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Impact of Country Governance on Non-Performing Loans in Lower-Middle-, Upper-Middle- And High-Income Countries

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Abstract

This study aims to determine the effects of the country governance on NPLs in lower-middle-, upper-middle- and high-income countries. Using the panel corrected standard error (PCSE) estimation method, this study finds that control of corruption, government effectiveness, rule of law, and regulatory quality can reduce NPLs significantly in high-income and upper-middle-income countries; regulatory quality and control of corruption play the highest role in high-income and upper-middle-income countries respectively. This study also finds significant positive associations between the two governance indicators (control of corruption and rule of law) and NPLs in lower-middle-income countries, and only political stability and

absence of violence/terrorism are found marginally significant in the control of the same in this group. To sum up, the impacts of country governance indicators on NPLs differ among three groups of countries. The findings of this study have implications for policy formulation for the banking sector in those groups of countries.

Keywords: Country's governance, level of NPLs, banking sector, country's income level

Jel classification: G28, E51, E52

1. Introduction

The banking sector is the key player in the money market, which contributes to the smooth and sustainable economic development of a country (Cheng & Degryse, 2010; Estrada et al., 2010; Kharel & Pokhrel, 2012; Tölö & Virén, 2021). To ensure the financial development of a country, stability in the banking sector is essential. Moreover, stability in the banking sector, to a greater extent, depends on the quality of the performing assets of the banks (Alqahtani et al., 2022), meaning that excessive non-performing assets, especially non-performing loans (NPLs), break the financial strength of the banks which ultimately hampers the stability in money market and overall economic development of a country (Amadi et al., 2021; Tölö & Virén, 2021). The banking sector in different countries, economic zones, continents, and subcontinents has been suffering from NPLs at different scales, and financial researchers have been repeatedly trying to identify the determinants of high NPLs to help the regulators and macroeconomic policymakers control the level of NPLs to ensure sustainable growth in the banking sector. Researchers claim that a country's income level affects the financial performance of the banks (Dietrich & Wanzenried, 2014). Additionally, Rinaldi & Sanchis-Arellano (2006) and Salas & Saurina (2002) show that the firms' and family level income, financial stability, and indebtedness are also related to loan repayment. Based on gross national income (GNI), the World Bank classified all the countries into four categories: low-, lower-middle-, upper-middle-, and high-income countries. The average level of NPLs changes differently in these groups[1]. Of countries presented in Figure 1, which shows the different nature of movements in yearly average NPLs in those groups of countries.

To explain the changes in the level of NPLs, most of the studies focus on the macroeconomic and bank-specific factors (Boussaada et al., 2022; Erdas & Ezanoglu, 2022; Kjosevski & Petkovski, 2021; Mishra et al., 2021), profitability (Hunjra et al., 2022; Saif-Alyousfi, 2022; Yahaya et al., 2022) and financial stability (Ali & Puah, 2019; Azmi et al., 2019; Chand et al., 2021; Chen, 2022) of the banks. However, few recent studies (Almaqtari et al., 2022; Ghosh et al., 2024; Kamarudin et al., 2022; Ozili, 2018) find the nexus between bank performance (i.e., profitability, bank productivity, and financial stability) and the country governance indicators[2]. A few studies state that the elements of country governance indicators affect banks' operational activities, such as line of credit, green banking practice, corporate

[1] Low-income countries are excluded from the graph because of unavailability of the data.

[2] Country governance denotes the Worldwide Governance Indicators developed by Kaufmann et al. (2009, 2010). The World Bank reports the status of six country governance indicators of the individual countries every year available at https://databank.worldbank.org/source/worldwide-governance-indicators .

governance, etc., and their performance (Chen et al., 2021; El-Chaarani & El-Abiad, 2022; Ghosh et al., 2018; Mollagholamali & Rao, 2022; Puspitasari & Prasetyo, 2019; Rathnayake et al., 2022).

