



Bank-Specific Variables and Credit Risk: A Moderating Effect of Bank Type

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ABSTRACT

Credit risk management has become a core activity in the banking sector, especially after the financial crisis of 2007-2008. This study aims to investigate the impact of bank-specific variables on credit risk in association with the moderating effect of bank type in Pakistan. For this purpose, the non-performing loan is taken as the dependent variable to represent credit risk. Independent variables include total equity to total assets representing capital buffer, total financing to total assets for financing expansion, interest income-interest expense to total assets as net interest margin, return on assets to represent efficiency, gross advances to deposit as a proxy of financial intermediation, log of total assets to represent bank size, crisis, and bank type. Bank type is also taken as a moderator in the second model. Annual data for 16 years (2006 to 2021) has been taken from 23 scheduled banks covering both Islamic and conventional banks for panel regression analysis. The study recommends two different models for regression analysis. First, bank type is taken as an independent variable in addition to other bank-specific variables. Later, bank type is taken as a moderator to observe if it moderates the relationship between independent variables and dependent variables. At the initial stage, taking bank type as an independent variable, a random effect model is applied followed by the Hausman test. All variables including bank type are found to be significantly related to credit risk in the model. Later, taking bank type as moderator, the random effect model is finalized to conclude the results followed by the Hausman test. Results show that bank type as moderator significantly affects the relationship of only bank size and capital buffer with credit risk. It is interpreted through results that both bank size and capital buffer of Islamic banks positively affect credit risk, and hence, an increase in these variables may lead to a higher level of credit risk as compared to conventional banks. This study will help the banking sector to improve credit risk management with respect to its type.

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Introduction:

Risk management is a core activity for organizations, especially in a diversified global environment with volatile markets and economic challenges. After the global financial crisis of 2007-2008, academicians, researchers, and policymakers began to pay more attention to the key consequences that a banking crisis, being a part of the financial market, can have on the overall economy of the country (Ntow, and Alu, 2016; Yüksel, Mukhtarov, Mammadov and Ozsari, 2018; Kantharia and Biradar, 2022). Hence, it can be said that the intensity of banking distress has expanded after the financial crisis, and in the process, financial instability has also been recorded. In other words, a rapid increase in asset prices, a decline in lending standards, lenders and borrowers assuming a high level of leverage, connecting with liquidity and insolvency problems that may arise due to an increase in non-performing loans (NPL) and failure in supervision as well as regulation may boost up the risk related to the financial crisis to occur (Castro, 2013; Laeven and Valencia, 2008; Claessens et al., 2014)

The risk of financial intermediaries has been increased due to the international link's strength between public finance and the financial sector's soundness. Deterioration in the banks' portfolio loan, usually, discloses essential and existing weaknesses followed by an assessment of credit and process of credit monitoring (Miller and Noulas, 1996). As per experience and problems being faced for loan portfolio management, banks are characterized by less prudent lending caused by increased risk. It is for this reason that problems related to advances in loan portfolios can be potentially through efficient credit process management (Nandi and Choudhary, 2011). Risk management, in any organization, means the process that helps the organization identify, assess, and control threats related to capital and earnings. Berger and DeYoung (1997) highlighted that if banks do not have effective credit risk management, not only the banking turmoil but also financial crisis would be the incident of such outcomes. Since the early era of the 2000s, expansion has been made with respect to regulatory compliance rules by many industries and different government bodies so that risk management plans, procedures, and policies may be scrutinized.

Among different types of risks associated with the banking sector, one of the areas related to risk management is credit risk, which has been given much importance, especially after the financial crisis in 2008-2009 (Chamberlain, Hidayat and Khokhar, 2020) and Covid-19 (Pandemic) in 2020-2022 (Kantharia and Biradar, 2022). Risk itself can arise in different forms and can originate through different varieties of sources. Likewise, credit risk (the risk of loss reported because of borrowers who fail to meet requirements as the loan contract specifies. Chamberlain et al., (2020) argued that the health of an individual bank, to some extent, depends on the proper management of credit risk. Failure to do this may cause impairment in the health of the bank and the overall banking system. Therefore, it is very important that there should be an effective management system to identify such factors which affect credit risk. Such a system should also help to analyze the effect of identified factors on credit risk (Chamberlain et al., 2020).

