The Economics and Finance Letters
2025 Vol. 12, No. 4, pp. 743-756
ISSN(e): 2312-430X
ISSN(p): 2312-6310
DOI: 10.18488/29.v12i4.4618

Determinants of credit risk in lower-middle-income countries: Evidence from interest spread, efficiency, and macroeconomic factors

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Article History
Received: 23 July 2025
Revised: 6 November 2025
Accepted: 3 December 2025
Published: 24 December 2025

Keywords
Bank competition
Efficiency
Intermediation costs
Macroeconomic condition
Panel model.

JEL Classification:
G21; E43; O16.

ABSTRACT

The study examines the influence of interest rate spread, efficiency, and macroeconomic factors on credit risk by analyzing a sample of lower-middle-income countries (LMICs) worldwide. It utilizes secondary data from 25 LMICs over the period 2000-2021 and employs the Pooled Ordinary Least Squares (POLS), Fixed-Effect (FE), and Random-Effect (RE) estimators. The baseline model indicates that the interest spread increases credit risk in LMICs. This finding is supported by sensitivity analysis. Additionally, the results reveal that inefficient banks produce higher non-performing loans (NPLs) in LMICs. Conversely, an increase in the capital ratio reduces NPLs, a result confirmed by sensitivity analysis. The presence of excess liquidity and minimal competition contribute to the rise of NPLs in LMICs, with further validation from the consistency check. Economic growth is associated with a reduction in credit risk faced by banks in LMICs. The relationship between inflation and credit risk remains inconclusive. Policymakers and regulators can utilize these findings to implement effective corrective measures before banks become insolvent due to high NPLs, thereby protecting banks from bankruptcy and safeguarding the real economy from shocks.

Contribution/Originality: This research provides new evidence to the field of credit risk analysis by examining the relationship between interest rate spreads and credit risk in lower-middle-income countries. This area has received limited attention in previous studies and can address a gap in the existing literature.

1. INTRODUCTION

The nonperforming loan (NPL) is a metric used for assessing the loan quality of banks and financial institutions. The higher level of NPL can be the outcome of a higher spread rate, operating inefficiency, excess capital, high liquidity, more concentration, and economic downturns. From one standpoint, it is believed that inefficient banks impose higher interest spreads on borrowers and cover the higher operating expenses to maintain the desired level of profit. Similarly, inefficient banks hold excess capital and liquidity, which increase operating costs and impose a higher spread to shift their operating costs to borrowers (Islam & Nishiyama, 2016; Rahman, Zheng, Ashraf, & Rahman, 2018). The higher-level NPL can reduce both liquidity and capital due to lower net income (Afroj, Dutta, & Farjana, 2024). Banks can charge a high spread because efficient banks can obtain deposits at lower interest rates and lend at higher rates, which widens the interest spread. The high-interest spread increases borrowers' cost of funds, decreases the debt service capacity of borrowers, and can increase the NPL of banks (Ahmed, Majeed, Thalassinos, & Thalassinos, 2021). Similarly, a high-interest spread increases the cost of capital, and many feasible projects turn

infeasible, which reduces loan demand, and banks can increase the interest spread to achieve the desired profit through collusive behavior.

Efficient banks can offer a comprehensive menu of banking services at a more competitive price, thereby stimulating profitability. The higher operating cost is linked with high net interest margin (NIM) and non-performing loans (NPL) (Aysen, 2013; Karim, Chan, & Hassan, 2010). Similarly, NPL is associated with bank efficiency, indicating that a higher NPL erodes bank efficiency (Phung, Van Vu, & Tran, 2022). In addition, the Bad Management Hypothesis (BMH) asserts that inefficient banks impose higher interest margins on borrowers and shift their operating costs to borrowers, which can help maintain the desired level of profitability. However, a high-interest margin can lead to an increase in the NPLs of banks. Conversely, the Skimping Hypothesis (SH) states that banks can reduce operating costs by cutting expenses on credit evaluation, monitoring, and control in the short run, which can lower loan quality and thus lead to increased NPLs (Berger & DeYoung, 1997).

On the one hand, a higher level of bank capital brings financial stability and efficiency. It attracts more deposits because depositors put their funds in a safer bank at a lower interest rate. However, holding more equity capital raises banks' cost of funds and increases NIM (Angori, Aristei, & Gallo, 2019). Therefore, banks can invest in risky lending portfolios to get high returns (Ananou, Chronopoulos, Tarazi, & Wilson, 2022; Haq, Srivastava, & Wang, 2025; Osei-Assibey & Asenso, 2015) which can increase the NPL of banks. The excess capital, on the other hand, reduces banks' deposit rates because depositors are satisfied with lower interest rates from a safer bank. The bank lending rate primarily depends upon the deposit rate. If a bank can obtain deposits at a comparable lower rate, then it can lend to borrowers at a lower rate and vice versa. This lower lending rate can increase borrowers' debt service capacity and, thus, result in a reduction in the NPL of banks. In this regard, utilizing fixed- and random-effects, and system GMM, the study by Akhter (2023) confirmed that a capital ratio reduces NPL.

Holding excess liquidity, on the one hand, increases the opportunity cost because liquid assets, including required reserves, earn minimal returns, and banks invest in risky loan portfolios, which charge excess risk premiums to obtain the desired profit. However, risky loans can result in higher NPLs for banks. On the other hand, holding excess liquidity can reduce banks' lending (Hsieh & Lee, 2020). Consequently, banks can grant loans to selected creditworthy borrowers, leading to a decrease in the NPL of banks.