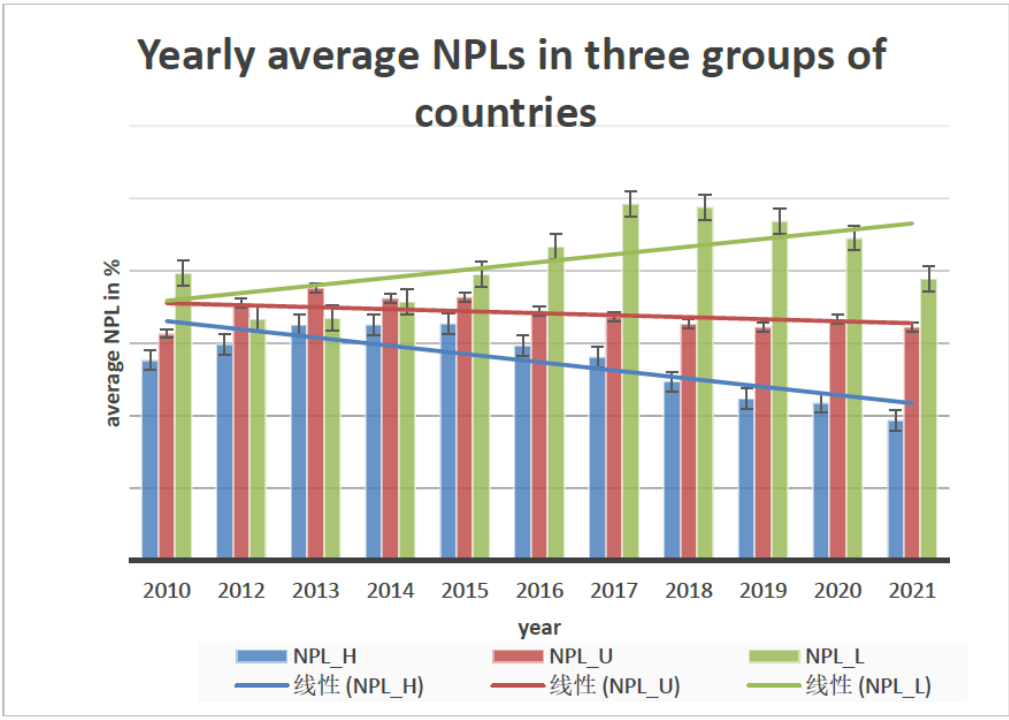

Figure 1. Represents yearly average NPLs in three groups of countries. NPL_H, NPL_U, and NPL_L stand for yearly average NPLs in high-income, upper-middle-income, and lower-middle-income countries, respectively

Ozili (2018) finds a mixed significant and insignificant association between the country governance indicators and NPLs in African countries. Moreover, a few studies (Cerulli et al., 2020; Schiantarelli et al., 2020) show that judicial inefficiency, a part of a country's governance, enhances NPLs in Europe. Chen et al. (2022) and Chen et al. (2021) find that government policies and support affect the financial performance of the banks. However, all those studies ignore one important aspect: the country's income level, which can affect the country's governance and the level of NPLs. Following the importance of a country's income level, Dietrich & Wanzenried (2014) identify the bank profitability determinants in low-, middle- and high-income countries and find significant differences in those groups of countries. Bolarinwa & Soetan (2019) and Kamarudin (2015) also prove that a country's income level changes the nature of the association between the regressors and performance indicators of the banks. Following their findings, our investigation finds differences in the mean values of the country governance indicators (presented in Table 2) and in the yearly average NPLs (presented in Figure 1) in those groups of countries and if the association between the country's governance and the level of NPLs differs in those groups of countries, it might affect policy formulation to reduce the level of NPLs. Eventually, to resolve this

contextual issue and ensure greater control over the level of NPLs, this study plans to contribute to the existing literature by measuring the impacts of country governance indicators on NPLs in high-income, upper-middle-income, and lower-middle-income countries.