Credit risk, which is usually represented by conventional banks as non-performing loans (NPLs), and for Islamic banks as non-performing financing (NPFs), is considered a crucial component in ensuring stability in the economy. It is caused due to the reason why non-performing loans (NPL) are bubbled up in the balance sheets of banks, which ultimately results in financial crisis due to other overlaying causes. In fact, it can negatively affect the financial soundness of banks (Goswami, 2022). Several studies (Strohecker and Saul, 2015; Kabir et al., 2016; Kasman and Carvallo, 2017; Deming et al., 2018; Kok et al., 2019; Gambetta et al., 2019; Abdolshah,



Moshiri and Worthington, 2020; Barra and Reggiero, 2022 & Goswami, 2022) have used NPL as a proxy to represent credit risk. Hence, this study also uses NPL as a proxy for credit risk.

Since non-performing loans (NPLs) were associated with the financial crisis during 2007-2008 and were also the reason for financial markets to collapse, consequently, it began to be considered an important issue to be addressed and considered to be represented as a challenge which is to be managed by financial institutions (Endut et al., 2013). It is not only conventional banks, but also Islamic banks that face issues related to credit risk in terms of non-performing financing (Dibooglu et al., 2022). As per the research of Al-Wesabi and Ahmad (2013), failure of the three quarters (1/3 of the year) of Islamic banks is caused by bad management of credit risk. Limited knowledge about credit risk and its different dynamics is one of the reasons that caused such distress levels in the financial sector. Hence, a sufficient and appropriate understanding of how credit risk can be managed will ensure more stability in the financial system (Adebola et al., 2011).

Keeping in view the previous discussion, various factors related to bank-specific variables affect credit risk. For instance, return on assets, Equity to total assets, loan growth, (Barra and Reggiero, 2022); (Goswami, 2022) size (Cincinelli and Piatti, 2021), (Barra and Reggiero, 2022); (Goswami, 2022), deposit to loans, cost of total assets, loan to total assets (Barra and Reggiero, 2022), non-interest income, intermediation cost (Goswami, 2022) have been considered as bank-specific variables to affect credit risk. In addition, total credit to total deposit and credit to the private sector over total credit (Mahrous, Samak, and Abdelsalam, 2020) are also considered to play a significant role in determining the credit risk of banks. Previous studies also investigated loan-to-earning assets, liquidity, net interest margin (Chamberlain, Hidayat & Khokhar, 2020), and cost inefficiency (Cincinelli and Piatti, 2021), (Chamberlain, Hidayat & Khokhar, 2020) as determinants of credit risk. TIER-1 (Cincinelli and Piatti, 2021), equity to total assets, and the size of the bank were also studied to observe the impact on credit risk by Wang and Luo (2019). One of the studies used bank-specific factors to see the effect on credit risk by applying market structure as bank competition among banks through the composition of indices for market structure at the LMA (local market areas) level (Barra and Reggiero, 2022).

Previous studies have mainly focused on factors affecting credit risk in the banking sector of developed countries. There is, but, very little attention is given to the scenario of developing economies where economic conditions are entirely different as compared to developed economies. Ahmad and Ariff (2007), in their study, concluded that the level of credit risk in emerging economies is higher than in developed economies in the case of the banking sector, and hence, bank-specific variables have a major impact on the credit risk of the banking sector in such economies as compare to developed ones.

As far as bank type is concerned, since bank categories also define the variations in NPL, therefore, determinants of NPL and their behavior could also rely on bank type (Martinez-Miera and Repullo, 2010). In addition, Barra and Zotti (2019) conducted a study on the banking industry of Italy. They found bank type to significantly affect the credit risk and stability of the banking sector. Mian (2003) also argued that bank type does affect the credit risk of banks. Even, recent studies (Wang and Luo, 2019; Cincinelli and Piatti, 2021; Priyadi, Utami, Muhammad and Nugraheni, 2021; Hasnaoui and Hasnaoui, 2022; Risfandy et al., 2022) found that bank type significantly affects the relationship between bank-specific variables and credit risk. Realizing



the important role of bank type, this study focuses on how bank type moderates between bank-specific variables with credit risk.

Therefore, there is no doubt that there is a great significance of such analysis due to the fact that the economy of India has a financial system that is bank-based like Pakistan and Indonesia, where the financial system is largely affected by banks and the entire economy is affected by any shocks to banking sector (Demirguc-Kunt and Levine, 1999).