On the one hand, it is expected that an increase in bank competition will increase the capital ratio and lend at a lower interest rate, which will enhance borrowers' debt-paying capability and thus lead to a decrease in default risk (Soedarmono, Machrouh, & Tarazi, 2013). Furthermore, a competitive banking system produces lower operating costs and can lend loans and advances at a lower rate to its valued borrowers, which can result in lower NPL. On the other hand, the decrease in market power can increase NPL because banks relax their credit standards in a more competitive banking system.

The effect of macroeconomic factors on NPL is inconclusive in the empirical literature. The Bad Luck Hypothesis (BLH) asserts that unintended external shocks, such as economic downturns (for instance, higher inflation rates and lower economic growth), increase NPLs. Recovering past-due loans (delinquent loans) requires more managerial efforts and costs, which accelerate operating costs and stimulate cost inefficiency (Gulati, Goswami, & Kumar, 2019). However, in some previous studies, for instance, Gulati et al. (2019) argued that inflation could decrease NPL by reducing the real value of borrowing and improving the debt service capacity of the borrowers if employers adjust their wages based on the inflation rate. However, some empirical studies cast doubt on the impact of inflation on NPL. For instance, Koju, Abbas, and Wang (2018) found that economic growth has reduced NPL in high- and low-income economies. However, its effect is insignificant in middle-income economies. Similarly, inflation reduces NPL in high- and middle-income economies but increases NPL in low-income economies. Similarly, Golitsis, Khudoykulov, and Palanov (2022) explored the determinants of NPLs using a sample of banks in North Macedonia for the period 2005-2022. Utilizing the ARDL estimator, the results demonstrated that an increase in GDP growth reduces NPLs in both the short and long run. Nasim, Nasir, and Downing (2024) stated that "economic uncertainty" brings credit risk to

banks because banks usually respond to this uncertainty by increasing loan rates and postponing loan granting and renewals, which can reduce borrowers' cash flows and decrease debt service capacity, thus contributing to a rise in NPLs of banks. In addition, higher inflation can decrease borrowers' profits if expenses increase more rapidly than revenue, thereby reducing their debt-paying capacity and increasing NPLs.

Understanding the significant factors that influence credit risk is pivotal because NPLs can reduce profitability, and banks can increase lending rates to offset losses arising from bad loans. In addition, banks can follow a strict credit policy, which reduces the flow of credit in the financial system. Thus, NPLs directly impact banks' performance and indirectly affect the real economy. Furthermore, the role of banks in financial stability is much more important in a bank-driven economy than in a market-driven economy. Therefore, this study examines the major determinants such as interest spread, cost efficiency, liquidity, capital, competition, and macroeconomic factors that affect NPLs in LMICs. In particular, this research offers novel perspectives on the influence of interest spread on NPLs in LMICs, which is found to be understudied in empirical studies and fills a research void.

The outline of the remaining parts of this research is as follows. Section two reviews both theories and empirical studies. Section three describes the method employed; sections four, five, and six present the results, discussion, and conclusion, respectively.

2. REVIEW OF LITERATURE

This section explains the theoretical and empirical reviews and develops the hypotheses.

2.1. Theoretical Review

This study examines the Bad Management Hypothesis (BMH), Skimping Hypothesis (SH), Moral Hazard Hypothesis (MHH), and Bad Luck Hypothesis (BLH) as proposed by Berger and DeYoung (1997). The BMH indicates that banks with inefficiencies impose a greater interest spread to sustain similar profitability levels, attributed to elevated operating costs. Moreover, an increased interest spread diminishes borrowers' ability to repay loans and may lead to a rise in NPLs for banks. Consequently, BMH anticipates that an elevated interest spread will lead to an increase in the NPLs of banks. In a similar vein, BMH indicates that elevated operating costs stemming from inefficiency result in increased expenses, as ineffective managers lack the necessary skills to manage costs effectively due to their inadequate expertise in areas such as credit scoring, loan underwriting, monitoring, and control (Berger & DeYoung, 1997). The empirical studies by Podpiera and Weill (2008) and Crespi and Aliano (2017) supported the BMH, stating that inefficiency leads to an increase in NPL. Consequently, BMH anticipates that reduced cost-efficiency will result in an increase in NPLs for banks. On the other hand, SH indicates that banks incur lower expenses on loan screening and monitoring, appearing more cost-efficient in the short term. However, this approach leads to a deterioration in loan quality and an increase in NPLs over the long term. Therefore, this shareholder anticipates that reduced operating expenses (greater efficiency) in the short term will lead to an increase in NPLs in the long run.

The BMH indicates that when the bank manager decides to reduce liquidity by raising the credit-to-deposit ratio, there is a potential for an increase in the banks' NPLs. Therefore, this hypothesis anticipates that an elevated credit-to-deposit ratio (indicating a reduced level of liquidity) results in an increase in the NPLs of banks. Furthermore, BMH indicates that banks' operating costs will rise if they maintain higher liquidity (Chen, Tsai, Chen, Lin, & Li, 2025), which consequently leads to a reduction in net profits. To sustain profitability, banks engage in high-risk lending practices, leading to an increase in NPLs. In a similar vein, banks might concentrate their investments on a limited number of clients and exercise less caution in lending when competition is minimal, which can increase NPLs. The MHH indicates that financial institutions tend to participate in riskier lending practices when they maintain lower capital levels, resulting in a rise in NPLs. In a related context, BLH indicates that banks with higher concentration tend to lend in riskier sectors, and if external factors like an economic downturn occur, the banks' NPLs

can rise significantly. Ultimately, BLH indicates that during periods of economic downturn, characterized by rising inflation and declining growth, banks experience an increase in NPLs due to adverse circumstances.