2. Literature Review

Because of the vast NPLs in different countries and economic zones, researchers rigorously try to identify the causes of NPLs in different contexts; however, most use bank-specific and macroeconomic factors. In an investigation, Erdas & Ezanoglu (2022) find that capital adequacy and GDP are negatively associated with NPLs, meaning that increased capital adequacy and GDP significantly reduce NPLs in the banking sector. Goswami (2022) and Thomas & Thakur (2021) also find that increased bank-level efficiency is crucial to controlling NPLs. Ravirajan & Shanmugam (2021) state that excessive credit growth and government-prioritized sectoral lending increase NPLs, while capital buffers and sound lending policies are essential to control it. Alaoui Mdaghri (2021) shows that liquidity creation in the short- and long-run can reduce the level of NPLs. In another investigation, Kjosevski & Petkovski (2021) also conclude that macroeconomic factors, i.e., GDP growth rate, public debt, inflation, and unemployment rate, and bank-specific factors, i.e., equity to total assets, ROA, ROE, and growth of gross loans, affect the level of NPLs. Mishra et al. (2021) demonstrate that macroeconomic factors, such as inflation, exchange rate, policy repo rate, and bank-specific factors, such as the sector of the bank, provision on contingencies, and income on investment, significantly affect NPLs in the Indian banking sector. Khan et al. (2020) show that profitability, operating efficiency, and capital adequacy are negatively associated with NPLs. Hada et al. (2020) conclude that macroeconomic factors, such as the exchange rate, unemployment rate, and inflation rate, significantly affect the level of NPLs. Likewise, from the review of some publications (Beck et al., 2015; Chen et al., 2018; Ghosh, 2015; Haniifah, 2015; Jabbouri & Naili, 2019; Mazreku et al., 2018; Skarica, 2014), this study finds that a set of macroeconomic factors, such as DP growth, inflation, exchange rate, unemployment rate, export etc., and some bank-specific factors, such as bank size, lag of NPLs, operating efficiency, liquidity, capital adequacy ratio, profitability etc., affect the level of NPLs in different countries. However, mixed impacts are found in different contexts, meaning that some significant and positive factors are significantly negative in another context or vice versa.

Apart from the bank-specific and macroeconomic-based investigation, few scholars have tried to link country governance indicators or elements with changes in the level of NPLs. Zhang et al. (2016) state that banking sector reform through regulatory policy and controlling moral hazard reduce the level of NPLs in China. Eichler & Sobański (2016) show that national politics, the national electoral cycle, and the government's power significantly affect the banks' financial stability. Jiang et al. (2018) conclude that public policies that prompt corrective action in the banking sector reduce the level of NPLs in the U.S. banking sector. Ozili (2018), in a study on the financial stability of the banks in Africa, finds significant and insignificant mixed associations between the country governance indicators and the level of NPLs in the pre-, during, and post-crisis periods. Controlling macroeconomic and

bank-specific factors, Cerulli et al. (2020), in a study on the European banking system, find that judicial inefficiency is a key determinant of the level of NPLs in this economic region. Schiantarelli et al. (2020) state that judicial inefficiency in enforcing collateral recovery causes borrowers to make intentional loan repayments despite their ability to pay. Gaur et al. (2022) conclude that effective national policies for the banking sector can control the level of NPLs and increase the banks' asset quality. Based on the investigation of 44 countries, Mollagholamali & Rao (2022) find that country-level corporate governance enhances the usage of the lines of credit by business firms, and eventually, excessive lines of credit can enhance the level of NPLs.

Furthermore, Forson et al. (2022) show that regulatory quality and government effectiveness negatively affect NPLs in Gana. Although Cerulli et al. (2020), Forson et al. (2022), Ghosh et al. (2023), Ozili (2018), and Schiantarelli et al. (2020) find the relationship between country governance and the level of NPLs, they did not consider one important context, which is country's income level. The country's income levels are classified as low-, lower-middle-, upper-middle- and high-income countries by the World Bank. Our initial investigation reveals that the trend of NPLs (shown in Figure one) and the values of country governance indicators in those groups of countries are different. Eventually, this study assumes that the nature of the relationship between them in those groups of countries might differ. Finally, controlling bank-specific and macroeconomic factors, this study aims to contribute to the existing literature investigating how country governance indicators affect the level of NPLs in different income levels.