Literature has addressed factors affecting credit risk in the banking sector related to developed nations (Ozili, 2018; Barra and Ruggiero, 2022) or cross-country analysis (Hasnaoui and Hasnaoui, 2022; Chamberlain et al., 2020; Mahrous, Samak and Abdelsalam, 2020), especially in terms of after-effects of global crisis. Different research has also been conducted to analyze factors affecting credit risk in the scenario of a single country but most of the studies have focused only on European nations or emerging economies (Supriani and Sudarsono, 2018; Barra and Zotti, 2019; Cincinelli and Piatti, 2021; Priyadi, Utami, Muhammad and Nugraheni, 2021; Barra and Ruggiero, 2022). Hence, very little attention has been given to developing countries (Abdolshah, Moshiri, and Worthington, 2020; Goswami, 2022; Bawa et al. 2019). Secondly, many of the studies have addressed macroeconomic and bank-specific factors (Abid, Ouertani, and Ghorbel, 2014; Wang and Luo, 2019; Goswami, 2022;) but very few studies on credit risk by taking net interest margin, capital ratio, total credit to deposit, financing expansion (total financing to total assets), return on assets and bank type (Islamic and conventional banks) with pre-financial crisis and post-financial crisis period in banking industry of Pakistan have been analyzed together for extensive research. Thirdly, the majority of the research efforts have been put only into observing the impact of bank-specific variables considering the time of the post-global financial crisis of 2007-2008, mostly among the US and European banks. There are very few studies, however, which focused on the pre-financial and post-financial crisis periods. Hence, this study contributes to credit risk literature in several ways. First, it studies the behavior of bank-specific variables in Pakistan as it has different economic dynamics as compared to developed countries. Secondly, it also extends literature covering bank-specific variables such as the type of banks (Islamic and conventional) in Pakistan. Finally, it also analyzes bank-specific variables and their effect on credit risk in the era of pre-financial and post-financial crisis.

Literature Review:

There are several studies conducted on identifying bank-specific factors which may affect credit risk. Barra and Ruggiero (2022) conducted research on credit risk by taking bank-specific variables. These variables include bank solvency measured by equity to total assets; bank's profitability measured as return on assets; bank's size measuring log of total assets; intermediation cost measured as deposits to loans; efficiency of bank or intermediation's volume measured by cost of total assets; credit market's volume measured as loans to total assets; credit policy measured as growth of loans. They used bank-specific factors to see the effect on credit risk by applying market structure as Bank Competition among banks through constructing the market structure's indices at the LMA (local market areas) level. The study focused on bank-specific variables to observe the effect on credit risk by using a sample of commercial, cooperative, and some prominent banks in Italy by taking data for the period from the year 1994 to 2015.

Another study considered not only bank-specific variables to observe the effect on credit risk but also included macroeconomic variables as well as ownership and financial crisis. The



analysis included data from all banks operating in the Indian banking industry during the period from year 1998/1999 to 2016/2017. The author, Goswami (2022), took Credit Growth, Size, Non-interest Income, Intermediation Cost, ROA, and Solvency (equity to total assets) Ratio as bank-specific variables to observe the impact on Logit Non-performing Loan to represent Credit Risk by applying two-step system GMM estimation approach. It is concluded through the research that higher profitability, income diversification from nontraditional activities, better managerial efficiency, banks' optimal size, adherence to regulatory norms, and proper credit screening, as well as monitoring, would help the banking sector in India to improve the credit quality and minimize the probability of default risk.

Bank-specific variables have been addressed in addition to monetary policy variables in another study to analyze the impact on credit risk. Mahrous, Samak, and Abdelsalam (2020) researched to find out how credit risk is affected by monetary policy and a few bank-specific variables in the MENA region. For this purpose, panel data for 20 years over the period of 1997 to 2017 was taken from 15 countries in the MENA Region. The study addressed GDP Per Capita and Consumer Price Index as macroeconomic variables, Lending Interest Rate as monetary policy, and, Total Credit to Total Deposit as bank-specific variables. The study concluded that Total Credit to Total Deposit has a significant negative impact on Credit Risk by taking CPI as a threshold variable.

Credit Risk was also investigated by another research through bank-specific variables for comparing the risk profile of Islamic and conventional banks. Chamberlain, Hidayat, and Khokhar (2020) studied risk profiles by taking data from 56 conventional banks and 25 Islamic banks of the GCC region for the period 1987 to 2014. The comparison was done by test of mean difference, correlation test, and pooled OLS regression with interaction. For this purpose, the research focused on Capital to Assets, Loan to Earning Assets, Cost Inefficiency, Size, and Loan Growth as bank-specific variables. Their findings indicate that there is lower credit risk experienced by Islamic banks as compared to conventional banks. In addition, Loan to loan-to-earning assets, Liquidity, Net Interest Margin, Capital to Assets, Loan Growth, and Size have significant negative effects on Credit Risk. Whereas, Liquidity, Cost Efficiency, and Net Interest Margin significantly and positively affect Credit Risk.