2.2. Empirical Review

This section describes the more recent previous findings on the link between predictor and response variables and develops research hypotheses.

2.2.1. Interest Spread and NPL

The empirical studies yielded inconclusive findings regarding the influence of interest spread on credit risk, ranging from positive to negative. For instance, Das Gupta, Sarker, and Rifat Rahman (2021) examined how interest spread, risk, and efficiency influence NPL relying on observations from Bangladesh banks for the period 2000-2016. Applying the GMM estimator, the outcome demonstrated that interest spread reduces credit risk. This implies that a rise in interest spread erodes the debt service capacity of borrowers, and banks focus on lending to creditworthy borrowers, which reduces NPL. Erdas and Ezanoglu (2022) investigated the influence of banks' internal factors on NPLs using a sample of G20 countries for the period 1998-2017. Utilizing the GMM system, the results demonstrated that NIM hurts NPLs in G20 nations. This suggests that profitable banks can effectively manage credit risk by allocating more resources to borrowers' screening, loan monitoring, and follow-up with borrowers, as well as the costs associated with legal processes resulting from defaulted loans. Similarly, Shaheen, Ameer Uddin Khan, Baig, and Muzammil (2024) investigated the factors contributing to default risk, drawing on a sample of Islamic banks in Pakistan for the period 2007-2021. The outcome of the OLS estimator reveals that an increase in interest rate decreases NPLs. This outcome implies that an increase in the interest rate directly boosts the cost of deposits, and bank managers need to make prudent lending, which facilitates the efficient allocation of bank resources and thereby decreases NPLs.

Conversely, Zheng, Bhowmik, and Sarker (2019) examined the impact of various determinants on NPL using a sample of Bangladeshi banks for the period 1979-2018. The results demonstrated that higher lending rates imposed by banks on borrowers stimulate the NPLs in Bangladesh. This depicts that a higher lending rate simultaneously decreases borrowers' debt service capability and boosts banks' exposure to defaulted loans. Cetinkaya (2019) examined the factors of default risk by deploying a sample of Turkish banks for the period 2014-2017. Utilizing panel data estimators, the results showed that a rise in NIM would also increase banks' credit risk. Antony and Suresh (2023) investigated the factors contributing to default risk using a sample of 31 banks for the period 2012-2021. Using POLS, FE, and RE estimators, the results showed that NIM has an insignificant adverse impact on NPL. However, it turned out to be positive (significant) when using another measure, the loan loss provision, as a default risk measure. This study set the following first hypothesis based on theoretical and more recent empirical findings.

H_1: Interest spread increases NPL.

2.2.2. Overhead Costs and NPL

Overhead cost can have either a positive or a negative impact on default risk. For instance, Podpiera and Weill (2008) tested the "bad luck or bad management" drawing on a sample of transition countries over the period 1990-2000. Utilizing system GMM, the outcome supported the BMH and concluded that inefficiency prevails in banks, accelerating NPLs and increasing the risk of bank collapse in transition economies. Similarly, Ghosh, Kamarudin, and Kharuddin (2025) investigated how governance influences NPLs working with a sample of 133 countries, including LMIC, UMIC, and HIV, over the period 2010-2021. Utilizing the PCSE estimator, the results concluded that inefficiency has a positive influence on NPLs. Muhammed, Desalegn, Fekete-Farkas, and Bruder (2023) examined the influence of various determinants on credit risk, using a sample of Ethiopian banks covering the period from 2010 to 2019. Utilizing the FE estimator, the outcome demonstrated that less efficient banks produce higher NPLs in

Ethiopian banks. This implies that efficient banks can minimize operating costs and focus on less risky lending practices, which in turn can lower NPLs.

Utilizing the GMM system, Erdas and Ezanoglu (2022) investigated the factors of NPL using a sample of G20 countries for the period 1998-2017, and surprisingly, the outcome demonstrated that inefficiency decreases NPL in G20 nations. Similarly, Antony and Suresh (2023) investigated the factors of default risk and found that the increase in the operating expenses ratio reduces NPL. This indicates that banks allocate more resources to borrower screening, loan monitoring, information collection, and follow-up, thereby reducing their NPL. This study set the following second hypothesis based on theoretical and more recent empirical findings.

H_2: Cost efficiency decreases NPL.

2.2.3. Capital Ratio and NPL

The earlier studies demonstrated inconclusive results on the nexus between capital ratio and default risk. For instance, Erdas and Ezanoglu (2022) investigated the banks' internal factors that impact NPLs, drawing a sample of G20 countries for the period 1998-2017, and the results demonstrated that the increase in capital ratio positively influences NPLs in G20 nations. Alnabulsi, Kozarević, and Hakimi (2022) examined the factors that affect NPL, utilizing a sample of MENA banks over the period 2005-2020. The outcome demonstrated that the capital ratio reduces NPL. This indicates that management makes better lending decisions when the capital ratio is high. Shaheen et al. (2024) investigated the factors contributing to default risk and found that the capital adequacy ratio negatively affects NPLs.

Conversely, Cetinkaya (2019) examined the factors affecting default risk, and the results showed that higher bank capital stimulates the credit risk. Similarly, Ghosh et al. (2025) investigated how governance influences NPL, drawing a sample of 133 countries, including LMIC, UMIC, and HIC, over the period 2010-2021. Utilizing the PCSE estimator, the results concluded that capital has an insignificant impact on NPL. This study set the following third hypothesis based on theoretical and more recent empirical findings.