3. Methodology

3.1 Variable Selection

This study uses quantitative methods using secondary data from the World Bank to measure the associations between country governance indicators and the level of NPLs in high-, upper-middle- and lower-middle-income countries. The country's aggregate NPL is our dependent variable. This study assumes that

NPLs= f (country governance indicators, macroeconomic factors, bank-specific factors)

Six country governance indicators, such as Control of Corruption Index (CCI), Government Effectiveness Index (GEI), Regulatory Quality Index (RQI), Rule of Law Index (RLI), Voice and Accountability Index (VAI), and Political Stability and Absence of Violence/Terrorism Index (PSAVTI), are our main independent variables, developed by Kaufmann et al. (2009, 2010) and used by some authors (Almaqtari et al., 2022; Ghosh et al., 2024; Kamarudin et al., 2016, 2022; Ozili, 2018). Macroeconomic control variables, i.e., GDP growth rate (GDP) and inflation rate (IR), are selected following some studies (Boussaada et al., 2022; Jabbouri & Naili, 2019; Kjosevski & Petkovski, 2021; Makri et al., 2014). As a few scholars have proven that COVID-19 influences the financial performance of the banks (Demirgüç-Kunt et al., 2021; Mateev et al., 2024; Xiazi & Shabir, 2022), this study includes COVID-19 as a macroeconomic control variable. Bank-specific control variables are bank cost-to-income ratio (BCI), bank capital-to-total assets ratio (BCA), and bank overhead cost ratio (BOCR),

which are selected following some research publications (Azmi et al., 2019; Berger & DeYoung, 1997; Dietrich & Wanzenried, 2014; Jabbouri & Naili, 2019). The definitions of the selected variables are presented in table-1:

Table 1. Represents the selected variables and their definitions

Name of the variables	Definition
Non-performing loans (NPLs)	NPL is a ratio of default loans to total gross loans, presented in percentage.
Control of Corruption Index (CCI)	It represents controlling usages of public power for private gain, presented in ratio.
Government Effectiveness Index (GEI	It denotes the quality of public and civil services, policy formulation and implementation, degree of freedom from political pressure, and credibility of the government's commitment in this regard.
Regulatory Quality Index (RQI)	It represents the formulation and implementation of sound policies and regulations for private sector development by the government.
Rule of Law Index (RLI)	It shows confidence in the law and its implementation in contract enforcement, property rights, police, and court.
Political Stability and Absence of Violence/Terrorism Index (PSAVTI)	It denotes the likelihood of political instability, politically motivated violence, and terrorism.
Voice and Accountability Index (VAI)	It represents the freedom of people to select government, express opinions, and have freedom of media and association.
GDP growth rate (GDP)	It represents the annual growth rate of GDP in market price presented in US dollars, presented in percentage.
Inflation rate (IR)	This rate is calculated based on the consumer price index, which measures the average yearly change in costs, presented in percentage form.
COVID-dummy	The year 2020 and 2021 are used as the COVID period (COVID_dum2), whereas 2010 to 2019 is used as the non-COVID period (COVID_dum1)
Bank cost-to-income ratio (BCI)	It is the percentage ratio of bank operating costs to the sum of net interest revenue and other operating income.
Bank capital to total assets ratio (BCA)	It is a ratio of contributed capital, retained earnings, and other reserves to total assets, presented in percentage.
Bank overhead cost ratio (BOCR)	It is a ratio of bank operating cost to total assets, presented in percentage.