By taking Leverage Ratio (Equity to Total Assets), Efficiency (Cost to Income Ratio), Liquidity Ratio (Liquid Assets to Total Assets), Size of Bank and Funding (Non-Deposit short-term funding to Total short-term funding), Shah, Fianto, Sheikh, Sukmana, Kayani, and Bin Ridzuan, (2023) investigated how Credit Risk of banking sector is affected in the Middle East and North African Countries. The authors took sample data from 279 banks which include 204 conventional banks and 75 Islamic banks from these countries over the period of 2011 to 2017 and used a fixed effect model to conclude results. The study finds that Liquidity, Funding Source, and Size play a significant role in the bank risk-oil price nexus. The heterogeneity of the bank risk-oil price relationship is affected significantly by bank-specific variables (characteristics) such as Liquidity, Size, and Funding Strategy.

Cincinelli and Piatti (2021) studied tier-1, capital ratio, ROA, gross loan growth rate, cost to income, and size (natural log of assets) as determinants of credit risk (NPLs). For this purpose, they used data of 12 years from 338 different Italian banks for the period of 2006 to 2017. The study finds Tier-1, cost to income, and size to be positively significant, whereas, gross loan growth to be negatively significant in relation to the observed effect on credit risk.



ROA is found to be insignificant in the study. The core objective of our study is to focus on bank-specific variables that affect credit risk in Pakistan over the period of 20 years (from year 2002 to 2021). For this purpose, capital ratio (equity to total assets), net interest margin, total credit to deposit, financing expansion (total financing to total assets), total assets as a proxy of size, and return on assets will be taken as BSV to observe the effect on credit risk (non-performing loan) with bank type (Islamic and conventional banks) as independent as well as a moderating variable of the Pakistani banking industry. This study also intends to analyze the effect of financial crisis on credit risk.

Methodology:

Since this study intends to investigate the cause and effect of bank-specific-variables with bank type as a moderating variable on credit risk, the model of the study is as follows:

$$CR = \alpha + \beta(CB)_{it} + \beta(FE)_{it} + \beta(NIM)_{it} + \beta(ROA)_{it} + \beta(FI)_{it} + \beta(SIZE)_{it} + \beta(TYPE)_{it} + \beta(FC)_{it} + \beta(PPC)_{it} + \varepsilon_{it}$$

For this purpose, panel data of 23 banks including 4 Islamic banks will be used covering the period from 2006 to 2023. Panel regression model (fixed and random effect) will be applied to conclude the objective of the research. Bank type will be used as a moderating variable by considering '1' if a bank is Islamic, otherwise, '0' for the conventional bank.

Data and Variables:

To investigate how bank-specific variables affect credit risk empirically and to test if bank type affects credit risk during a financial crisis, this study uses bank-level information to analyze and conclude the research objective. Data for this research is collected through analysis of financial statements for all banks published by the State Bank of Pakistan annually, which ensures the provision of a reasonable level of information related to bank balance sheets as well as bank-specific factors including both Islamic and conventional banks (see "Table 1" for description of the studied variables). Our annual data covers the time period from 2006 till 2021 including 23 commercial banks out of which 19 banks are conventional and 4 are Islamic. The said period covers a sample excluding those banks that were either incorporated during this period or were taken over by large banks. The selection of only 4 Islamic banks and 21 conventional banks is based on the reason that this research intends to investigate the dynamics of dual banking systems in the presence of pure Islamic banks but not the banks with Islamic windows. Hence, this study addresses 4 pure Islamic banks for fair representation of bank type as Islamic. The reason for taking data from 2006 is that some of the main government banks converted into private banks which indicates that the dynamics of such banks were different before privatization which may cause insignificant results. The data is also found consistent with respect to banks during the same period due to the conversion of large government banks into private banks.

Table 1: Variable Description



Variables	Symbol	Description
Credit Risk	CR	Non-performing loan to total loan
Capital Buffer	CB	Total equity to total assets
Financing Expansion	FE	Total financing to total assets
Net Interest Margin	NIM	Interest income-interest expense to total assets
Efficiency	ROA	Net income after tax to total assets
Financial Intermediation	FI	Gross advances to deposits
Bank Size	SIZE	Log of total assets
Bank Type	TYPE	Bank type = 1 if Islamic bank otherwise '0'
Financial Crisis	FC	Financial crisis time = 1 otherwise '0'
Pre- and post-Crisis	PPC	Pre and Post-crisis time = 1 otherwise '0'