H_3: A higher Capital ratio decreases NPL.

2.2.4. Liquidity and NPL

Liquidity can have either a positive or a negative impact on default risk. For example, Zheng et al. (2019) investigated the determinants of NPL by analyzing data from Bangladeshi banks spanning the years 1979 to 2018. Utilizing ARDL and VECM estimators, the study found that increased liquidity is associated with higher levels of NPL in Bangladesh. This indicates that if banks hold a large amount of liquidity, then it decreases operating inefficiency and erodes the bank's profit. To achieve the same level of profit, banks lend to riskier clients, which increases NPLs in the banking sector. The findings also revealed that the deposit rate affects NPLs.

Conversely, Erdas and Ezanoglu (2022) investigated how the banks' internal factors influence NPLs, drawing a sample of G20 countries for the period 1998-2017. Utilizing the GMM system, the outcome demonstrated that the credit-to-deposit ratio (liquidity ratio) increases NPLs in G20 nations. This shows that holding a lower level of liquidity increases banks' default risk in G20 nations. Cetinkaya (2019) examined the factors influencing default risk employing a sample of Turkish banks for the period 2014-2017. Utilizing panel data estimators, the outcome showed that an increase in liquidity would decrease banks' credit risk. This study set the following fourth hypothesis based on theoretical and more recent empirical findings.

H_4: A higher liquidity ratio increases NPL.

2.2.5. Bank Concentration and NPL

The earlier studies yielded inconclusive findings, indicating that bank concentration has either a positive or a negative impact on default risk. For instance, Gulati et al. (2019) evaluated the factors of default risk by taking a

sample of Indian banks for the period 1998/99-2013/14, and the outcome demonstrated that low competition boosts NPLs in Indian banks. This outcome supports the "concentration-fragility hypothesis," which states that banks facing less competition charge higher interest rates and misuse their market power to engage in risky lending, resulting in increased NPLs in Indian banks. Similarly, Alnabulsi et al. (2022) examined the factors of NPL, and the results concluded that bank concentration hurts NPL. This implies that banks can avoid engaging in risky lending practices in a more concentrated banking system, which reduces NPL. Conversely, Das Gupta et al. (2021) examined the influence of interest spread, risk, and efficiency on NPL, and the results concluded that increased competition also increases default risk and efficiency; however, it reduces the interest spread. This study set the following fifth hypothesis based on theoretical and more recent empirical findings.

H_5: A higher bank concentration ratio increases NPL.

2.2.6. GDP Growth and NPL

The earlier empirical evidence showed that economic growth can have either a positive or a negative impact on default risk. For instance, Koju et al. (2018) examined the impact of macroeconomic conditions on NPL, drawing a sample of high-, middle-, and low-income economies, and results demonstrated that economic growth can reduce banks' NPL in high- and low-income economies. This finding implies that economic prosperity stimulates borrowers' debt-repaying ability and thus can decrease banks' NPL.

However, the outcome exhibited that economic growth did not affect NPL in middle-income economies. Similarly, Ghosh et al. (2025) examined the influence of governance on NPL, drawing on a sample of 133 countries, including LMIC, UMIC, and HIC, over the period 2010-2021. Utilizing the PCSE estimator, the results concluded that a rise in economic growth diminishes the NPL of banks in HICs, UMICs, and LMICs. Erdas and Ezanoglu (2022) examined how banks' internal factors influence NPLs, using a sample of G20 countries for the period 1998-2017. Utilizing the GMM system, the outcome demonstrated that GDP growth reduces NPLs in G20 nations.

Conversely, Cetinkaya (2019) examined the factors contributing to default risk, drawing a sample of Turkish banks for the period 2014-2017. Utilizing panel data estimators, the results showed that a rise in GDP would increase banks' default risk. Alnabulsi et al. (2022) examined the factors of NPL, drawing a sample of MENA banks for the period 2005-2020. Applying the system GMM, the outcome depicted that GDP growth has a positive impact on NPL. Antony and Suresh (2023) investigated the factors contributing to default risk, using a sample of 31 banks for the period 2012-2021. Applying POLS, FE, and RE estimators, the results showed that GDP growth increases NPL. This study set the following sixth hypothesis based on theoretical and more recent empirical findings.

H_6: A higher economic growth ratio decreases NPL.

2.2.7. Inflation and NPL

The earlier empirical evidence showed that inflation can have either a positive or a negative impact on NPL. For instance, Koju et al. (2018) examined the impact of NPLs in high-, middle-, and low-income economies for 1998-2015. The results demonstrated that inflation reduces NPLs in high- and middle-income economies. This is because a rise in the inflation rate diminishes the real value of debts (Gulati et al., 2019) and makes it easier for borrowers to repay interest and principal amounts on time, which can reduce NPLs of banks. However, interestingly, it was found that inflation increases NPLs in low-income economies. This result suggests that an increase in the inflation rate also increases the lending rate, which can decrease the real rate of return. Furthermore, an increase in the inflation rate also stimulates the cost of living, decreases borrowers' debt service capability, and ultimately leads to more loan defaults for banks.

Similarly, Ghosh et al. (2025) assessed the impact of governance on NPL and found that inflation negatively affects NPL in HIC and UMIC. Conversely, inflation increases NPL in LMIC. Alnabulsi et al. (2022) examined the factors of NPL, adopting a sample of MENA banks for the period 2005-2020. The results demonstrated that inflation

has a positive impact on NPL. Conversely, Antony and Suresh (2023) investigated the factors contributing to default risk, using a sample period of 2012-2021. Applying POLS, FE, and RE estimators, the results showed that inflation decreases NPL. This study set the following seventh hypothesis based on theoretical and more recent empirical findings.

