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Determinant of credit risk of Islamic banks in Pakistan

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Abstract

This study aims to investigate the influence of macroeconomic variables and bank-specific factors on the credit risk of Islamic banking in Pakistan, through the panel data regression tools. The statistical tool which is applied to the research is ordinary least square (OLS) regression model. All the assumption to be fulfilled before using OLS. The secondary data have been taken from four (04) full-fledged Islamic banks in Pakistan, from 2007 to 2021. The focus of the research is to find the impact of macroeconomic variables like Gross domestic product, inflation, and growth in the interest rate and bank-specific factors like size, return on assets, loan loss provision, capital Adequacy ratio, and Asset quality to determine the credit risk (non-performing loans) of Islamic banks in Pakistan. The result of the ordinary least square (OLS) regression model is that loan loss provisions (LLP) have a positive and significant impact on credit risk (CR) and size of bank (S), and Capital adequacy ratio (CAR) have a negative and significant impact on credit risk (CR) of Islamic Bank of Pakistan. Inflation (INF) and Gross domestic product (GDP) have a positive and insignificant impact on credit risk (CR), and growth in interest rate (INT), return on assets (ROA), and asset quality (AQ) has a negative and insignificant impact on Credit risk (CR) of Islamic Bank of Pakistan. Therefore, Islamic banks should carefully examine their specific factors, i.e. LLP, S, and CAR to manage their credit risk, particularly in monitoring loans.

Keywords Islamic financing tools, Credit risk, Macroeconomic factors, Bank-specific factors

Introduction

Overview

Banks have a fundamental role in a Country's Economic growth. The essential functions of banks are accepting deposits from the public and lending money to those who need it. Credit Risk management is also an important activity that banks must perform carefully to survive in the competitive banking industry because inefficient credit risk management must affect the performance of banks and economic growth. Credit risk is described as loss arising from a bank's borrowers, who are unable to meet their obligations according to their credit term

conditions. Credit risk is one of the factors which is responsible for bank failure [15] as it found through the studies that failure to pay loans along with deficiency of banking skills, inadequate regulations, deposit insurance, mismanagement, and corruption are causes of banking institution failures. The studies also show that [9] high debt levels generated a higher possibility of bankruptcy, if credit risk is managed efficiently, the bank's Profitability can be increased.

Islamic Banking Industry is getting growing encouragement and importance around the globe, and it has not only got growing popularity in the Islamic world but also in non-Islamic countries of the world. According to International Monetary Fund (IMF), Islamic finance has a lot of importance in Asia and the Middle East, while it is also spreading with a notable international reach. Islamic finance is a financing activity that must obey Islamic law (sharia). Sharia law does not allow any type of

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receipt and payment of Riba (Interest), Gambling, Speculation, and short sales or purchase activities. The essential role of Islamic Finance is Risk and Reward Sharing in all circumstances and avoiding unjustified benefits to any of the parties involved in the contract. Credit is created in Islamic banks based on real transactions. Credit risk is affiliated with specific features of Islamic financing agreements. The risk measurement processes undertaken by Islamic Banking Industries shall also apply to profit-sharing assets (Mudarabah and Musharakah). Mudarabah is a partnership agreement, in which one partner is responsible to invest the fund in the business venture and the other partner is responsible to run and manage the business. In the mudarabah agreement, the person investing is called Rabb-ul-maal (Bank). The person who manages the business is called Mudarib (Entrepreneur), and the investment is called "Raas-ul-Maal." The profit/Loss sharing according to the pre-defined ratio. In this agreement, the whole fund of Rabb-ul-maal (Bank) is handed over to Mudarib (Entrepreneur) which may cause credit risk. Musharakah means "sharing." Under sharia law, Musharakah is a partnership agreement, in which two or more partners combine their investment and expertise to form a business and all partners agree to share the profit and loss according to their contribution ratio. There are two types of Musharakah agreements, Running Musharakah "Is a Shirkat-ul-aqd based financing agreement offered by the bank to their customers where the Bank participates in the operating activities of the customer and shares profit and loss according to the performance of the business. Running Musharakah can be used by commercial and corporate entities to meet their working capital requirements." Diminishing Musharakah "Is a Shirkat-ul-Milk based financing agreement offered by the bank to their customers who are looking to avail financing where the Bank and the customer jointly purchase an asset and create joint ownership in the asset. After the creation of co-ownership, the Bank will rent out its portion of the asset to the customer for periodic rental payments and in the meanwhile, the customer would also purchase the Bank's partial ownership in the asset such that the Customer would become the sole-owner of the asset at the specific time of maturity of the transaction. Diminishing Musharakah can be used by small, medium, commercial enterprises & corporate entities to meet their working capital requirements."