In the equation, CR is taken as the dependent variable, representing credit risk which is defined as a non-performing loan to total advances. Previously used NPL as a proxy for credit risk by Rahman (2010), Hasnaoui and Hasnaoui (2022), and Goswami (2022), this paper employs non-performing loans to represent credit risk in the banking sector. In order to investigate the impact on CR, independent variables taken in this research are capital buffer (CB): measured by total equity to total assets; financing expansion (FE): measured by total financing to total assets; net interest margin (NIM): measured by interest income-interest expense to total assets; efficiency (ROA): measured by net income after tax to total assets; financial intermediation (FI): measured by gross advances to deposits; bank size (SIZE): measured by log of total assets; bank type (TYPE): measured by '1' if Islamic bank otherwise '0'; financial crisis (FC): measured by '1' if year of financial crisis otherwise '0'; pre and post-financial crisis (PPC): measured by '1' if year of pre and post-financial crisis otherwise '0'. In the later analysis, bank type (TYPE) is also taken as a moderating variable to investigate how TYPE moderates the relation between independent variables and CR.

Empirical Evidence:

Before estimating the empirical models, the following a priori expectations are made in the study: A significant and positive relationship is expected between CR and FI. According to Salas and Saurina (2002), more advances may contribute to an increase in non-performing loans (CR). A higher efficiency level is expected in larger banks for collecting loans, therefore, SIZE is expected to negatively affect non-performing loans (CR). The study also expects that the higher the profitability of banks is, the higher the credit risk it will face in the form of non-performing loans since the asset pricing model depicts that risk and return are positively related to each other, hence, efficiency (ROA) in our study is expected to be positively related to CR. It is also expected that CB



will have either a significant positive or negative effect on CR. A study by Boudriga et al.(2009) and Satyajit and Avijit (2015) implies that a higher capital buffer (CB) and policy of provision for prudence seems to reduce the level of CR, hence, CB is expected to be significantly negatively related to CR. Whereas, according to another study by Delis et al. (2011), CB is significantly positively related to CR, therefore, CB is expected to be significantly positively or negatively related to CR depending upon different bank characteristics, other regulations, and overall macroeconomic environment within the country (Delis et al, 2011). Financing expansion (FE) is expected to be significantly positively related to CR according to Keeton (1999). The study took a proxy of total loan to total assets as credit growth to examine the effect on CR followed by Messai and Jouini (2013), Espinoza and Prasad (2010), and Alhassan et al. (2014). Ntow and Alu (1996) find NIM to be insignificantly related to CR, hence, NIM in this study is expected to be insignificant.

A study conducted by Hasnaoui and Hasnaoui (2022) finds that bank type (TYPE) significantly and negatively affects CR. Taking a dummy variable (1=Islamic banks, 0=conventional banks), they conclude that a negative sign with bank type shows that Islamic banks experience less credit risk. Hence, TYPE as per our study is expected to have a significant negative effect on CR. The moderating effect of TYPE has also been tested in previous studies like Sheho, Shaiban, and Ghafoor (2023) where TYPE as a moderator interacted with different independent variables to observe the impact on bank risk.

A financial crisis (FC) is expected to have a significant effect on CR either positively or negatively as a study conducted by Goswami (2022) reveals that a financial crisis affects CR positively as well as negatively based on the model effect (random or fixed).

Model Specification:

In order to achieve the research objective, panel data methodology is used while estimating the impact of bank-specific variables on credit risk with the moderating effect of bank type by applying an OLS model. Individual heterogeneity is managed through panel data due to hidden factors that lead to prejudiced results if neglected in cross-section or time-series (Baltagi, 2008).

Initially, a regression model can be specified in equation (1) as:

$$Y_{it} = \alpha + \beta X_{it} + \varepsilon_{it} \quad (1)$$

Where the cross-sectional dimension is denoted by the subscript ‘i’ and the time series dimension is represented by ‘t’. The dependent variable, Y_{it} of the model is represented on the left-hand as a non-performing loan (proxy of credit risk) in the model, X_{it} contains the set of explanatory variables in the estimation model such as total equity to total assets (proxy of capital buffer), total financing to total assets (proxy of financing expansion), net interest margin, net income after tax to total assets (ROA: proxy of efficiency), gross advances to total deposit (proxy of financial intermediation), log of total assets (proxy of bank size), bank type and financial crisis. α is the constant and β represents the coefficients. The random error term is represented by ε_{it} .