H_7: A higher inflation increases NPL.

3. RESEARCH METHODOLOGY

This study employed an explanatory research design to investigate the impact of interest spread on credit risk, using a sample of banks from lower-middle-income economies worldwide from 2000 to 2021. The bank-specific data were extracted from the World Bank (2023). In addition, macroeconomic-related data were extracted from the World Bank (2025). The details of the sample countries and study period are presented in Table 1. This study excludes some low-income countries (LICs) due to the unavailability of data. In addition, this study excludes high-income and upper-middle-income countries because these countries typically experience stable economic growth, lower inflation rates, and high employment rates, which collectively improve borrowers' debt service capacity and reduce the probability of loan defaults (Erdas & Ezanoglu, 2022; Koju et al., 2018). In addition, high- and upper-middle-income economies have strong regulation, supervision, institutional quality, and credit information, which can reduce credit risk (Ghosh et al., 2025).

Table 1. List of countries included in the sample.

LMIC	Periods
Bangladesh, Bolivia, Cameroon, Algeria, Egypt, Arab Rep., Ghana, Honduras, Indonesia, India, Kenya, Kyrgyz Republic, Lesotho, Morocco, Nigeria, Nepal, Pakistan, Philippines, Senegal, Eswatini, Tajikistan, Tunisia, Tanzania, Ukraine, Uzbekistan, Vietnam	2000-2021

This study employed NPL as a predictor variable to achieve the research objective. This variable is measured as NPL divided by loans and advances. A higher value of this measure indicates a higher credit risk and vice versa. Previous studies by Antony and Suresh (2023), Gulati et al. (2019), Afroj et al. (2024) and Salas, Lamothe, Delgado, Fernández-Miguélez, and Valcarce (2024) were used to measure the default risk of banks. The independent variable is the interest spread, which is measured as the lending rate minus the borrowing rate. Das Gupta et al. (2021) and Ahmed et al. (2021) were used to measure the interest spread of banks. The high interest spread reflects higher intermediation costs and vice versa. This study employed liquidity, overhead costs, capital ratio, and bank concentration as control variables.

Liquidity, the first control variable, is measured as the ratio of liquid assets to deposits. Cetinkaya (2019) and Zheng et al. (2019) used this measure to assess the liquidity position of banks. The high liquidity ratio indicates that the banks hold a greater amount of liquidity, and vice versa. The second control variable is the overhead cost ratio, which is computed as overhead costs divided by total assets. Ghosh et al. (2025); Antony and Suresh (2023) and Gulati et al. (2019) used this metric to measure the efficiency of banks. The lower value of this ratio indicates a higher level of efficiency. The third control variable, capital ratio, is measured as capital divided by total assets. Ghosh et al. (2025) and Antony and Suresh (2023) used this metric to measure the capital of banks. The higher level of equity held by the banks is indicated by the higher value of this metric and vice versa.

The fourth control variable, bank concentration, is measured as the proportion of total assets held by the top three banks. Gulati et al. (2019) and Alnabulsi et al. (2022) used this metric to measure bank competition. The higher the value of this metric, the lower the degree of competition in the banking industry, and vice versa. Finally, GDP growth and inflation are used to measure the macroeconomic situation in the economy. Koju et al. (2018), Gulati et al. (2019), and Salas et al. (2024) utilized these measures to evaluate a country's economic condition. The higher value of inflation indicates a higher level of inflation prevailing in the economy, and vice versa. Finally, Ghosh et al. (2025);

Gulati et al. (2019) and Salas et al. (2024) utilized the GDP growth metric to measure a country's economic condition. The higher value of this indicator indicates a higher level of economic prosperity prevailing in the economy, and vice versa.

3.1. Models

This study considered POLS, FE, and RE models to achieve its objectives. The choice between POLS, FE, and RE estimators depends on the outcomes of the Durbin-Wu-Hausman (DWH) and Breusch-Pagan LM tests. The best model is used as the baseline regression model, and the other two models are used for sensitivity analysis (robustness check). The first proposed POLS estimator is as follows.

$$Y_{it} = \alpha + \beta_1 X_{it} + \sum_{k=1}^{n} \gamma_2 Controls_{it} + \sum_{k=1}^{n} \lambda_3 + Macro_{it} + \varepsilon_{it} \quad (1)$$

The second proposed fixed-effect model is as follows.

$$Y_{it} = \alpha_i + \beta_1 X_{it} + \sum_{k=1}^{n} \gamma_2 Controls_{it} + \sum_{k=1}^{n} \lambda_3 + Macro_{it} + \varepsilon_{it} \quad (2)$$

The third proposed random-effect model is as follows.

$$Y_{it} = \alpha + \beta_1 X_{it} + \sum_{k=1}^{n} \gamma_2 Controls_{it} + \sum_{k=1}^{n} \lambda_3 + Macro_{it} + u_i + \varepsilon_{it} \quad (3)$$

where Y_{it} denotes the dependent variable, which includes nonperforming loans. X_{it} denotes an independent variable, which includes interest spread. Controls denote control variables, which include the overhead cost ratio, capital ratio, liquidity, and bank concentration. Macro denotes macroeconomic variables, which include GDP growth and the inflation rate. i denotes country, and t denotes year. ε_{it} denotes an error term. a represent an intercept. a_i denotes country-specific fixed effect. u_i denotes a random country-specific effect.

