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Macro-Economic and Bank-Specific Determinants of Credit Risk in Commercial Banks

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Abstract

Inadequate credit risk assessment procedures may have a significant negative influence on a financial institution's operational performance, perhaps leading to liquidity concerns. It is hypothesized that different factors such as macroeconomic, and bank-specific factors affect the credit risk in financial institutions. The objective of this study is to check those factors responsible for credit risk. The data came from WDI and Bankscope databases. The data is balanced panel data of 106 private and state-owned commercial banks for 6 years (n=106, t=6). This study used Fixed Effect (FE), and Random Effect (RE) models. The results suggest that if inflation, interest rate, unemployment increase, the credit risk of commercial banks increases. The results also suggest that if GDP growth, efficiency, and bank size increase, the credit risk become minimized. Additionally, the credit risk is lower in private banks than in state-owned banks. The findings of this research, however, do not support the hypotheses that exchange rate and regulatory capitals influence credit risk.

Keyword: *Commercial bank Credit risk, Macroeconomy, Panel data.*

Introduction

With the recent spectacular growth in retail credit and increase in real-economy volatility, managing credit risk has become one of the most important concerns for modern financial institutions (Mays, 1998). This is the possibility of financial loss if the applicants fail to repay the credit. Financial institutions and banks are attempting to manage credit risk by assessing capital requirements based on the risk of applicants and decreasing default risk (De Servigny and Renault, 2004). Customers are expected to repay the principal and interest on a set date when financial institutions offer loans. When both principal and interest payments are current and in accordance with agreed-upon repayment terms, a credit facility is said to be performing (Bluhm, Overbeck and Wagner, 2016). Non-performing loans (NPLs) are credits that financial institutions consider to be at risk of losing money owing to loan defaults. They are further divided into three categories: substandard, suspect, and bad loans. Bank credit in the lost category prevents the bank from meeting its goals (Duffie and Singleton, 2012) (Lando, 2009).

In order for banks and other financial institutions (FIs) to survive and flourish, they must effectively manage credit risk. Because of the increased levels of perceived risks coming from some of the characteristics of customers and the business settings in which they find themselves, the problem of credit risk is of even greater concern to banks (Lopez and Saidenberg, 2000).

The primary source of revenue for banks is credit generation. However, both the lender and the borrower face significant risks as a result of this transaction. The danger of a trade partner failing to meet his or her contractual obligations on time or at all might undermine the smooth operation of a bank's operations (Altman and Saunders, 1997). A bank with a high credit risk, on the other hand, has a significant danger of insolvency, putting depositors at risk. Among the risks that banks face, credit risk is one that most bank authorities and banking regulators are concerned about (Wilson, 1997) (Tong, 2021). This is due to the fact that credit risk is a risk that may easily and often lead to bank collapse.

Despite the fact that bank failures and difficulties can be caused by a variety of factors, a common cause of serious bank difficulties has been linked to weak credit risk standards for clients and borrowers, poor credit risk management for credit portfolios, and a lack of awareness of changes in economic and other circumstances that lead to a deterioration in counterparty creditworthiness. Basel formed important tenets that banks and supervisors should consider in every process of credit risk

management and supervision in order to provide broad guidelines of sound credit risk management to bankers, practitioners, and supervisors all over the world.

Determinants of credit risk

a) GDP (Virolainen, 2004)

Bank risks arise from both the economic and business cycles. Due to the deteriorating commercial and economic circumstances during the recession, the bank will be riskier than before. During boom times, economic activity increases, and the amount of cash held by businesses and families increases as well. This situation might improve a borrower's repayment capabilities, lowering the bank's credit risk. The major measure of macroeconomic circumstances in most research is GDP growth rates. A drop in GDP growth rates may be interpreted as a fall in income and borrowers' capacity to service their debt. During favorable economic times, both borrowers and lenders feel confident in their investment and capacity to repay the loans.