However, in such agreements, bank's share of profit or investment may be considered as credit toward the other partners (entrepreneur). So, at times, the other partner (entrepreneur) may default not paying the bank's share of profit or investment and this can lead to the arising of credit risk. Likewise, the invested capital in a Mudarabah or Musharakah agreement will be converted to debt in

case of proven negligence or misconduct of Mudarib or Musharakah's managing partner. Bank purchases goods on the demand of the client, who makes deferred payments that cover the costs and at an agreed profit margin. In Murabahah, the buyer has the right to reject the product delivery that is already purchased by the bank [1]. Ijarah means "to give something on rent." Ijarah is a lease agreement, in which a bank buys assets, properties, or equipment on the demand of their customer and leases these assets to them at a fixed price for a fixed period. Ownership of the assets passes on to the customer either during the schedules of payment or at the end of the period. During the agreement life, the risk inherent in an Ijarah agreement is transformed from market risk to credit risk. Other such agreements Salam and Ististna are forward sale-based agreements between two or more parties where the seller sells their assets to the buyer at the future date in exchange for the price fully paid in advance [13] found that Salam and Ististna are also used as proxies of credit extension facilities that create credit risk. Islamic Financing is also prohibited from using the amount of any penalty for their benefit; they must donate any such amount to charity. This also increases the cost of default.

Problem statement

Islamic Banking financing is growing at a fastest rate in the world as well as in Pakistan, for last few decades. Pakistan aims to Islamize its overall banking industry in near future. In 1992, it was decided that conventional banks will be converted into Islamic banks. As a result, Meezan bank, the first Islamic bank was established in 2002 in Pakistan and paved the roots for Islamic financing. Today, Pakistani banking industry is providing conventional as well as Islamic banking financial services. Due to the increase in Islamic banking, the determinants of the credit risk of Islamic banks are also affected by macroeconomic variables and bank-specific factors. So, our research will study the influence of macroeconomic variables like gross domestic product, inflation, and growth in the interest rate and bank-specific factors like Size, return on assets, loan loss provision, capital adequacy ratio, and asset quality on the credit risk of Islamic banking in Pakistan.

Research objective

This study aims to investigate the influence of macroeconomic variables and bank-specific factors on the credit risk of Islamic banking in Pakistan, through applying the panel data regression tools. The statistical tool which is applied to the research is Ordinary Least Square (OLS) Regression Model. All the assumption to be fulfilled before using OLS. The secondary data have been taken

from four (04) full-fledged Islamic banks in Pakistan, from 2007 to 2021. Additionally, as Islamic banking is recently evolving in different parts of the world, therefore, the research work done on Islamic banking is limited. So, there is fewer research work available on the determinants of the credit risk of Islamic banks in Pakistan. There is limited literature available. However, the research work regarding determinants of conventional banks is fully studied. In order to fill this gap, the focus of this research is to study the full-fledged Islamic banks in Pakistan and to find the impact of bank-specific factors like Size, Return on Assets, Loan loss provision, Capital Adequacy ratio, and Asset quality and macroeconomic variables like Gross domestic product, Inflation, and Growth in the interest rate to determine the Credit risk (Non-Performing Loans) of Islamic banks in Pakistan.

Research question

The research question, the study aims to investigate whether the macroeconomic variables and bank-specific factors have a significant impact on the Credit Risk of Islamic banks or not?

Structure of the study

The research paper is organized as follows. The next sections focus on the review of literature about the topic, followed by the research methodology, which is used to conduct this study, while the fourth section exhibits the results acquired through this research and the last section provides the conclusion and recommendations of the study.

Literature review

Islamic banks have some differences compared to Conventional banks in terms of risk management because direct lending money at an interest rate to their customers is prohibited in Islamic law. The essential role of Islamic Finance is Risk and Reward Sharing in all circumstances and avoiding unjustified benefits to any of the parties involved in a contract. Credit is created in Islamic banks based on real transactions (Like Mudarabah, Musharakah, Murabahah, Ijarah, Salam, and Ististna). In these agreements, credit risk arises due to the inability of debtors to meet their obligation on the date of maturity. Although Islamic banking is growing rapidly in different parts of the world, the research work done on Islamic banking is limited. So, there is fewer research work on the determinants of the credit risk of Islamic banks in Pakistan. There is limited literature available. However, the literature regarding determinants of conventional banks is fully studied. In order to fill this gap, this research aims to study how macroeconomic variables and bank-specific

factors influence the credit risk of Islamic banking in Pakistan.

In Turkey, the research conducted by [8] on Credit Risk Management: A Panel Data Analysis on The Islamic Banks in Turkey, and the sample data calculated with the help of the quarterly financial statements between the years 2014–2017, were obtained from the statistical reports on the websites of Turkey Participation Banks Association (TPBA), Central Bank of the Republic of Turkey (CBRT) and banks. According to research, the relationship between credit risk and capital adequacy, net profit share income, and natural logarithm of total assets are positive and significant, which means that the one-unit increase in the capital adequacy ratio will also increase the credit risk. net profit share income and the natural logarithm of total assets means if one-unit increases in any of these variables will increase the credit risk too and a negative relationship between gross domestic product variable and credit risk means if one-unit increases in gross domestic product variable will decrease the credit risk.