4. RESULTS

The basic descriptive characteristics of study variables have been presented in Table 2. The outcome demonstrated that the average score of NPL is 10.495, with a standard deviation (SD) of 8.469. The difference between the maximum and minimum is 53.832, indicating that the variable NPL is highly dispersed. Similarly, the mean score of interest spread is 8.039, with an SD of 5.401.

The range between the maximum and minimum is 41.835, indicating that this variable is highly dispersed. However, this variable has comparatively less dispersion than NPL. The average score for overhead cost is 4.034, with an SD of 2.129, and its range is 11.698, indicating that it is less dispersed than NPL and interest spread. The average capital ratio score is 10.527, with an SD of 3.660. The range of this variable is 22.91, indicating that the dispersion of this variable is comparatively higher. The mean score of liquidity is 31.881, with an SD of 17.025. The range between the maximum and minimum is 96.057, indicating that this variable is also highly dispersed compared to all other study variables.

This suggests that holding a lower level of liquidity creates liquidity problems, whereas holding a higher level of liquidity reduces liquidity risk but raises questions about the ability of banks to mobilize their scarce resources for investment, which can reduce banks' profitability and stability. The mean bank concentration (BCR3) score is 58.754, with an SD of 20.791. The range between the maximum and minimum is 83.856, indicating that this variable is highly dispersed.

However, it is less dispersed than the capital ratio. The average score of GDP growth is 4.488, with an SD of 3.154. The range between the maximum and minimum is 30.465. Finally, the mean inflation score is 6.825, with an SD of 5.962. The range between the maximum and minimum is 65.559, indicating that this variable is highly dispersed.

Table 2. Descriptive statistics.

Variables	Mean	SD	Min.	Max.
NPL	10.495	8.469	0.709	54.541
Spread	8.039	5.401	0.186	42.021
Overhead	4.034	2.129	0.833	12.531
Capital	10.527	3.660	1.490	24.4
Liquidity	31.881	17.025	6.705	102.762
BCR3	58.754	20.791	16.144	100
GDP	4.488	3.154	-15.136	15.329
Inflation	6.825	5.962	-16.860	48.699

Note: NPL denotes nonperforming loans. Spread represents the interest spread. Overhead denotes the ratio of overhead costs to total assets and measures the bank's efficiency. Capital denotes the capital ratio, calculated as capital divided by total assets. Liquidity denotes the liquidity ratio, which is measured as liquidity divided by total assets. BCR3 denotes three bank concentration ratios, a measure of bank competition. GDP represents gross domestic product. Inflation represents the inflation rate.

This study employs Pearson's correlation and Variance Inflation Factor (VIF) to check for multicollinearity issues among the predictor variables. Findings show that all coefficients between predictor variables are less than the threshold value of 0.8 (Field, 2024), indicating no such issues are present. Additionally, the VIF of all predictor variables is less than 5 (Kutner, Nachtsheim, Neter, & Li, 2005), indicating no multicollinearity issues found in predictor variables. Table 3 presents the results of correlation analysis, which reveals a significant, favorable association between NPL and interest spread, suggesting that they move in the same direction. Similarly, a bank's inefficiency, measured by the ratio of overhead costs to total assets, is positively associated with NPL, suggesting that higher overhead expenses are linked to an increase in NPL. Conversely, the capital ratio measured by capital to assets is adversely linked with NPL, indicating that an increase in the capital ratio is associated with decreased NPLs. Liquidity and bank concentration (BCR3) are favorably associated with NPLs, suggesting that a higher level of liquidity and a lower level of competition are linked to increased NPLs. The GDP growth macroeconomic variable is negatively linked with NPLs, revealing that higher GDP growth is linked to a decrease in NPLs. Finally, the inflation macroeconomic variable is positively linked with NPLs, implying that higher inflation growth is linked to increased NPLs.

Table 3. Correlation analysis.

Variables	NPL	Spread	Overhead	Capital	Liquidity	BCR3	GDP	Inflation
NPL	1							
Spread	0.103* (0.089)	1						
Overhead	0.086* (0.090)	0.509*** (0.000)	1					
Capital	-0.128** (0.013)	0.540*** (0.000)	0.548*** (0.000)	1				
Liquidity	0.069 (0.181)	0.359*** (0.000)	0.227*** (0.000)	0.228*** (0.000)	1			
BCR3	0.050 (0.329)	0.336*** (0.000)	0.262*** (0.000)	0.306*** (0.000)	0.440*** (0.000)	1		
GDP	-0.101** (0.047)	-0.001 (0.592)	0.065 (0.141)	0.009 (0.669)	0.023 (0.602)	-0.064 (0.115)	1	
Inflation	0.097* (0.058)	0.100* (0.061)	0.211*** (0.000)	0.208*** (0.000)	0.109** (0.014)	-0.041 (0.355)	0.043 (0.324)	1
VIF		1.75	1.52	1.61	1.17	1.38	1.06	1.03

Note: NPL denotes nonperforming loans. Spread represents the interest spread. Overhead denotes the ratio of overhead costs to total assets and measures the bank's efficiency. Capital denotes the capital ratio, calculated as capital divided by total assets. Liquidity denotes the liquidity ratio, which is measured as liquidity divided by total assets. BCR3 denotes three bank concentration ratios, a measure of bank competition. GDP represents gross domestic product. Inflation represents the inflation rate. VIF denotes the variance inflation factor. ***, **, and * denotes that correlation is significant at the 1%, 5%, and 10% level of significance, respectively.