b) Inflation (Carling *et al.*, 2007)

Another macroeconomic aspect that might have an influence on the bank's credit risk level is the rate of inflation. Inflation may degrade the value of money, lowering the bank's rate of return. In most cases, a high inflation rate will result in a high loan interest rate. Because inflation reduces the future value of money, it causes people to try to forecast inflation. Based on the forecast, banks will adjust their interest rate to compensate for the losses caused by inflation. If inflation is not anticipated, bank costs may rise faster than bank revenue, negatively impacting bank profitability.

c) Rate of Unemployment (Ali and Daly, 2010)

The unemployment rate is an important measure of economic circumstances. The unemployment issue will worsen if the quantity of jobs available in the labor market is inadequate to meet everyone's needs. During times of economic decline, a relatively high unemployment rate is usually seen at the same time. As the unemployment rate rises, indicating that the labor market is saturated, it is expected to have a negative influence on consumers' cash flow streams, reducing their capacity to repay their debts. Increases in unemployment suggest a decrease in output owing to a fall in effective demand, which might lead to a loss in revenues, which could lead to a poor debt situation.

d) Interest Rates (Ali and Daly, 2010) (Hackbarth, Miao and Morellec, 2006)

Because it influences the debt load, the interest rate might be considered another driver of a bank's credit risk. The interest rate's shifting and fluctuating value is significant to a bank's credit risk since it determines how difficult it is for borrowers to service their loan. A rise in interest rates will immediately raise the return on newly created or variable interest loans for borrowers, resulting in an increase in debt load; for banks, it will result in a high proportion of nonperforming loans. Higher interest rates, according to asymmetric information theories, will exacerbate the adverse selection problem, as some borrowers are still willing to pay the loan with a higher interest rate because they are privately aware that even with the high interest rate, it is still attractive with their poor credit quality.

e) Variation in the exchange rate (Lin, Farhani and Koo, 2016)

The volatility of the currency rate is one of the key factors for economic instability in emerging markets. The exchange rate has an impact on the borrower's capacity to repay the debts. The exchange rate expresses the value of one currency in terms of another. The key issue for businesses is the regular appreciation of foreign currencies against the local currency, as well as the difficulties in maintaining native clients as the cost of imported goods and services rises, affecting the cost of final products supplied locally. As the domestic price of the foreign exchange rate increases, acquiring foreign products and services becomes costlier, necessitating the use of more units of domestic currency to purchase the same amount of goods and services as previously. As a result, there is an increase in demand for bank credit to meet the higher cost caused by exchange rate depreciation, which reduces the firm's profitability. As a result of the decrease in profitability, the company is unable to service its debts' interest and principal.

f) The bank's ownership (Mays, 1998)

A considerable body of evidence suggests that the bank's ownership structure has a significant impact on its credit risk, particularly the nature of the link between the bank's ownership and its credit risk level. State-owned banks, on average, are expected to assume higher risks than private and international banks. Banks have less motivation to manage credit risk in the real world, particularly government banks. This is because state-owned banks think they would be bailed out by the

government if they go bankrupt, therefore they have less incentive to manage credit risk. From a societal standpoint, government intervention seeks to repair market failure caused by public banks. From a political standpoint, state-owned banks might be utilized to further politicians' personal interests. The third reason is that the author points out that state-owned banks are plagued by corruption and resource misallocation, according to the agency's perspective.

g) Size of the Bank (Altman and Saunders, 1997)

The loan quality may also be linked to the bank's diversity. Larger banks have a better control ability for credit risk than smaller banks because diversification can lower credit risk. Since large banks typically have a larger number of borrowers with a variety of businesses, diversification can lower unsystematic risk, according to Modern Portfolio Theory.