Another research, “How size influences the credit risk in Islamic banks” analyzes the effects of bank size and its financing to the customer on credit risk, conducted by [5]; the researchers considered the size of banks and the size of their financing to clients are the main issues of credit risk. The sample data were used by 48 Islamic banks from 16 countries around the world over the period from 2008 to 2018. The result of this research is that there is a negative relationship between bank size, financing to the customer, and capital-to-assets ratio with credit risk.

Another study was conducted [12] in which financial performance of top 10 banks operating in Pakistan were selected and financial performance of Islamic and conventional banks was analyzed on the basis of financial ratios. According to this study, Islamic banks have higher capital, lower in risks and higher liquidity in comparison to conventional banks who are offering Islamic banking in Pakistan.

Banking Industry of Pakistan is facing many challenges among them determinants of credit risk and operational risk were studied. The research shows positive and significant relationship of credit risk and operational risk related to the gearing ratio, NPLs and operating efficiency while insignificant but positive relationship with the liquid assets. [11].

“Islamic Bank Credit Risk: Macroeconomic and Bank Specific Factors” this research conducted by [18] and the panel data gathered from the Central Bureau of Statistics and Central Bank Indonesia for the period 2010 to 2016.

The reason for the research is to analyze the influence of macroeconomic and banking factors on credit risk in Islamic banking. According to research, the size of the banks influenced credit risk positively and other variables financing expansion, financing quality, GDP, and inflation influenced negatively.

Another Indonesian research “Determinants of credit risk of Indonesian Shariah rural banks” conducted by [16], the purpose of this research is to find the impact of internal and external factors on the credit risk of Indonesian Shariah rural banks (SRBs)—a type of Islamic bank that provides Islamic financial services, especially to small and medium businesses in Indonesia. The dependent variable was non-performing financing [NPF] and the independent internal variables were capital adequacy ratio (CAR), financing to deposit ratio (FDR), return on assets (ROA), operating expense ratio (OER), financing to value (FTV) and profit and loss sharing (PLS) financing ratio and the external variables were inflation, economic growth, and interest rate. The data were collected from Shariah rural banks in Indonesia as secondary data for the years 2010–2019. Autoregressive distributed lag (ARDL) is used as the analysis method to find the short-run and long-run relationships between the variables. The results show that in the short run, the delay has been observed in four of the variables those are NPF, Inflation, CAR, and PLS. Additionally, each of the variables has shown different results. In the long run, the results found that capital adequacy ratio (CAR) and return on assets (ROA) have a positive impact on non-performing financing [NPF], on the other hand, inflation and loss sharing (PLS) have a negative impact on non-performing financing [NPF] and other variables economic growth, interest rate financing to deposit ratio (FDR), financing to value (FTV) and operating expense ratio (OER) have no impact on non-performing financing [NPF] in Shariah rural banks (SRBs).

Akram and Rahman [2] analyzed the Credit risk management (CRM) of Islamic banks and Conventional banks in Pakistan. The secondary data were chosen for the research. The sample data of five Conventional banks (CBs) and four Islamic banks (IBs) were used from the banks’ annual financial reports for 13 years, from 2004 to 2016. Multiple regression, correlation, and descriptive analysis were used in the examination of the data. Loan quality (LQ) and Asset quality (AQ) were the variables. The results indicate that loan quality (LQ) has a positive and significant impact on CRM in both IBs and CBs. Whereas Asset quality (AQ) has a negative impact on CRM in Islamic banks (IBs) but has a positive impact on CRM in Conventional banks (CBs). Regression model using a dummy variable of financial crises for strong comparison among Conventional banks (CBs) and

Islamic banks (IBs). The model proved that the Credit risk management (CRM) performance of Islamic banks (IBs) was better than that of Conventional banks (CBs). Furthermore, the mean average value of financial ratios used as a measuring tool for these variables indicates that the Credit risk management (CRM) performance of Islamic banks (IBs) operating in Pakistan was better than the Conventional banks (CBs) over the period.

Another research held in Pakistan, “Factors Affecting Credit Risk in Islamic Banks” was analyzed by Shah et al. [17]. The purpose of this research is to find the effects of bank-specific variables on the credit risk of Islamic Banks. The Secondary data and Pooled OLS regression model were used in the research. The data were collected from four (04) full-fledged banks Islamic Banks for ten years, from 2008 to 2017. Credit risk (CR) is the dependent variable, and Bank size (BSIZE), Management efficiency (MGT), Capital ratio (CAPR), Risky investment (RSI) and Bank profitability (PERF) are independent variables. The study shows that Capital ratio and Bank profitability have a negative and significant impact on credit risk and other variables, such as Bank size, Management efficiency, and Risky investment, were found insignificantly related to credit risk.