In order to investigate the effect of bank type as a moderating variable, the model can be specified as in the following equation through interaction between independent variables and moderating variable:

$$y_{it} = \alpha + \beta x_{it} + \beta(x_{it} \times \text{type})_{it} + \varepsilon_{it} \quad (2)$$



Results and Discussion:

This section of the research paper discusses the empirical findings related to the study conducted. Initially, this section presents the econometric estimation based on the research model. Further discussions explain the rationality of the findings and implications of this study for banks and policymakers involved at large. Finally, it also includes the results and discussion of panel regression estimations followed by model diagnostics.

Regression Results:

The study applied two regression models at two different stages for estimation. First, the baseline OLS model is estimated by taking TYPE and other bank-specific variables (BSV) as independent variables to examine the impact on the dependent variable (NPL). Later, in the second stage, TYPE is taken as moderator to examine how independent variables are related to dependent variables. After that, the random effect model (REM) is estimated by taking TYPE as an independent variable at the first stage, and later, taken as a moderator in the model. The Hausman test was performed to choose the most appropriate regression model as either random effect model (REM) or fixed effect model (FEM). Prior to the estimation of both models, endogeneity and multicollinearity in the model were checked.

Endogeneity Test:

An endogeneity test is applied to check if independent variables have a covariance with the error terms in the model. The following results are estimated for the studied variables;

Table 2: Endogeneity

NPL	p-value
NI_TO_TA	.000
TA_LN	.000
TC_TO_TD	.008
TE_TO_TA	.000
TF_TO_TA	.001
TYPE	.028
NIM	.000
CRISIS	.016

Results shown in the above table imply that there is no issue of endogeneity in the model since the sig. value of all variables is less than 0.05 at a 95% confidence interval.

Multicollinearity Test:

Prior to deciding on the final model for the research objective, multicollinearity among independent variables was also checked. The following table shows the stated results:



Table 3: Multicollinearity

Variables	VIF	1/VIF
NI_TO_TA	1.53	.653595
TA_LN	1.86	.538403
TC_TO_TD	1.17	0.857735
TE_TO_TA	1.45	0.691021
TF_TO_TA	1.22	0.820852
TYPE	1.20	0.833592
NIM	1.14	0.879434
CRISIS	1.29	.775194

It is observed in the above results that no multicollinearity exists among independent variables since the value of VIF for all variables is less than ‘2’.

Model (1): Dependent variable NPL with TYPE as independent variable:

We first applied the OLS model to estimate NPL in the presence of TYPE as an independent variable with other BSV. The results of the OLS model are given in the table below:

Table 4: Panel Least Square – CR as the dependent variable

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NI_TO_TA	-3.585558	0.304829	11.76253	0.0000
TA_LN	-0.006542	0.004676	1.399147	0.1627
TC_TO_TD	-0.044821	0.029855	1.501267	0.1342
TE_TO_TA	-0.137880	0.052907	2.606088	0.0096
TF_TO_TA	0.022655	0.011846	1.912555	0.0566



TYPE	-0.072842	0.011836	- 6.154117	0.0000
NIM	-0.022964	0.179933	- 0.127624	0.8985
CRISIS	-0.036504	0.013750	- 2.654855	0.0083
C	0.302562	0.101134	2.991686	0.0030

0.462
R-squared 334
Adjusted R-squared 0.449
683
36.54
F-statistic 535
Prob(F-statistic) 0.000
000

The above results show that all variables except total assets, total credit to total deposit, total financing to total assets, and net interest margin have a significant impact on non-performing loans. The value of R-squared shows that almost 46% of the variation in non-performing loans is explained by independent variables.

After this, we applied the random effect model (REM) to estimate NPL against all independent variables. The results of REM are given in the table below:

Table 5: Random Effect Model – CR as the dependent variable

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NI_TO_TA	-2.961024	0.268292	- 11.03659	0.0000
TA_LN	-0.025378	0.004928	- 5.149501	0.0000
TC_TO_TD	-0.091836	0.028066	- 3.272148	0.0012
TE_TO_TA	-0.236557	0.047133	- 5.018921	0.0000
TF_TO_TA	0.026978	0.010286	2.622822	0.0091
TYPE	-0.092107	0.026595	- 3.463385	0.0006



NIM	-0.290151	0.147131	- 1.972065	0.0494
CRISIS	-0.042847	0.011346	- 3.776535	0.0002
C	0.717816	0.104733	6.853779	0.0000

	0.431
R-squared	285
Adjusted R-squared	0.417
	904
	32.22
F-statistic	988
Prob(F-statistic)	0.000
	000

According to the results, after applying REM, all variables become significant in the model. The value of R-squared shows that almost 43% of the variation in non-performing loans is explained by independent variables.