The results of the baseline regression are presented in Table 4. At first, this study considers three regression models: POLS, FE, and RE. The choice between FE and RE models is made by the Durbin-Wu-Hausman (DWH)

test. The outcome of this test suggested that the RE model is better than the FE model. In addition, this study tested the Breusch-Pagan LM test, and the results revealed that the FE model is better than the POLS model. Therefore, this study deployed an RE model as a baseline regression model. The findings revealed that interest spread increases NPLs in LMIC, suggesting that higher interest rates boost credit risk and can lead to financial instability. Similarly, the overhead cost ratio increases a bank's NPL, indicating that inefficient banks must bear higher credit risk and can cause financial instability. In other words, efficient banks can reduce credit risk and stabilize LMIC financially. Conversely, the results showed that holding a higher level of capital reduces NPL, indicating that a higher capital ratio can decrease credit risk and promote financial stability in LMIC.

On the other hand, liquidity positively affects NPL, implying that a bank can hold more liquid assets for unseen credit risk. Furthermore, bank concentration (BCR3) stimulates banks' credit risk, implying that more concentrated banks would become inefficient and increase their credit risk. Conversely, GDP growth reduces banks' credit risk, suggesting that high economic growth raises borrowers' income levels and reduces credit risk. Finally, inflation stimulates the banks' NPL; however, it is not statistically significant, implying that inflationary situations erode borrowers' debt-repaying capability and increase credit risk in LMIC.

Table 4. Baseline regression analysis.

Variables	Dependent variable = NPL		
	Coefficients	t-stat.	p-value
Spread	0.284*	1.700	0.090
Overhead	1.598***	4.390	0.000
Capital	-1.177***	-6.300	0.000
Liquidity	0.138***	3.64	0.000
BCR3	0.096***	2.96	0.003
GDP	-0.286**	-2.040	0.042
Inflation	0.079	0.95	0.244
Constant	5.200*	1.67	0.095
Hausman test	20.81***		0.004
Breusch-Pagan LM test	283.454***		0.000
R-square	0.470		
Wald-test	85.18***		0.000

Note: NPL denotes nonperforming loans. Spread represents the interest spread. Overhead denotes the ratio of overhead costs to total assets and measures the bank's efficiency. Capital denotes the capital ratio, calculated as capital divided by total assets. Liquidity denotes the liquidity ratio, which is measured as liquidity divided by total assets. BCR3 denotes three bank concentration ratios, a measure of bank competition. GDP represents gross domestic product. Inflation represents the inflation rate. ***, **, and * denotes that coefficient is significant at the 1%, 5%, and 10% level of significance, respectively.

This study presents the outcomes of POLS and FE models for the robustness check in Table 5. Findings of the study from POLS and FE models revealed that interest spread increases the NPL in LMIC, which is consistent with results derived from RE models, suggesting that a rise in spread by banks increases default risk, which decreases banks' liquidity, profitability, lending capacity, and increases operational costs. In addition, it erodes depositors' confidence, requires them to hold more regulatory capital, and faces operational restrictions imposed by regulators. Similarly, the overhead costs ratio increases the NPL, implying that inefficient banks impose higher spread rates on their borrowers, and these outcomes are consistent with the baseline regression results. Furthermore, inefficient banks might have weaker credit assessment and monitoring systems, leading to higher NPLs. Conversely, the results from POLS and FE estimators demonstrated that capital ratios reduce NPLs. This is consistent with the findings shown by baseline regression results, implying that well-capitalized banks do not provide risky loans and better manage credit risk. Nonetheless, the robustness check demonstrated that liquidity increases NPLs, implying that banks with excess liquidity and limited lending opportunities can lower their credit standards, increasing their riskier loans and thus raising NPLs.

Furthermore, robustness check results showed that a lower level of competition increases the NPLs in LMICs, which is consistent with the outcome of the baseline regression result, implying that the dominant banks can use their

monopoly power to engage in lending without screening borrowers' creditworthiness and make loans based on relationships, which can increase banks' NPLs. Conversely, economic growth reduces the NPLs, similar to the outcome of baseline results. However, they are not statistically significant in both POLS and FE models. This implies that as GDP rises, the income level of borrowers also increases, and NPLs are reduced. Finally, the robustness check results demonstrated inconclusive findings on the impact of inflation on NPLs, where the POLS showed a significant positive impact and the fixed effect showed an insignificant negative impact on NPLs in LMICs.

Table 5. Robustness check.

Variables	Dependent variable = NPL					
	POLS			Fixed-effect		
	Coefficients	t-stat.	p-value	Coefficients	t-stat.	p-value
Spread	0.389**	2.44	0.015	0.311*	1.73	0.086
Overhead	0.549*	1.76	0.080	2.039***	5.16	0.000
Capital	-0.849***	-4.800	0.000	-1.145***	-5.67	0.000
Liquidity	0.064*	1.76	0.079	0.163***	4.18	0.000
BCR3	0.005	0.17	0.863	0.118***	3.73	0.000
GDP	-0.198	-1.19	0.234	-0.383	-2.71	0.007
Inflation	0.259***	2.60	0.010	-0.132	-1.60	0.111
Constant	10.450***	4.46	0.000	1.670	0.50	0.618
F-stat.	5.74***		0.000	14.76***		0.000
R-square	0.438		0.361			

Note: NPL denotes nonperforming loans. Spread represents the interest spread. Overhead denotes the ratio of overhead costs to total assets and measures the bank's efficiency. Capital denotes the capital ratio, calculated as capital divided by total assets. Liquidity denotes the liquidity ratio, which is measured as liquidity divided by total assets. BCR3 denotes three bank concentration ratios, a measure of bank competition. GDP represents gross domestic product. Inflation represents the inflation rate. ***, **, and * denotes that coefficient is significant at the 1%, 5%, and 10% level of significance, respectively.