A study conducted in [10] was focused on macro and bank-specific variables stating that capital adequacy ratio, and loan loss provision are significantly linked with credit risks, whereas operating inefficiency, GDP growth and growth in advances are directly linked with credit. Further, commercial banks’ return on asset and size have significant negative connection with credit risk in Pakistan. Study also suggests that interest rate growth exerts no effect on credit risks of Commercial Banks’ system in Pakistan. The results reveal that operating inefficiency, size and loan deposit ratio have unconnected relation with credit risks in Pakistan commercial banks.

Research methodology

The study investigates the influence of macroeconomic variables and bank-specific factors on the credit risk of Islamic banking in Pakistan, through the panel data. The statistical tool which is applied to the research is Ordinary Least Square (OLS) Regression Model. All the assumption to be fulfilled before using OLS. The secondary data used in this research are collected from different websites. Some of the key websites are World Bank, Exchange Rates, State Bank of Pakistan, and Pakistan Bureau of Statistics, and annual financial statements of banks and data have been taken from four (04) full-fledged Islamic banks in Pakistan, for fifteen (15) years from the period of 2007 to 2021. Further, as Islamic banking is recently evolving in different parts of the world, therefore, the research work done on

Islamic banking is limited. So, there is fewer research work available on the determinants of the credit risk of Islamic banks in Pakistan. There is limited literature available. However, the research work regarding determinants of conventional banks is fully studied. In order to fill this gap, the focus of this research is to study the full-fledged Islamic banks in Pakistan. The data are collected based on convenient sampling, which means only financial data has been taken which is available for the given period 2007 to 2021. The aim of the research is to find the impact of macroeconomic variables like Gross domestic product, Inflation, and Growth in the interest rate and bank-specific factors like Size, Return on Assets, Loan loss provision, Capital Adequacy ratio, and Asset quality to determine the Credit risk (Non-Performing Loans) of Islamic banks in Pakistan. Furthermore, descriptive statistical techniques such as mean, median mode, and standard deviation were also used in this research data. The fully Islamic banks in Pakistan are shown in Table 1).

Hypothesis

In this research, following hypothesis are established based on the research model.

Macroeconomic variables such as GDP, inflation, and interest rate play a crucial role in economic growth as it gives information related to the size of the economy and how an economy is growing and performing, and these macroeconomic variables also play an important role in credit risk evaluation. According to [16], macroeconomic variables have an impact on credit risk, macroeconomic stability and positive economic growth will reduce credit risk (NPLs). Meanwhile, poor macroeconomic implications and higher capital costs will increase credit risk.

The GDP has a significant impact on credit risk. The GDP increases, which means employment is also increasing as companies hire more workers for their factories and people have more money in their pockets, so peoples are able to pay their loans which decreases the credit risk.

H1 GDP has a significant impact on the CR of Islamic banks.

Inflation has a significant impact on credit risk. Inflation increases which affect the purchasing power means that circulations of money increases but the value of money decreases, that increases the credit risk.

H2 INF has a significant impact on the CR of Islamic banks.

Interest rate has also a significant impact on credit risk. Interest rate increases which affect people’s paying ability, peoples are unable to pay back to their loans, that increases the credit risk.

H3 INT has a significant impact on the CR of Islamic banks.

Bank-specific factors like Size, Return on Assets, Loan loss provision, Capital Adequacy ratio, and Asset quality also play an essential role in credit risk evaluation.

SIZE of bank has a significant impact on credit risk, the larger the size of the bank, the higher is its financial performance, which affects the credit risk. According to [5], Larger banks are more diversified, which will allow the banks to reduce their credit risk based on their ability to diversify their assets portfolio, as well as the ability to diversify their financing portfolio. According to [18], the greater the size of the bank, the higher the financing to be issued, therefore it can trigger an increase in credit risk.

H4 S has a significant impact on the CR of Islamic banks.

ROA has a significant impact on credit risk, ROA is the profitability indicator that measures how efficiently companies’ generate their profits. According to [14], ROA are the widely used metrics for analyzing the financial performance of banks [17] which explained that banks’ profitability affects the credit risk, and the higher the profitability ratio the more favorable for banks to monitor and control the loans.

H5 ROA has a significant impact on the CR of Islamic banks.

LLP has a significant impact on credit risk; according to [3], LLP is an essential indicator for the bank; banks put some money aside as a reserve for any potential loan default that occurs in the future, which will help to protect banks’ position in terms of profitability and capital [4] has concluded that Loan loss provision is a ratio of total loans affect credit risk significantly positive.

Table 1 List of Banks

S. No	Bank names
1	Meezan Bank Limited
2	Dubai Islamic Bank
3	Al Baraka Bank
4	BankIslami Pakistan Limited

H6 LLP has a significant impact on the CR of Islamic banks.

CAR has a significant impact on credit risk, Capital Adequacy Ratio is a banks indicator which indicates banks has an enough fund to deal with their unexpected losses. According to [6], the higher the values of CAR which indicates banks more easily will manage their financing problems which reduce the credit risk.