Following by above results, we also perform the Hausman test to choose between REM and FEM. The results of the Hausman test are mentioned below in the table:

Table 6: Hausman Test:

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	13.523449	7	0.0603

Hausman Test's results show the Chi-Square Statistic as 13.5235 with a p-value of 0.0603 which favors the random effect model for model description.

Hence, based on the diagnostic test and followed by REM, the following results are interpreted:

- Financing expansion has a positive effect on credit risk; therefore, more financing may lead to an increase in non-performing loans and banks may have to face higher credit risk.
- On the other hand, the results show a negative significant impact of ROA on credit risk. Hence, our findings indicate that banks with higher efficiency may lead to lower credit risk.



- Bank size also has a negative relationship with non-performing loans which implies that large size of banks may have less amount of non-performing loans.
- The negative impact of financial intermediation on non-performing loans shows that the higher the ratio of financial intermediation is, the higher the credit risk is to be. This result contradicts previous studies. This could be possible because of the different dynamics of the banking sector in Pakistan as a developing economy.
- total equity to total assets as the negative relationship with non-performing loans in our study indicates that banks with a greater amount of equity part in total assets may have less credit risk. It means the higher the equity ratio, the lower the credit risk.
- In our findings, the negative relationship of net interest margin with credit risk implies that an increase in net interest margin ratio may help banks to overcome non-performing loans.
- bank type with a negative coefficient in the result shows that Islamic banks in Pakistan face fewer issues of non-performing loans.
- the crisis with a negative impact on credit risk indicates that banks in Pakistan had fewer issues of non-performing loans during the financial crisis. This result contradicts previous studies. This could be because of the reason that during the crisis time period, some government banks were newly converted to privatized banks, and hence, such banks would have been very careful in lending loan

Model (2): Dependent variable NPL with TYPE as moderating variable:

In this section, we first applied the OLS model to estimate NPL in the presence of TYPE as a moderating variable with other BSV as independent variables. The results of the OLS model are shown in the table below:

Table 7: Panel Least Squares with TYPE as moderator:

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NI_TO_TA	-3.642511	0.314293	11.58954	0.0000
TA_LN	-0.009589	0.005291	1.812406	0.0708
TC_TO_TD	-0.049360	0.034113	1.446936	0.1489
TE_TO_TA	-0.159743	0.061028	2.617529	0.0093
TF_TO_TA	0.019176	0.015422	1.243421	0.2146



TYPE	0.001274	0.328295	0.003881	0.9969
NIM	0.048418	0.186477	0.259646	0.7953
CRISIS	-0.033006	0.014871	- 2.219485	0.0271
MOD_TY_CR	-0.014630	0.043841	- 0.333702	0.7388
MOD_TY_NI	2.510515	1.675310	1.498538	0.1349
MOD_TY_NIM	-1.806368	1.157392	- 1.560723	0.1195
MOD_TY_TA	0.001381	0.015450	0.089394	0.9288
MOD_TY_TC	-0.082275	0.086521	- 0.950921	0.3423
MOD_TY_TE	0.125827	0.146746	0.857450	0.3918
MOD_TY_TF	-0.006066	0.030461	- 0.199128	0.8423
C	0.367481	0.116401	3.157026	0.0017

	0.472
R-squared	901
Adjusted R-squared	0.449
	158
	19.91
F-statistic	733
Prob(F-statistic)	0.000
	000

The results of OLS with type as a moderating variable in the above table show that other than the log of total assets, total credit to total deposit, total financing to total assets, and net interest margin, other variables remain significant in the model. Whereas, type as moderator does not significantly moderate the relationship between any independent variables and non-performing loans.

After this, we applied the random effect model (REM) to estimate NPL against all independent variables with the moderating effect of TYPE. The results of REM are given in the table below:

Table 8: Random Effect Model with TYPE as moderator

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NI_TO_TA	-2.993607	0.267531	- 11.18977	0.0000



TA_LN	-0.041171	0.005781	- 7.121869	0.0000
TC_TO_TD	-0.141773	0.031165	- 4.549049	0.0000
TE_TO_TA	-0.316797	0.052600	- 6.022717	0.0000
TF_TO_TA	0.032043	0.013725	2.334673	0.0202
TYPE	-0.787565	0.271517	- 2.900610	0.0040
NIM	-0.180980	0.145519	- 1.243683	0.2145
CRISIS	-0.042168	0.011727	- 3.595829	0.0004
MOD_TY_CR	0.002841	0.033883	0.083841	0.9332
MOD_TY_NI	2.589806	1.366062	1.895819	0.0588
MOD_TY_NIM	-1.060885	0.958875	- 1.106385	0.2694
MOD_TY_TA	0.036113	0.012915	2.796212	0.0055
MOD_TY_TC	0.035270	0.082245	0.428842	0.6683
MOD_TY_TE	0.303903	0.117717	2.581633	0.0103
MOD_TY_TF	-0.021686	0.024225	- 0.895197	0.3713
C	1.059440	0.124158	8.533011	0.0000