3.2 Data Collection, Processing and Descriptive Analysis

After variable selection, data on the selected variables are collected for the period starting from 2010 to 2021[3]. There are 54 lower-middle-, 54 upper-middle- and 80 high-income countries (a total of 188) on the World Bank website, but the data on the selected variables are not available for all. After data collection, we reduced the number of countries because of the missing values, and our sample size has been reduced to 133 countries' banks, having 12 years of data for each (49 high-income, 45 upper-middle-income, and 39 lower-middle-income countries). So, each variable's maximum number of observations is 1596 (133 countries' bank data for ×12 years). This study uses aggregate country-level bank data, not individual bank-level data for NPLs and bank-specific factors. After collecting the raw data and initial processing, descriptive analysis is done, and descriptive statistics for each variable, i.e., mean, standard deviation, maximum and minimum value for all countries and each group of countries, are presented in Table 2.

[3] Data on all the selected variables are available until 2021 as on 30 September,2024

3.3 Inferential Analysis

We clean our data set before starting inferential statistical analysis, removing outliers. To do so, we run OLS estimation and predict residuals(r) using the 'rstudent' command in STAT-15 and delete all the rows from the data set with residuals greater than two. After data cleaning, we run OLS estimation for each group of countries to measure the impacts of the independent and control variables on the level of NPLs. To run OLS estimation, the following econometric equation is developed.

$$NPLs_{it} = \beta_0 + \beta_1 CCI_{it} + \beta_2 GEI_{it} + \beta_3 RQI_{it} + \beta_4 RLI_{it} + \beta_5 PSAVTI_{it} + \beta_6 VAI_{it} + \beta_7 GDP_{it} + \beta_8 IR_{it} + \beta_9 lnGNI_{it} + \beta_{10} COVID\_DUM2_{it} + \beta_{11} BCI_{it} + \beta_{12} BCA_{it} + \beta_{12} BOCR_{it} + \varepsilon_{it}$$

Where NPLs stands for non-performing loans, β_0 stands for constant, CCI denotes control of corruption index, GEI denotes government effectiveness index, RQI means regulatory quality index, RLI means rule of law index, PSAVTI denotes political stability and absence of violence/terrorism index, VAI means voice and accountability index, GDP stands for GDP growth rate, IR stands for inflation rate, COVID_DUM means dummy variable for Covid-19 (COVID_DUM1 is used for non-COVID period and COVID_DUM2 is used COVID-19 period 2020 and 2021), BCI stands for bank cost to income ratio, BCA denotes bank capital to total assets ratio, BOCR stands for bank overhead cost to total assets ratio, ε stands for error term, i denotes individual country (i ϵ 1,2,3,…..,133), and t denotes individual year (t ϵ 1,2,3,…….,12).

The measurement of association is divided into three parts: Table 3 is for high-income countries, Table 4 is for upper-middle-income countries, and Table 5 is for lower-middle-income countries. The **breach-Pagan test** is used to check the presence of heteroskedasticity, and the **Wooldridge test** is used to measure first-order autocorrelation. Our OLS estimations under each group of countries fail to overcome heteroskedasticity and autocorrelation tests. To check cross-sectional dependence in the data, we use **Pesaran (2015) panel cross-sectional dependance (CD) test** and find that the residuals of OLS estimations under each category suffer from cross-sectional dependence. As OLS estimation under each group suffers from heteroskedasticity, autocorrelation, and cross-sectional dependence, we use **a corrected standard error (PCSE)** estimation model (pairwise) for the regression analysis. Hoechle (2007) states that both generalised least squares (GLS) estimation and panel corrected standard error (PCSE) estimation generate robust estimation when panel data suffer from heteroskedasticity, serial correlation (type AR(1)), and cross-sectional dependence. Still, GLS is statistically feasible when T>N, whereas PCSE is feasible when N>T. Breitung et al. (2022) also find that PCSE estimation rather than using bias-corrected method of moment (BC) estimation and generalised method of moment (GMM) estimation when panel data suffer from cross-sectional dependence, heteroskedasticity, and serial correlation. Moreover, checking Mallows's component-plus-residual plots also justifies the selection of the PCSE method, as this study does not find any non-linearity issues between independent and dependent variables in the residual plots.