Bank credit risk may be efficiently reduced by diversifying revenue sources and lending portfolios, according to empirical research. First, engagement in non-credit risk-taking activities, such as payment transactions, broking, and so on, which may diversify revenue resources and enable banks to generate less hazardous income, thereby lowering incentives to fund speculative projects. Second, banks may limit the number of faulty loans by lending money to a diverse group of borrowers.

h) Regulation Capital (He and Xiong, 2012)

Higher capital requirements, according to popular perception, will lead to greater banking sector stability, which would ultimately lead to greater bank stability and lower risk levels. According to Basel I and II, banks must maintain a regulatory capital ratio of at least 8% of their total risk weighted assets in order to prevent bank failures and preserve depositors' funds.

It is commonly established in the literature that a low capital ratio is linked to a 40 percent chance of a bank failing, since it may encourage management to take on more riskier ventures. According to 'Moral Hazard' concept, low capitalization institutions result in a rise in non-performing loans, and managers of thinly capitalized banks have incentives to enhance the riskiness of their loan portfolio.

i) Bank Efficiency and Management Quality (Brown and Moles, 2014)

In the literature, the link between credit risk and bank efficiency is uncertain; there is no agreement. On the one hand, high cost efficiency indicators may indicate a reduction in resources given to the risk management process and borrowers' monitoring, resulting in a drop in loan quality. High cost efficiency will lead to an increase in the number of nonperforming loans. This is because a trade-off will exist between allocating resources for underwriting and monitoring loans and the measured cost efficiency, implying that banks will be more cost-efficient with less effort to ensure a higher loan quality. In the long term, this will result in a large number of non-performing loans.

Low cost efficiency, on the other hand, indicates a low level and quality of bank management, resulting in an increase in problem loans as a result of poor loan management. The "poor management" hypothesis states that low cost efficiency is associated with an increase in future non-performing loans. Poor management entails a lack of credit rating, collateral evaluation, and borrower monitoring abilities.

Hypotheses

Based on the determinants discussed above, the following research hypotheses are formulated:

Hypothesis: The size of a bank and its credit risk have a negative connection.

Hypothesis: Commercial bank credit risk is inversely proportional to regulatory capital.

Hypothesis: The credit risk of commercial banks is positively linked to bank management efficiency.

Hypothesis: The pace of real GDP growth is adversely connected to the credit risk of commercial banks.

Hypothesis: Inflatithesion is inversely proportional to the credit risk of commercial banks.

Hypothesis: The exchange rate and the credit risk of a bank have a considerable negative connection.

Hypothesis: The unemployment rate is inversely proportional to the credit risk of the bank.

Hypothesis: The interest rate is connected to the bank's credit risk in a positive way.

Hypothesis: The state-owned banks are expected to take on higher risks than other types of commercial banks.

Methodology

$$Risk_{it} = \alpha_{it} + \beta_1 SIZE_{it} + \beta_2 REG_{it} + \beta_3 LOSS_{it} + \beta_4 EFFICIENCY_{it} + \beta_5 GDP_t + \beta_6 INF_t + \beta_7 EX_t + B_7 UNEMP_t + \beta_8 INTEREST_t + \beta_9 OWNER_{it} + \varepsilon_{it}$$

	Symbols	Description
1	α	Intercept
2	$B_{1...9}$	Slope coefficients
3	SIZE	Total Assets
4	REG	Total Regulatory Capital Ratio
5	LOSS	Loan Loss Provision to Total Loans Ratio
6	EFFICIENCY	Return On Average Total Assets
7	GDP	GDP growth rate
8	INF	Inflation rate
9	EX	Exchange Rate
10	UNEMP	Unemployment Rate
11	INTEREST	Lending Interest Rate
12	OWNER	1 if state-owned banks, 0 otherwise
13	ε	