	0.472
R-squared	624
Adjusted R-squared	0.448
	869
	19.89
F-statistic	524
Prob(F-statistic)	0.000
	000

According to the above results, after applying REM, all variables, except net interest margin, become significant in the model. Type as moderator significantly moderates the relationship of total assets and total equity to total assets with non-performing loans. The value of R-squared shows that almost 47% of the variation in non-performing loans is explained by independent variables.

Following by above results, we also perform the Hausman test to select between REM and FEM. The results of the Hausman test are mentioned below in the table:



Table 9: Hausman Test:

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	15.723449	14	0.0703

The results of the Hausman Test show the Chi-Square Statistic as 15.7235 with a p-value of 0.0703 which favors the random effect model for model description.

Hence, based on the diagnostic test and followed by REM, the following results are interpreted:

- Total financing to total assets has a positive effect on non-performing loans, therefore, more financing may lead to an increase in non-performing loans and banks may have to face higher credit risk.
- On the other hand, net income to total assets, log of total assets, total credit to total deposit, total equity to total assets, net interest margin, and crisis have a negative impact on non-performing loans. Hence, these variables may help banks to decrease credit risk by increasing BSV. It also implies that financial crisis as a variable does not cause an increase in non-performing loans of Pakistani banks.
- As far as the moderating effect of type is concerned, it significantly moderates the relationship of only total assets and total equity to total assets with non-performing loans.
- The positive moderating effect of type between total assets and non-performing loans indicates that larger Islamic banks may have a higher ratio of non-performing loans because of Islamic modes of investment and financing.
- The moderating effect of type between Total equity to total assets and non-performing loans shows that more equity of Islamic banks may help to decrease the ratio of non-performing loans.
- The study finds no significant moderating effect of type on other independent variables in relation to non-performing loans.

Conclusion

Focusing on the Pakistani contest during the period 2006-2021, the main objective of this paper has been to investigate the impact of bank-specific variables on credit risk, taking into account the role of bank type as a moderating variable. Initially, panel regression analysis was estimated by taking bank type as an independent variable in addition to other bank-specific variables. The random effect model is finally recommended on the basis of the Hausman test. The results show mixed results for different variables. All variables including bank type are found to be significantly related to credit risk. Financing expansion is positively related to credit risk, whereas,



other variables (ROA, bank size, capital buffer, financial intermediation, net interest margin, bank type, and crisis) are negatively related to credit risk. The analysis based on bank type as moderator brings different results with respect to the significance level of independent variables to observe the impact on credit risk. Results estimated on the basis of the random effect model show that type as moderator significantly affects the relationship of only bank size and capital buffer with credit risk. Other variables are found to be insignificant in the presence of a moderator (bank type) to predict credit risk.

Implications

The positive significant impact of financing expansion indicates that more financing may cause higher credit risk in the banks of Pakistan. ROA has a negative significant impact on credit risk which shows that higher efficiency may help banks to lower credit risk. Bank size with a negative coefficient also indicates that the larger the bank is, the less the credit risk faced by banks. An increase in financial intermediation, capital buffer, and net interest margin may also help banks to control credit risk. Bank type as an independent variable shows that Islamic banks may have less credit risk as compared to conventional banks in Pakistan. It is also concluded that banks had fewer issues related to credit risk during the financial crisis.

In the presence of bank type as moderator, it is interpreted through results that both bank size and capital buffer of Islamic banks positively affect credit risk, and hence, an increase in these variables may lead to a higher level of credit risk as compared to conventional banks.

Limitations and Future Directions

The analysis based on the credit risk of individual banks shown in this paper provides a baseline assessment in the presence of a few selected bank-specific variables. Although this research addressed the time period of 16 years (2006-2021) covering financial crisis time, other bank-specific variables with macroeconomic indicators as control variables can be considered for future studies. Bank type, which represents Islamic and conventional banks in this research, could be taken as a type representing government and private banks for further dimensions of investigation of how issues related to credit risk in Pakistani banks may be resolved.



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