Moreover, to check the presence of multicollinearity in the independent and control variables, the Variance Inflation Factor (VIF) test (presented in Table A1 in the appendix) is conducted,

and we use VIF value five as our cutoff point to consider multicollinearity. To double-check the presence of multicollinearity, a correlation matrix under each category is developed (presented in Table A2 in the appendix). Several regression models are developed under PCSE estimation following the VIF values and correlation coefficients of the variables in the correlation matrix to remove the multicollinearity effect from the model. Although few country governance indicators show VIF values below 5 in upper-middle-income and lower-middle-income countries, we find a high degree of positive correlation with other country governance indicators. To ensure greater robustness in the estimation, we develop a regression model separately for variables with a mutual correlation coefficient of more than 0.700.

4. Empirical Findings

4.1 Descriptive Statistics

Panel A in Table 2 represents the descriptive statistics for all the countries in the sample. Panel B, panel C, and panel D represent the same for the high-income, upper-middle-income, and lower-middle-income countries, respectively. From tale 2, it is evidenced that lower-middle-income countries hold the highest average NPLs, high-income countries have the lowest average NPLs, and the upper-middle-income countries remain between them and very close to the average level of NPLs for all the countries. While discussing country governance indicators, this study finds that high-income countries show the highest efficiency in a country's governance with the highest and positive average values for each indicator compared to the other two groups. The lower-middle-income countries hold the lowest average values, which denotes the weak form of country governance in lower-middle-income countries. Although the negative average values of various country governance indicators represent a weak form of a country's governance in upper-middle-income countries, they are better than lower-middle-income countries. The average values of NPLs and country governance indicators in those groups of countries represent an inverse scenario, meaning that high-income countries have the lowest level of NPLs having the highest efficiency in the country's governance. In contrast, lower-middle-income countries have the highest level of NPLs and the lowest efficiency in the country's governance. Accordingly, this study finds the highest average values of BCA, BOCR GDP growth rate, and IR in lower-middle-income countries, followed by upper-middle-income and high-income countries. Still, high-income countries hold the highest BCI, lower-middle-income countries hold the lowest, and upper-middle-income countries remain in the middle.

Table 2. Descriptive statistics of all high-, upper-middle- and lower-middle-income countries

Panel A						Panel B				
Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
NPL	1,463	6.671309	7.687102	0.092335	55.08034	548	5.496547	8.140546	0.092335	47.74785
CCI	1,596	0.164863	0.996948	-1.62769	2.399264	588	1.161461	0.72894	-0.46441	2.399264
GEI	1,596	0.244614	0.902875	-1.80962	2.32486	588	1.186332	0.562875	-0.30855	2.32486
PSAVTI	1,596	0.095279	0.8612	-2.81004	1.639301	588	0.75133	0.493456	-1.34115	1.639301
RQI	1,596	0.258451	0.895759	-1.72983	2.255347	588	1.174516	0.561775	-0.26845	2.255347
RLI	1,596	0.184163	0.935585	-1.79169	2.124782	588	1.154252	0.592814	-0.67413	2.124782
VAI	1,596	0.168506	0.915175	-2.12443	1.751755	588	0.881555	0.724171	-1.9072	1.751755
BCA	1,439	9.391191	4.933707	-1.32253	89.48432	533	8.304402	6.640757	-1.26152	89.48432
BCI	1,344	54.98166	13.41879	5.032482	202.0408	535	55.94592	14.36713	5.032482	118.1902
BOCR	1,342	2.948004	3.047125	0.213335	84.33607	540	1.741355	1.54437	0.213335	29.76008
GDP	1,591	2.694718	4.728951	-54.2359	41.7451	587	1.980105	4.729818	-54.2359	25.12276
IR	1,556	3.702183	6.055791	-4.29487	154.7561	583	1.874156	1.91692	-2.40464	10.5492
Panel C						**Panel D**				
Variables	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
NPL	493	6.789731	6.528678	0.953674	55.08034	422	8.058484	8.096349	0.128031	54.82328
CCI	540	-0.28729	0.582993	-1.62769	1.295473	468	-0.56556	0.559306	-1.46788	1.66271
GEI	540	-0.10417	0.510311	-1.35571	1.16092	468	-0.53612	0.466101	-1.80962	0.796327
PSAVTI	540	-0.1017	0.738599	-2.60378	1.39232	468	-0.50171	0.808361	-2.81004	1.27523
RQI	540	-0.01488	0.538082	-1.71281	1.196947	468	-0.57712	0.408602	-1.72983	0.403909
RLI	540	-0.22904	0.554061	-1.79169	1.023956	468	-0.55789	0.509295	-1.4524	1.162658
VAI	540	-0.08807	0.744093	-1.99927	1.202203	468	-0.43133	0.696766	-2.12443	1.147597
BCA	488	9.93705	3.028154	-1.32253	20.89	418	10.1397	3.814407	1.490407	27.37582
BCI	443	54.75812	12.1497	9.861906	98.92865	366	53.84273	13.38167	26.64992	202.0408
BOCR	443	3.729671	4.429766	0.465078	84.33607	359	3.798454	1.812229	1.044364	12.25821
GDP	540	2.659101	5.256518	-33.4928	41.7451	464	3.640217	3.843391	-11.3185	14.04712
IR	524	4.074022	8.736773	-3.74915	154.7561	449	5.641818	5.012531	-4.29487	48.69986