H7 CAR has a significant impact on the CR of Islamic banks.

AQ has a significant impact on credit risk, AQ is an indicator of banks that reflects the quantity of potential credit risk based on its investment and loan portfolios and other assets. [7] explained the bank earn the large portion of revenue from interest income that's way the higher the ratio is expected to be more efficient in earning profits and positive effect on profit. The higher asset quality, the lower the credit risk (NPLs).

H8 AQ has a significant impact on the CR of Islamic banks.

See Table 2.

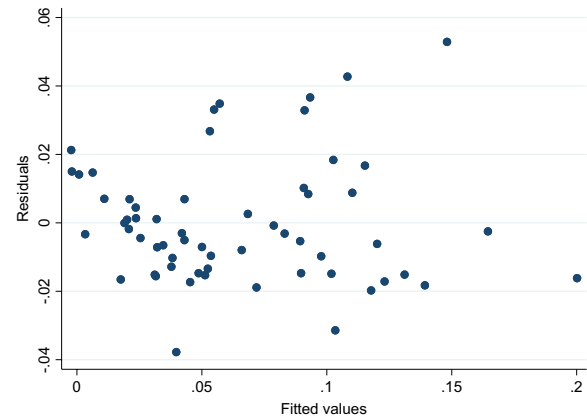
Therefore, the regression research model constructed is as follows:

$$CR_{it} = \beta_0 + \beta_1(GDP)_{it} + \beta_2(INF)_{it} + \beta_3(INT)_{it} + \beta_4(S)_{it} + \beta_5(ROA)_{it} + \beta_6(LLP)_{it} + \beta_7(CAR)_{it} + \beta_8(AQ)_{it} + \varepsilon_{it}$$

where β_0 : Constant coefficient. ε_{it} : Term of the Random Error. i : i for banks, and t for years. β_1 : The coefficient, respectively, of variable 1 (GDP) and so on others.

Assumptions of the ordinary least square (OLS) regression model

To test the assumption of Endogeneity, the relationship between residuals and fitted values, there is no specific pattern between residuals and fitted values, so there is no any problem of Endogeneity in this model.



Multicollinearity means that the variables of interest are highly correlated. According to Econometrician and statistician to test the assumption of multicollinearity, VIF should not be greater than 10. That's why in this model, for my independent variables VIF is less than 10 and there is no problem of multicollinearity among my independent variables.

Table 2 Description of Variables

S. No	Name of variables	Proxy for variables	Sign	References
	<i>Dependent</i>	<i>Variable</i>		
1	Credit risk	(Non-performing loans/total loans) * 100	CR	
	<i>Independent</i>	<i>Variables</i>		
2	Gross domestic product	Log of (Consumption + Govt. spendings + Investments + Net Exports)	GDP	Wiryo and Effendi [18]
3	Inflation	[(Current CPI – initial CPI)/initial CPI] * 100	INF	Priyadi et al. [16]
4	Growth in the interest rate	(Current year rate – Previous year rate)/current year rate	INT	Kasana and Naveed [10]
5	Size	Logarithm of total assets	S	İncekara and Çetinkaya [8]
6	Return on assets	Net profit/total assets	ROA	Shah et al. (2021)
7	Loan loss provision	(Loan loss provision/total loan) * 100	LLP	Al-Wesabi and Ahmad [4]
8	Capital adequacy ratio	(Capital/risk weighted assets) * 100	CAR	Alzoubi and Obeidat [5]
9	Asset quality	(Total loan/total assets) * 100	AQ	Ekinci and Poyraz [7]

Variable	VIF	1/VIF
S	6.62	0.151099
GDP	5.66	0.176738
CAR	2.39	0.418757
AQ	2.28	0.439336
INT	2.27	0.440033
INF	2.21	0.451599
ROA	1.93	0.518826
LLP	1.62	0.616259
Mean VIF	3.12	

To test the assumption of Heteroscedasticity. The *p* value is 0.0713 which is greater than significance level which means that the null hypothesis is accepted and there is no any heteroscedasticity problem in this model.

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Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: INF GDP INT S ROA LLP CAR AQ

F(8 , 51) = 1.96
Prob > F = 0.0713
    
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Theoretical Framework

In the framework, the credit risk (CR) is the dependent variable in our study which is shown on the right side whereas, Gross domestic product (GDP), Inflation (INF), and Growth in the interest rate (INT) are macroeconomic independent variables and Size (S), Return on Assets (ROA), Loan loss provision (LLP), Capital Adequacy ratio (CAR), and Asset quality (AQ) are bank-specific independent variables shown in the left side of Fig. 1. The relationship between independent variables with dependent variable (Credit risk) were determined in the paper. The data for dependent and independent variables will be collected for fifteen (15) years from the period of 2007 to 2021.