Panel data approaches are used to achieve the study's goal. If we have access to a panel of data, there are significant advantages to fully using this rich structure (Chen, 2021). To begin with, and probably most crucially, panel data enables us to address a wider range of concerns and solve more difficult problems than time series or cross-sectional data alone. Second, analyzing the dynamic changes in variables or their interactions is typically intriguing (over time). When working with pure time series data, it's frequently necessary to run the data for a long time to gather enough observations to do any significant hypothesis testing (Torres-Reyna, 2007) (Garcia, 2021). However, by combining cross-sectional and time-series data, one may improve the degree of freedom and therefore the test's strength by simultaneously include information on the dynamic behavior of a large number of entities. Furthermore, the additional variance produced by this technique may assist in alleviating multicollinearity difficulties that may develop when time series are simulated individually. Third, as demonstrated below, by appropriately designing the model, it is possible to eliminate the impact of certain types of missing variables on regression findings.

In empirical research, panel estimator approaches are divided into two categories: fixed effects (FE) models and random effects (RE) models (Torres-Reyna, 2007). Fixed effects models in their most

basic versions allow for cross-sectional but not longitudinal change in the intercept, but all slope estimates are fixed cross-sectionally and longitudinally. While this approach is undoubtedly more sparing than SUR models (which demand the estimation of (N + k) parameters), it nonetheless necessitates their estimation (Torres-Reyna, 2007). (Bell and Jones, 2015).

The fixed-effect paradigm posits that the true effect size is consistent across studies and that sampling error is the only cause of variation in effect size (error in estimating the effect size). As a result, while balancing the various research, information from smaller studies may be effectively discarded if we have more information on the same impact size from larger studies.

The random-effects model, on the other hand, aims to estimate the mean of a range of impacts rather than a single observable impact. Because each study reports a different impact size, it is vital to double-check that the summary estimate includes all of these effect sizes.

Results

The tables below display the estimated results for our models. It can be observed that all the variables except exchange rates and regulatory capital have significant effects on banks' credit risk. Inflation, interest rates, and unemployment rates have significant positive impacts on credit risk. This means that if theses variables increase, the credit risk of commercial banks also increases. On the other hand, the bank efficiency, size of the bank and GDP growth rate have significant negative effect on credit risk. This implies that the credit risk decreases in good economic conditions. The dummy variable 'owner' has also negative impact on credit risk. This suggest that if he bank is private the credit risk is minimized and that state-owned banks face a greater credit risk. The residuals graph has also anomaly. Additionally, the confidence intervals of all the variables are reported.

Substituted Coefficients:
==========
RISK = -0.986864814339*EFFICIENCY + 0.999754954402*INF + 1.00428162389*INTEREST-
0.992631353854*OWNER - 0.998160715064*SIZE + 1.0055657878*UNEMP - 1.01453900554*GDP +
0.010511300432*EXG - 0.0101543652862*REG + 0.48763152997

Dependent Variable: RISK
Method: Panel Least Squares
Sample: 2014 2019
Periods included: 6

Cross-sections included: 106
Total panel (balanced) observations: 636

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EFFICIENCY	-0.987271	0.012659	-77.99052	0.0000
INF	1.001967	0.012970	77.25204	0.0000
INTEREST	1.009911	0.012590	80.21258	0.0000
OWNER	-0.990080	0.024733	-40.03109	0.0000
SIZE	-1.001178	0.012453	-80.39821	0.0000
UNEMP	1.005655	0.013125	76.62140	0.0000
GDP	-1.015674	0.013084	-77.62436	0.0000
EXG	0.014191	0.013631	1.041078	0.2983
REG	-0.005583	0.013032	-0.428405	0.6685
C	0.485894	0.017281	28.11677	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.990242	Mean dependent var	0.089114
Adjusted R-squared	0.988084	S.D. dependent var	2.657258
S.E. of regression	0.290070	Akaike info criterion	0.526019
Sum squared resid	43.75303	Schwarz criterion	1.338603
Log likelihood	-51.27413	Hannan-Quinn criter.	0.841512
F-statistic	458.8597	Durbin-Watson stat	2.471768
Prob(F-statistic)	0.000000		

