased interest rate the rate of default will also increase. The Table 4.24 proved consequential impact of policy rate on infection ratio. In short, results identified that high interest rate increases credit risk (NPL). These findings were the confirmation of earlier research work performed by (De Menna, 2021; Nikhil and Deene, 2021).

b. NPL and MG, INF, EG

The empirical work for the panel regression estimators from the DK standard error approach was shown in the Table 8. Because the error structure was heteroskedastic and potentially correlated between the selected banks, this econometrical technique was applied to calculate the impact of money supply (monetary policy tool) on the credit risk of the banking sector in Pakistan. Due to the fact that inflation and economic growth had an impact on profitability, the control variables were also employed to assess the appropriateness of a financial instrument (Baloch et al., 2019). According to the results reported in Table 8, highly significant and positive impact (at level of 0.05) of MG on NPL ($0.01 < 0.05$) was observed. P-value of 0.06 describe that these results were non-significant at 5% significance level. In terms of control variable inflation and economic growth had significant positive influence on non-performing loan ratio.

Table 8: Driscoll kraay pooled OLS regression for NPL and MG, INF, EG

Dependent Variable: NPL	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
MG	.4237701	.1497064	2.83	0.010	.1114879	.7360523
INF	.7229239	.3448758	2.10	0.049	.0035257	1.442322
EG	1.145151	.47047	2.43	0.024	.1637677	2.126534
Constant	-5.295676	5.434511	-0.97	0.341	-16.63187	6.040515
RMSE			7.0243			
F-Stats			2.89			
Probability Value (P-value)			0.0611			
No of banks			21			
Observations			273			
No of groups			13			

At 5% significance level

It was evident from the value of coefficient that if there is increase of 1% in the MG the corresponding NPL ratio will increase by 0.42%. it means if the money supply in the country increase people will not pay their loans timely because excessive money supply devalues the money and can cause upward trend in default rate. The efficient circulation of money assures the debtors reliability but undue increase in MG can create inflation and also become the reason of increase in NPL. This model signified efficient results which also evident from the studies of (Colletaz et al., 2018; Abbas and Hussain, 2021; Modugu and Dempere, 2022). These studies concluded that money supply had weak but to some extent significant impact on credit risk. The study of (Mahrous et al., 2020) found that Positive and substantial relationship existed between credit risk and monetary policy.

c. NPL and SLR, INF, EG

Table 9 exhibited how the liquidity rate and non-performing loans were related. According to the coefficient value, there were negative correlations between SLR and NPL. Therefore, assuming all other factors remain unchanged, a 1% increase in the liquidity rate will result in a negative movement of -0.53% in the banks' non-performing loan ratio. In other words, a 1% increase in SLR will have a -0.53% negative impact on NPL. The liquidity rate of monetary policy had a substantial impact on banks' ratio of non-performing loans.

Table 9: Driscoll kraay pooled OLS regression for NPL and SLR, INF, EG

Dependent Variable: NPL	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
SLR	-.535544	.1540017	-3.48	0.002	-.8567859	-.214302
INF	.3171882	.2388102	1.33	0.199	-.1809613	.8153376
EG	.2688046	.2351973	1.14	0.267	-.2218084	.7594175
Constant	13.27677	1.430949	9.28	0.000	10.29186	16.26168
RMSE			7.0268			
F-Stats			8.25			
Probability Value (P-value)			0.0009			
No of banks			21			
Observations			273			
No of groups			13			

At 5% significance level

The effectiveness of a forecast was evaluated using Root Mean Square Error (RMSE) at value (7.0268). A coefficient value explained the link between variables. According to this framework, banks' credit risk was affected by the statutory liquidity rate of monetary policy. INF and EG, the control variables were statistically insignificant in this model at ($P < 0.05$). The ratio of variable variances is vividly illustrated by F value (8.25). The P value of 0.0009 clearly founds that these results were statistically significant at $P < 0.05$. In terms of control variables, INF, EG had significant positive impact on NPL in this model. The results indicated that liquidity was negatively related with the indicator of credit risk (NPL). If banks fail to invest its funds in the financing and investing activities there will be surplus liquidity in the banks then bank may suffer from risk. Due to increase in liquidity rate the loan proportion of banks will diminish and consequently, the NPL rate will also fall down. Low proportion of debtors results in the form of low default rate (NPL ratio). The empirical outcome was similar to (Ayodele, 2014; Asiana and Amoah, 2018; Rezende et al., 2021) and disclosed that liquidity ratio exerted negative effect on loan and advances of commercial banks.

d. NPL and PR, MG, SLR, INF, EG (Combined Model)

The above given Table 10 articulates that results were highly significant at $p=0.0000$ its value was below the 0.05 so highly significance results were driven from this combined model. The value of the coefficients denoted that if the policy rate is increase by 1% the NPL will be rise by 0.89% based on positive and significant relationship between the policy rate and non-performing loans it means that if policy rate increase it means due to upward movement in interest rate the ratio of NPL will also rise. Because high interest rate will burden debtors and consequently, they will be unable to repay the debts. The same findings also explained by

(Asiama and Amoah, 2018; Mahrous et al., 2020; Abbas and Hussain, 2021; De Menna, 2021). The t-statistic determined how far the coefficient is from 0 in terms of standard errors.