Table 1 represents the descriptive statistics of the selected variables. Panel-A stands for all countries, Panel-B for high-income countries, panel-C for upper-middle-income countries, and panel-D for lower-middle-income countries. NPLs, IR, GDP, BCA, BCI, and BOCR are presented in percentage form. The minimum and maximum values of the country governance indicators are -2.50 and +2.50.

4.2 Measurement of Association in High-income Countries

Controlling bank-specific and macroeconomic factors, this study examines the impacts of a country's governance indicators on the level of aggregate NPLs of the banks in high-, upper-middle- and lower-middle-income countries. In this section, we examine how the selected explanatory variables affect the level of NPLs in high-income countries, and the summary of the regression outputs is presented in Table 3. Model-1 is developed under OLS estimation, but it has failed to overcome postestimation tests for heteroskedasticity and serial correlation; the resulting chi^2 and p-value of the Breusch-Pagan test (in Table 3) state that OLS suffers from heteroskedasticity at a 1% level of significance having unequal variance in the residuals. Similarly, the chi^2 and p-value of the Wooldridge test (in Table 3) represent that model-1 also suffers from the first-order serial correlation at a 1% significance level. Moreover, Pesaran (2015) cross-sectional dependence test (CD) and its associated p-value show that our data suffer from strong cross-sectional dependence. So, Model-1 is no longer the best linear unbiased estimator (BLUE) for statistical inferences.

The variance inflation factor (VIF) test (presented in Table A1) shows that country governance indicators (i.e., CCI, GEI, RQI, and RLI) suffer from multicollinearity. Eventually, several models are developed under PCSE estimation, as shown in Table 3. Two

bank-specific factors, BCA and BOCR, are found statistically insignificant in explaining the changes in the level of NPLs. Still, the positive association between BCI and the level of NPLs is marginally significant in explaining the changes in the level of NPLs in high-income countries. This finding means that if the bank-level inefficiency increases, the level of NPLs will increase. The negative association between GDP growth rate and the level of NPLs is found statistically significant at a 1% level of significance, and the resulting negative association represents that increased GDP reduces the level of aggregate NPLs in high-income countries. Inflation is found statistically insignificant in explaining the level of NPLs in this group of countries. The negative association of COVID_DUM2 with NPLs is significant at a 5% significance level. The reason behind the negative association between the COVID-19 period and the level of NPLs may be the slowdown of economic activities in this period, which causes the payback of existing loans from idle capital.