Dependent Variable: RISK
Method: Panel EGLS (Cross-section random effects)
Date: 12/02/21 Time: 09:10
Sample: 2014 2019
Periods included: 6
Cross-sections included: 106
Total panel (balanced) observations: 636
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EFFICIENCY	-0.986869	0.011413	-86.47196	0.0000
INF	0.999769	0.011885	84.11698	0.0000
INTEREST	1.004320	0.011561	86.87345	0.0000
OWNER	-0.992613	0.023200	-42.78568	0.0000
SIZE	-0.998182	0.011519	-86.65532	0.0000
UNEMP	1.005565	0.011893	84.54778	0.0000
GDP	-1.014548	0.011927	-85.06385	0.0000
EXG	0.010537	0.012365	0.852163	0.3945
REG	-0.010124	0.011774	-0.859854	0.3902
C	0.487619	0.016719	29.16521	0.0000

Effects Specification

	S.D.	Rho
Cross-section random	0.010790	0.0014

Idiosyncratic random		0.290070	0.9986

Weighted Statistics

R-squared	0.988347	Mean dependent var	0.088746
Adjusted R-squared	0.988161	S.D. dependent var	2.655466
S.E. of regression	0.288934	Sum squared resid	52.17686
F-statistic	5301.111	Durbin-Watson stat	2.076064
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.988348	Mean dependent var	0.089114
Sum squared resid	52.24625	Durbin-Watson stat	2.073307

Dependent Variable: RISK
Method: Panel Least Squares

Sample: 2014 2019
Periods included: 6
Cross-sections included: 106
Total panel (balanced) observations: 636

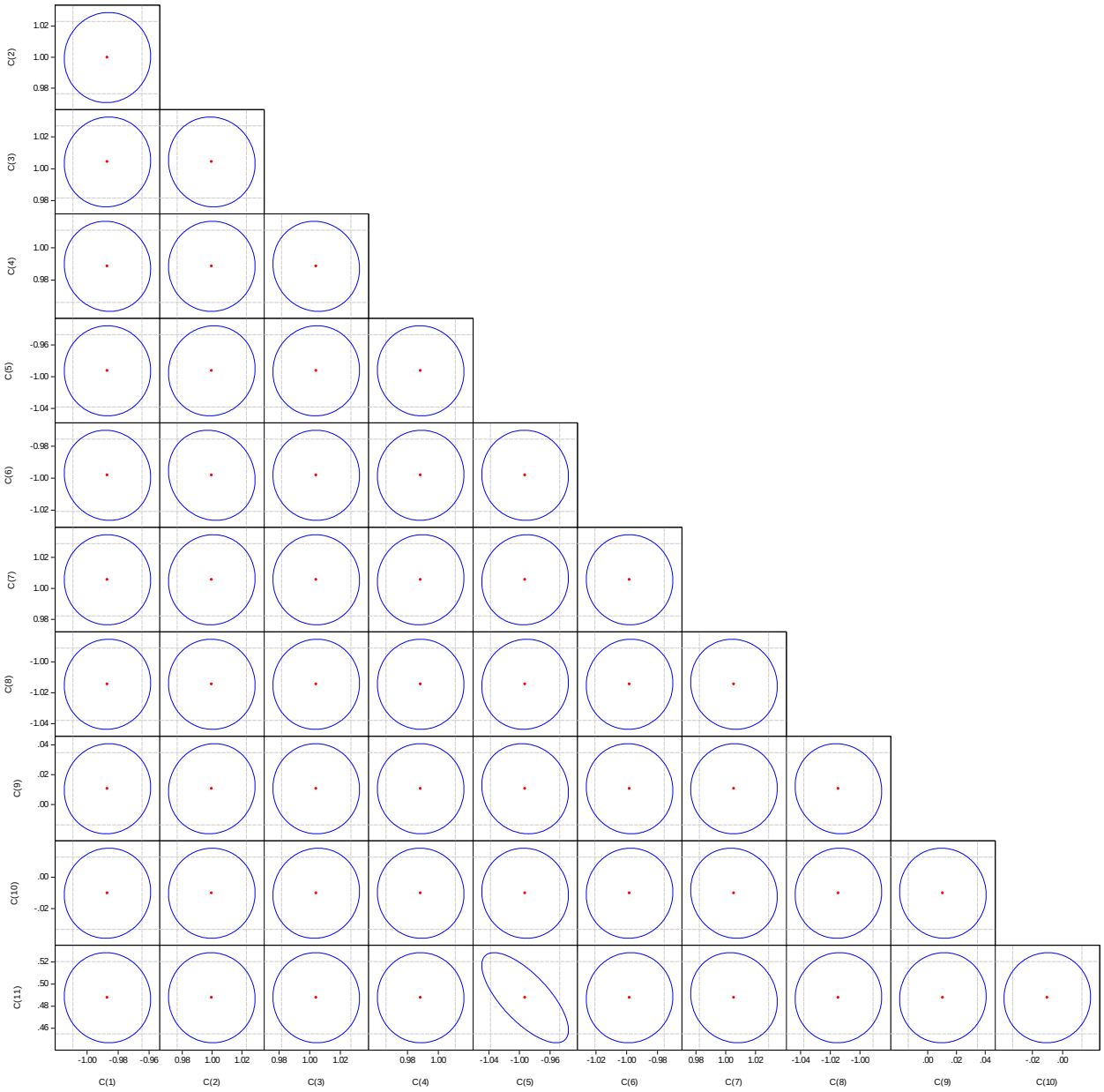
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EFFICIENCY	-0.986865	0.011367	-86.81917	0.0000
INF	0.999755	0.011839	84.44584	0.0000
INTEREST	1.004282	0.011516	87.20894	0.0000
LOSS	0.988563	0.011377	86.88839	0.0000
OWNER	-0.992631	0.023113	-42.94736	0.0000
SIZE	-0.998161	0.011475	-86.98784	0.0000
UNEMP	1.005566	0.011846	84.88603	0.0000
GDP	-1.014539	0.011880	-85.39988	0.0000
EXG	0.010511	0.012316	0.853483	0.3937
REG	-0.010154	0.011727	-0.865899	0.3869
C	0.487632	0.016628	29.32647	0.0000