Results and analysis

The research has been completed with a careful analysis of data including the dependent variable which is Credit Risk (CR) and the independent variables which are Inflation rate (INF), Gross domestic product (GDP), Growth in Interest rate (INT), Size of Bank (S), Return on assets (ROA), Loan loss provision (LLP), Capital adequacy ratio (CAR) and Asset quality (AQ) that exert impact on the

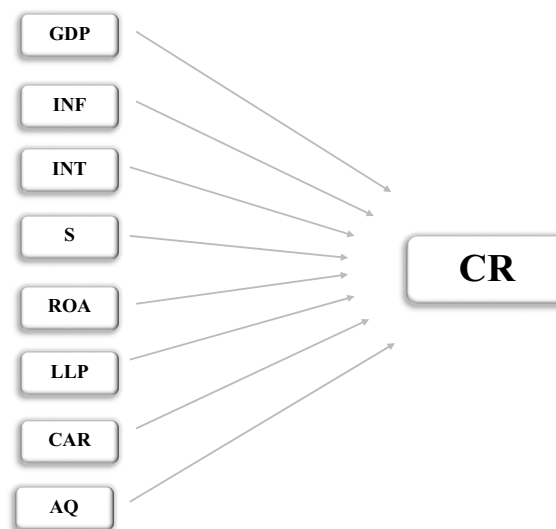


Fig. 1 Framework

Table 3 List of abbreviations

CR	Credit risk
INF	Inflation
GDP	Gross domestic product
INT	Growth in interest rate
S	Size of bank
ROA	Return on assets
LLP	Loan loss provisions
CAR	Capital adequacy ratio
AQ	Asset quality
OLS	Ordinary least square

credit risk of Islamic banking in Pakistan. The data have been interpreted through the use of statistical software, E-views. Furthermore, to ensure the reliability and validity of the data, various statistical techniques such as regression and descriptive analysis have been run from 2007 to 2021, fifteen (15) years of data, and several statistical tools have also been applied to the data to verify its credibility and for testing of hypothesis.

See Table 3.

Correlation analysis was used to analyze the correlations between variables and credit risk in this study. The result in Table 4 showed that INF had a correlation coefficient of -0.091 at the *p* value of 0.487 which indicates a relationship between INF and CR is negatively insignificant because the *p* value is greater than the level of the significant value of 0.05. GDP is positively insignificantly correlated with CR; the correlation coefficient and *p*

Table 4 Correlation analysis

Correlation									
Probability	CR	INF	GDP	INT	S	ROA	LLP	CAR	AQ
CR	1.000000	–							
INF	–0.091476	1.000000							
	0.4870	–							
GDP	0.161498	–0.466961	1.000000						
	0.2177	0.0002	–						
INT	–0.188933	0.657560	–0.436104	1.000000					
	0.1482	0.0000	0.0005	–					
S	–0.036144	–0.416725	0.804111	–0.382117	1.000000				
	0.7840	0.0009	0.0000	0.0026	–				
ROA	–0.149378	–0.197619	0.355543	–0.285409	0.627397	1.000000			
	0.2546	0.1301	0.0053	0.0271	0.0000	–			
LLP	0.852022	–0.232881							

value are 0.161 and 0.218. INT, S, ROA, and AQ are negatively insignificantly correlated with CR, whereas correlation coefficients of –0.189, –0.036, –0.149, and –0.07 at *p* values of 0.148, 0.784, 0.255, and 0.598, respectively. The relationship between LLP and CR is positively significant; with a correlation coefficient of 0.852 at the *p* value of 0.000. CAR is negatively significantly correlated with CR; the correlation coefficient and *p* value are –0.323 and 0.01, respectively.

In Table 5 shows the descriptive analysis of this study. There are 60 observations for each variable and the Total number of observations is 540. The Islamic banks in Pakistan had an average credit risk of 64.32% and the standard deviation (measure the dispersion of data from the mean) is 48.57% dispersed around the mean of credit risk. The average inflation of Pakistan is 9.09% whereas the standard derivation is 4.45% spread around the mean. The average GDP and growth in interest rate of Pakistan are 4.40 and 2.104 and standard derivation are 0.235 and

5.553, respectively. The average size of Islamic banks is 2.111 and the standard derivation is 0.505; dispersed around the mean. The average Return on assets, Loan loss provisions, Capital adequacy ratio, and Asset quality of Islamic banks of Pakistan are 0.39%, 4.38%, 16.92%, and 49.06%, respectively, whereas standard deviation are 0.90%, 3.35%, 7.37%, and 10.70%, respectively, dispersed around the mean. The median shows the middle value of all the variables, and the minimum and maximum values are also found for all the variables of the data.

The result of Table 6 shows that Ordinary Least Square (OLS) Regression Model is the most appropriate for this study because Cross-section *p* value is 0.6267 and Time *p* value is 0.5039 are greater than level of significant value 0.05, which means accept the null hypothesis and go for the Ordinary Least Square (OLS) Regression Model.