5. DISCUSSION

The empirical finding demonstrated that a higher interest spread stimulates NPLs in LMICs worldwide. This finding supports the Bad Management Hypothesis (BMH) as expressed in our first hypothesis. Our finding aligns with earlier empirical research by Zheng et al. (2019), Cetinkaya (2019) and Antony and Suresh (2023). However, this finding differs from the empirical outcomes of Das Gupta et al. (2021), Erdas and Ezanoglu (2022) and Shaheen et al. (2024). Our findings align with the argument that inefficient banks incur higher operating costs and lend into riskier portfolios to achieve higher profits, resulting in higher levels of NPLs across LMIC. Similarly, the overhead cost ratio, an indicator of inefficiency, stimulates NPLs in LMIC. The findings support the BMH. Our empirical findings align with earlier studies by Podpiera and Weill (2008), Muhammed et al. (2023) and Ghosh et al. (2025). Conversely, our finding contrasts with the earlier empirical outcomes of Erdas and Ezanoglu (2022) and Suresh (2023). Our findings indicate that higher operating costs, including expenses related to credit such as borrower loan monitoring, information collection, and follow-up with borrowers, can decrease banks' profits. Additionally, management's decision to grant loans to risky borrowers can increase the non-performing loans (NPLs) of banks in LMIC.

Our findings revealed that a higher capital ratio reduces credit risk in LMIC. This finding supports the Moral Hazard Hypothesis (MHH). Our results are similar to those of Erdas and Ezanoglu (2022) and Shaheen et al. (2024). By contrast, this finding differs from the previous empirical results of Cetinkaya (2019) and Ghosh et al. (2025). It indicates that management makes prudent lending decisions when the capital ratio is high and reduces NPLs in LMIC. Conversely, our findings demonstrate that liquidity boosts NPLs in LMIC. This result supports the BMH, which states that when the bank manager decides to reduce liquidity by raising the credit-to-deposit ratio, there is a potential for an increase in the banks' NPLs. Our result is similar to the earlier empirical results of Zheng et al. (2019) and Erdas and Ezanoglu (2022). However, this result differs from the outcome of Cetinkaya (2019).

Our findings indicate that BCR3 enhances NPL in LMIC. The findings support the Bad Luck Hypothesis, indicating that banks with greater concentration are inclined to extend credit to riskier sectors. Consequently, if external factors such as an economic downturn arise, there can be a notable increase in the banks' NPLs. Our results

align with earlier findings. Gulati et al. (2019) and Alnabulsi et al. (2022) while differing from the outcome presented by Das Gupta et al. (2021). Conversely, our findings demonstrated that GDP growth is associated with a reduction in NPL. This result aligns with the empirical findings of Koju et al. (2018) and Ghosh et al. (2025). This outcome differs from the results of Cetinkaya (2019) and Alnabulsi et al. (2022). However, inflation increases the NPL in LMIC. This result is congruent with the empirical result of Alnabulsi et al. (2022). This outcome differs from the outcome of Koju et al. (2018) and Ghosh et al. (2025). These findings both support the Bad Luck Hypothesis (BLH), which states that during periods of economic downturn, characterized by rising inflation and declining growth, banks experience an increase in NPLs due to unfortunate circumstances.

6. CONCLUSION AND IMPLICATIONS

This study examines how interest spread influences credit risk in lower-middle-income countries (LMICs) worldwide. It further investigates how efficiency, capital, liquidity, bank concentration, and macroeconomic conditions impact credit risk in LMICs. The analysis uses data from 25 LMICs over the period 2000-2021. A random-effects estimator serves as the baseline regression model, with Pooled Ordinary Least Squares (POLS) and fixed-effects estimators employed for sensitivity analysis. The baseline model results reveal that interest spread increases credit risk in LMICs, a finding confirmed by both POLS and fixed-effects estimators, which validate the robustness of the outcomes. Additionally, the results indicate that inefficient banks measured by the overhead cost ratio produce higher non-performing loans (NPLs) in LMICs. Conversely, a higher capital ratio decreases NPLs, and sensitivity analysis supports these findings. Furthermore, holding excess liquidity and low competition tend to stimulate NPLs in LMICs, with the consistency checks reaffirming these results. Economic growth is associated with a reduction in bank credit risk in LMICs, while inflation exhibits an inclusive effect on the relationship between inflation and credit risk. Based on these findings, management should aim to reduce interest spreads by increasing operational efficiency and lowering excess liquidity. Policymakers should promote bank competition by removing entry barriers for foreign banks. These insights are also relevant for other stakeholders, including borrowers, depositors, investors, and consumers, who should monitor NPL levels, as banks with higher NPLs tend to charge higher interest rates and may be reluctant to renew loans. Depositors risk losing their deposits if banks become insolvent, and investors may suffer losses when banks face elevated NPLs. Policymakers and regulators can utilize these findings to implement corrective measures proactively, preventing banks from insolvency due to high NPLs, thereby safeguarding the banking sector and the broader economy.

Funding: This study received no specific financial support.
Institutional Review Board Statement: Not applicable.
Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Data Availability Statement: The corresponding author can provide the supporting data of this study upon a reasonable request.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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