R-squared	0.988348	Mean dependent var	0.089114
Adjusted R-squared	0.988161	S.D. dependent var	2.657258
S.E. of regression	0.289126	Akaike info criterion	0.373238
Sum squared resid	52.24624	Schwarz criterion	0.450293
Log likelihood	-107.6896	Hannan-Quinn criter.	0.403155
F-statistic	5301.221	Durbin-Watson stat	2.073352
Prob(F-statistic)	0.000000		

Coefficient Confidence Intervals

Sample: 2014 2019
Included observations: 636

Variable	Coefficient	90% CI		95% CI		99% CI	
		Low	High	Low	High	Low	High
EFFICIENCY	-0.986865	-1.005589	-0.968140	-1.009187	-0.964543	-1.016234	-0.957496
INF	0.999755	0.980253	1.019257	0.976506	1.023004	0.969166	1.030344
INTEREST	1.004282	0.985312	1.023252	0.981667	1.026896	0.974528	1.034035
LOSS	0.988563	0.969821	1.007305	0.966221	1.010906	0.959167	1.017959
OWNER	-0.992631	-1.030705	-0.954558	-1.038019	-0.947243	-1.052348	-0.932915
SIZE	-0.998161	-1.017063	-0.979258	-1.020694	-0.975627	-1.027808	-0.968513
UNEMP	1.005566	0.986052	1.025080	0.982303	1.028829	0.974959	1.036173
GDP	-1.014539	-1.034109	-0.994969	-1.037868	-0.991210	-1.045233	-0.983845
EXG	0.010511	-0.009776	0.030799	-0.013674	0.034697	-0.021309	0.042332
REG	-0.010154	-0.029472	0.009163	-0.033183	0.012875	-0.040454	0.020145
C	0.487632	0.460241	0.515022	0.454979	0.520284	0.444670	0.530593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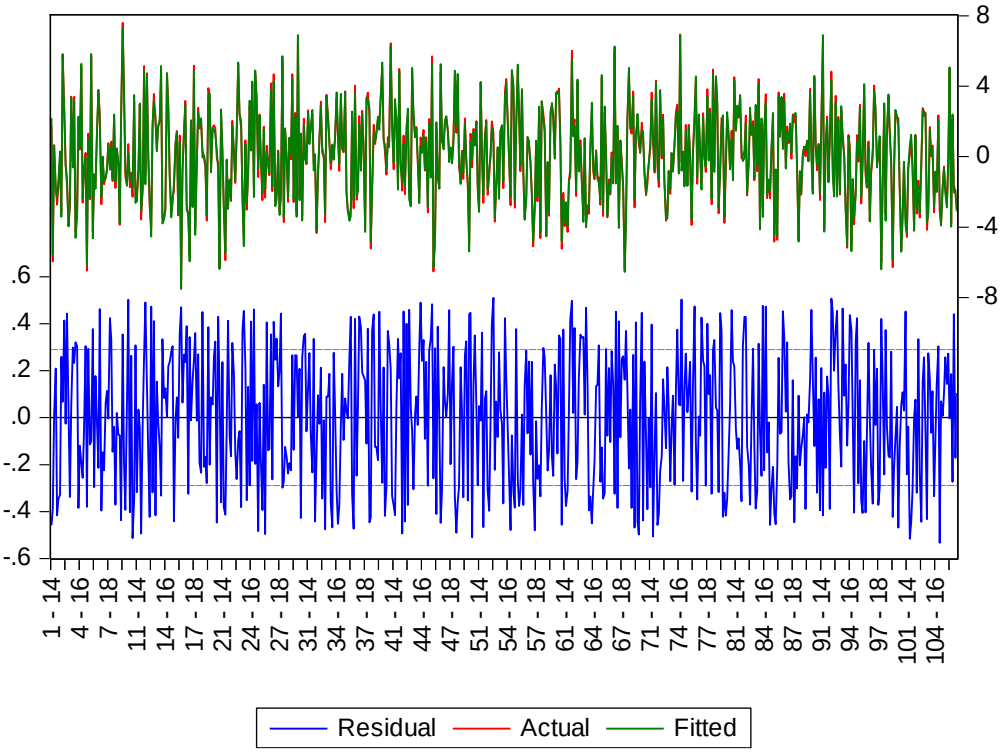

Conclusion

Many financial institutions have difficulty managing the wide range of risks and circumstances that might affect them. This is especially true in the sphere of credit risk, where banks often fail to comprehend the risks connected with a specific loan or investment, as well as the overall levels of credit risk in their portfolios. Credit risk is by far the most significant financial risk exposure for many financial firms. The goal of risk management is to limit the consequences of various types of hazards in a predetermined area to a level that society accepts. It may relate to a wide range of risks posed by the environment, technology, people, organizations, and politics. On the other side, it encompasses all human or, more specifically, risk management entity resources (person, staff, organization). Using WDI and Bankscope data, this study attempted to investigate the determinants of credit risk in 106 commercial banks worldwide. All variables, with the exception of currency rates and regulatory capital, have a major impact on banks' credit risk. Credit risk is significantly influenced by inflation, interest rates, and unemployment rates. This means that as these variables rise, commercial banks' credit risk rises as well. Bank efficiency, bank size, and GDP growth rate, on the other hand, have a strong negative impact on credit risk. This means that in strong economic times, credit risk decreases. Credit risk is also influenced by the dummy variable owner. This suggests that a private bank's credit risk is lower, whereas state-owned banks have a higher credit risk.

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