Table 10: Combined Model of Driscoll kraay pooled OLS regression for NPL and PR, MG, SLR, INF, EG

Dependent Variable: NPL	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
PR	.8942503	.2283733	3.92	0.001	.4178721	1.370629
MG	.6132043	.1927991	3.18	0.005	.2110323	1.015376
SLR	-.6241336	.1774968	-3.52	0.002	-.9943853	-.2538818
INF	-.3281841	.1790219	-1.83	0.082	-.7016173	.0452491
EG	.2549314	.257863	0.99	0.335	-.2829613	.7928241
Constant	2.773183	3.647339	0.76	0.456	-4.835032	10.3814
RMSE			6.9023			
F-Stats			13.51			
Probability Value (P-value)			0.0000			
No of banks			21			
Observations			273			
No of groups			13			

At 5% significance level

A t-value larger than +2 or less than -2 is generally considered acceptable. The higher the t-value, the more confident we are in the coefficient's prediction accuracy. Low t-values revealed that the coefficient's predictive ability was not at all reliable. The t statistic was computed by dividing the coefficient by its standard error. The lower the p-value, greater evidence that the null hypothesis should be rejected. Statistical significance is defined as a p-value less than 0.05 (typically ≤ 0.05). So, this model had rejected H0 and findings were declared as statistically significant. The coefficients expressed that money supply growth had significant and positive association with non-performing loans only if other variables especially the independent variables remain the constant. The coefficient revealed that 1% increase in MG% the NPL ratio will positively move in a same direction by 0.61% the fallouts indicates that money supply growth rate was directly related with the non-performing loans ratio. Similar results were supported by (Bonfim and Soares, 2018; Kabundi and De Simone, 2020; Modugu and Dempere, 2022). A positive coefficient specifies that the mean of the dependent variable goes up when the value of the independent variable increases. A negative coefficient indicates that the dependent variable tends to drop as the independent variable increases. The coefficients stated that if 1% increase in statutory liquidity rate the NPL will move inversely. There existed a significant negative relation between SLR and NPL. If SLR increase by 1% then it will impact NPL by -0.62% but under the condition of other variables remains constant. Similar outcomes presented by (Ayodele, 2014; Borio et al., 2017; Asiama and Amoah, 2018; Rezende et al., 2021; Dang and Nguyen, 2022). These above-mentioned research studies revealed that liquidity rate had negative impact on the growth of NPL.

6. Conclusion

Using quantitative approach, this study indicated that there exists a long run relationship among monetary policy and bank performance in Pakistan. It was clarified that profitability can be influenced by different monetary policy indicators. Data analysis was carried out with descriptive statistics, correlation analysis, and CD, Westerlund cointegration and Driscoll kraay OLS. The cross-Sectional Independence, Frees' test, Pesaran CD test, and Friedman's test specified that the Performance of Banks and monetary policy tools were cross-sectionally interrelated and dependent on each other. A co-integration relationship had been found in the panel data set at a statistically significant level. Westerlund panel cointegration tests was used due to high dependency among variables. The results presented high cointegration among variables and long-run relationship existed among all variables at $p=0.000$. ROA, ROE, NPL, PR MG, SLR, INF, and EG all were linked in long run. According to this DK (OLS) model, PR MG, ROE, ROA, and NPL were highly associated and Policy Rate, Money Growth had a significant positive impact on bank performance, while SLR had an adverse and negative impact on credit risk which was statistically significant too. In short, the monetary policy tools had a significant impact on the Credit risk of public sector banks in Pakistan.

6.1. Future Suggestions and Scope

- This research will provide fruitful suggestions regarding the changing dynamics of policy shocks on credit risk.
- The study will provide guidelines to the banks, government, monetarist, and concerned stakeholders.
- The study still has a wide gap to be filled. There are various factors which represent the credit and financial performance of public sector banks, which are other than the selected variables in this study.
- Depending on the needs of the future research, the study's duration may also be prolonged. Also, one can study the effectiveness of the monetary policy on the entire commercial banks in the economy and also can go for nationalized banks, private sector banks, Microfinance banks, and Regional Rural Banks in Pakistan.
- Future researchers can take more policy rates such as marginal standing facility and repo rate for identifying the better impact of monetary policy rates on bank's performance.

6.2. Policy Implications

Implications for Government

The government may incorporate those policies and regulations that facilitate and support the country's financial activities based on the empirical findings revealed in this research.

Implications for Bank Managers

With the help of this investigation, Bank managers can accurately predict changes to monetary policy and inflationary ups and downs because these factors are crucial indicators for efficient economic performance.

Implications for Investors

The results also assist people and investing class in perceiving productivity indicators and making the pertinent investigation of fiscal summaries to settle on refined and valued equity investing choices.

Implications for Researchers and Academicians

This study serves as a roadmap for future investigations about how institutions' financial performance was impacted by monetary policy tools.

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