Table 7 shows the impact of independent variables (macroeconomic variables and bank-specific variables) on the dependent variable – Credit Risk by using

Table 5 Descriptive analysis

	CR	INF	GDP	INT	S	ROA	LLP	CAR	AQ
Mean	0.064317	0.090867	4.399933	2.104200	2.111283	0.003933	0.043800	0.169167	0.490583
Median	0.047000	0.095000	4.392000	0.961000	2.106500	0.004500	0.029000	0.149000	0.483000
Maximum	0.201000	0.203000	4.754000	22.00000	3.281000	0.026000	0.163000	0.500000	0.683000
Minimum	0.000000	0.025000	3.966000	–3.143000	0.951000	–0.029000	0.000000	0.102000	0.269000
SD	0.048568	0.044530	0.234788	5.552915	0.504636	0.008961	0.033510	0.073688	0.106961
Observations	60	60	60	60	60	60	60	60	60

Source: Research Data

Dependent variable: CR

Independent variables: INF, GDP, INT, S, ROA, LLP, CAR, & AQ

the Ordinary Square Least (OLS) Regression Model. R^2 (0.8605) indicates that the Credit risk (CR) of Islamic banks of Pakistan is nearly 86.05% dependent on independent variables (macroeconomic variables and bank-specific variables); Inflation (INF), Gross domestic product (GDP), Growth in interest rate (INT), Size of bank (S), Return on assets (ROA), Loan loss provisions (LLP), Capital adequacy ratio (CAR), and Asset quality (AQ). The adjusted R^2 is (0.8386) 83.86% which indicates that the measurements are appropriate, and the model is a good fit. F-statistics is 39.31 showing the combined effect of all independent variables on the dependent variable.

Prob(F-statistics) is 0.000 which is less than level of significant 0.05, indicates that the model is significant which means that the combine effect of all independent variables on dependent variable is significant or considerable.

Moreover, the beta values of independent variables; INF, GDP, INT, S, ROA, LLP, CAR, and AQ are 0.167, 0.046, -0.0014, -0.049, -0.532, 1.159, -0.181, and -0.037, respectively, which indicates that INF, GDP, and LLP have a positive relationship with Credit risk which means that INF, GDP, and LLP increase by one unit, CR also increases by 0.167, 0.046, and 1.159 units, respectively. INT, S, ROA, CAR, and AQ have a negative relationship with Credit risk which means INT, S, ROA, CAR, and AQ increase by one unit, CR decreases by -0.0014, -0.049, -0.532, -0.181, and -0.037, respectively. The p value of INF, GDP, INT, ROA, and AQ are 0.0548, 0.0792, 0.0514, 0.1825, and 0.3051, respectively, which is greater than the level of significant 0.05 means these independent variables; INF, GDP, INT, ROA, and AQ have a statistically insignificant or not considerable impact on the credit risk of Islamic bank of Pakistan. The p value of LLP is 0.000 which means LLP has a statistically strongly significant impact on the Credit risk of the Islamic bank of Pakistan. S and CAR p values are 0.0004 and 0.0014, respectively, and have also a statistically significant impact on the Credit risk of the Islamic bank of Pakistan.

Table 6 Breusch-Pagan test

	Test hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	0.236612 (0.6267)	0.446705 (0.5039)	0.683318 (0.4084)

Dependent variable: CR; Independent variables: INF, GDP, INT, S, ROA, LLP, CAR, & AQ

Table 7 Regression analysis

Variable	Coefficient	SE	t Statistic	Prob
INF	0.166846	0.084897	1.965280	0.0548
GDP	0.046106	0.025738	1.791361	0.0792
INT	-0.001376	0.000690	-1.994879	0.0514
S	-0.049355	0.012951	-3.810826	0.0004
ROA	-0.531948	0.393593	-1.351518	0.1825
LLP	1.158915	0.096575	12.00018	0.0000
CAR	-0.180670	0.053277	-3.391130	0.0014
AQ	-0.037120	0.035834	-1.035895	0.3051
C	-0.046506	0.081836	-0.568280	0.5723
R^2	0.860459	Mean depend- ent var	0.064317	
Adjusted R^2	0.838570	S.D. dependent var	0.048568	
S.E. of regression	0.019514	Akaike info criterion	-4.897901	
Sum squared resid	0.019420	Schwarz criterion	-4.583749	
Log likelihood	155.9370	Hannan-Quinn criter	-4.775019	
F-statistic	39.31044	Durbin-Watson stat	0.667959	
Prob(F-statistic)	0.000000			

Source: Research Data

Dependent variable: CR

Independent variables: INF, GDP, INT, S, ROA, LLP, CAR, AQ & C

In Table 8, the ANOVA results show that the p value is 0.000 which is less than the level of the significant value of 0.05, which means the relationship between the dependent variable Credit risk (CR) and the independent variables Inflation (INF), Gross domestic product (GDP), growth in interest rate (INT), Size of bank (S), Return on assets (ROA), Loan loss provisions (LLP), Capital adequacy ratio (CAR), AND Asset quality (AQ) is significant. Therefore, these variables jointly effectively predict credit risk.

Table 8 Anova analysis

Method	df	Value	Probability
Anova F-test	(8, 531)	40.16735	0.0000
Analysis of Variance			
Source of Variation	df	Sum of Sq. (SS)	Mean Sq. (MS)
Between	8	1112.799	139.0998
Within	531	1838.857	3.463007
Total	539	2951.655	5.476169

Dependent variable: CR

Independent variables: INF, GDP, INT, S, ROA, LLP, CAR, & AQ

Conclusion and recommendations

This study aims to investigate the influence of macroeconomic variables and bank-specific factors on the credit risk of Islamic banking in Pakistan, through the panel data regression tools. The statistical tool which is applied to the research is Ordinary Least Square (OLS) Regression Model. The secondary data have been taken from four (04) full-fledged Islamic banks in Pakistan, from 2007 to 2021. The focus of the research is to find the impact of macroeconomic variables like Gross domestic product, Inflation, and Growth in the interest rate and bank-specific factors like Size, Return on Assets, Loan loss provision, Capital Adequacy ratio, and Asset quality to determine the Credit risk (Non-Performing Loans) of Islamic banks in Pakistan. Furthermore, descriptive statistical techniques such as mean, median mode, and standard deviation were also used in this research data. Breusch-Pagan Test was used to check the most appropriate Regression Model for this study and the result concluded that Ordinary Least Square (OLS) Regression Model is most appropriate for this research. Anova analysis was also used to analyze whether the model is significant or insignificant and the result concluded that the combined effect of all independent variables on the dependent variable is significant or considerable. The data are interpreted through the statistical software, e-views and the proper application of statistical techniques like regression and descriptive analysis tools had been run from 2007 to 2021, fifteen (15) years of data and several statistical tools had been applied to the data to verify its credibility and for testing of hypothesis.

The result of Ordinary Least Square (OLS) Regression Model concluded that Loan loss provisions (LLP) has a positive and significant impact on Credit risk (CR) and Size of bank (S) and Capital adequacy ratio (CAR) have a negative and significant impact on Credit risk (CR) of Islamic Bank of Pakistan. LLP, S, and CAR are the important determinant of credit risk of Islamic bank of Pakistan. Furthermore, Inflation (INF) and Gross domestic product (GDP) have a positive and insignificant impact on Credit risk (CR) and Growth in interest rate (INT), Return on assets (ROA), and Asset quality (AQ) have a negative and insignificant impact on Credit risk (CR) of Islamic Bank of Pakistan. Surprisingly INF, GDP, INT, ROA, and AQ are not powerful independent variables to define the credit risk of Islamic banks of Pakistan.

This study recommends that Islamic banks should carefully examine their specific factors, i.e., LLP, S, and CAR to manage their credit risk, particularly in monitoring loans. Furthermore, the future researcher should explore other contributing factors of credit risk among Islamic banks in Pakistan to improve the credit risk management.

Supplementary materials

The Supplementary Materials can be found online at:

- i). Yearly Inflation Rate (%), <https://www.macrotrends.net/countries/PAK/pakistan/inflation-rate-cpi>
- ii). Yearly GDP, <https://www.macrotrends.net/countries/PAK/pakistan/gdp-gross-domestic-product#:~:text=Pakistan%20gdp%20for%202021%20was,a%204.99%25%20increase%20from%202017>
- iii). Yearly average exchange rate, <https://www.exchangerates.org.uk/USD-PKR-spot-exchange-rates-history-2021.html>
- iv). Yearly Interest Rate (%), <https://data.worldbank.org/indicator/FR.INR.RINR?locations=PK>
- v). Al Baraka bank, annually financial reports taken from mentioned link and then extracted relevant data from the financial reports according to the dataset during the study. <https://www.albaraka.com.pk/page/investor-relations/>
- vi). Bankislamic Pakistan Ltd, annually financial reports taken from mentioned link and then extracted relevant data from the financial reports according to the dataset during the study. <https://bankislami.com.pk/investor-relations/>
- vii). Dubai Islamic bank, annually financial reports taken from mentioned link and then extracted relevant data from the financial reports according to the dataset during the study. <https://www.dibpak.com/index.php/financials/>
- viii). Meezan bank Ltd, annually financial reports taken from mentioned link and then extracted relevant data from the financial reports according to the dataset during the study. <https://www.meezabank.com/financial-information/>

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Author contributions

FA contributed to the conceptualization, the design of the work, Material preparation, analysis, or interpretation of data, contributed to the use of statistical analysis in the work and helped in writing the original draft. NK and MA searched and contributed to collection of relevant articles, and reviewed and helped in writing the manuscript. MM supervised project and provided his valuable comments to develop the quality of research. All authors have read and approved the manuscript.

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Availability of data and materials

The original contributions presented in the study are included in the article/ Supplementary Materials. Further inquiries can be directed to the corresponding authors.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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