Table 3. Regression outputs of high-income countries

	OLS	**PCSE estimation**			
	M-1	**M-2**	**M-3**	**M-4**	**M-5**
BCA	0.0248	-0.0039	-0.0062	-0.0034	-0.0056
	(0.252)	(0.632)	(0.476)	(0.676)	(0.536)
BCI	0.0032	0.019*	0.0169	0.0184*	0.0187*
	(0.822)	(0.087)	(0.131)	(0.083)	(0.087)
BOCR	0.0657	-0.0057	-0.0045	-0.0083	-0.0079
	(0.557)	(0.698)	(0.766)	(0.576)	(0.59)
GDP	-0.0353	-0.0469***	-0.0464***	-0.0459***	-0.0450***
	(0.298)	(0.002)	(0.002)	(0.003)	(0.003)
IR	-0.3968***	-0.0084	-0.0119	-0.0235	-0.0111
	(0.000)	(0.788)	(0.706)	(0.457)	(0.724)
COVID_DUM2	-1.9004***	-0.5905**	-0.6377**	-0.6435**	-0.6181**
	(0.000)	(0.029)	(0.019)	(0.021)	(0.018)
CCI	-1.5388**	-1.7782***			
	(0.005)	(0.000)			
GEI	0.4541		-1.5791***		
	(0.607)		(0.000)		
RQI	-0.8935			-1.8177***	
	(0.192)			(0.000)	
RLI	-2.4710**				-1.7807***
	(0.011)				(0.000)
PSAVTI	0.9661**	-0.2110	-0.3602	-0.4509	-0.3861
	(0.012)	(0.522)	(0.262)	(0.188)	(0.260)
VAI	1.5721***	0.2070	0.0605	0.1234	0.3199
	(0.000)	(0.630)	(0.875)	(0.749)	(0.429)
C	7.4650***	5.7975***	6.0466***	6.0790***	5.8085***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
F-stat / Wald Chi^2	16.62	90.81	40.60	39.14	65.86
Probability	0.000	0.000	0.000	0.000	0.000
R^2	0.3133	0.4269	0.4573	0.4508	0.4259
Breusch-Pagan, Chi^2	153.29***				
	(0.000)				
Wooldridge, Chi^2	143.859***				
	(0.000)				
Pesaran (20015) CD	24.989***				
	(0.000)				

Note(s): *, **, and *** denote associations that are significant at 10%, 5%, and 1% levels of significance, respectively.

Model-2 is developed to measure the impact of CCI on the level of NPLs, and the resulting negative association is statistically significant at a 1% level of significance, meaning that improvement in control of corruption index reduces the level of NPLs in high-income countries during our study period. Similarly, the negative coefficients of GEI, RQI, and RLI in regression model-3, 4, and 5, respectively, are statistically significant at a 1% level of significance, and the significant negative association states that improvement in GEI, RQI, and RLI reduces the level of NPLs in this group of countries. The coefficients of PSAVTI and VAI are negative and positive, respectively, but are found statistically insignificant in explaining the level of aggregate NPLs of the banking sector in this group. The resulting significant association between country governance indicators and the level of NPLs of the banks in high-income countries supports the external dependence of the firms explained by the **Resource Dependence Theory** (Pfeffer & Salancik, 1978)

4.3 Measurement of Association in Upper-middle-income Countries

This section represents the measurement of the association between country governance indicators and the level of NPLs of the banks in upper-middle-income countries. The summary of regression analysis is presented in Table 5. Model-6 is developed under OLS estimation, but this model fails to overcome the Breusch-Pegan test for heteroskedasticity and the Wooldridge test of first-order serial correlation as both test statistics are significant at a 1% significance level. Moreover, Pesaran's (2015) cross-sectional dependent test is significant at a 1% significance level, showing the cross-sectional dependence in this group. Although the VIF value of RLI is found to be greater than five in the VIF test (presented in table A1.) and the correlation matrix (presented in table A2.) shows a high degree of statistically significant positive correlation among CCI, GEI, RQI, and RLI in this group. So, to ensure greater robustness in regression estimation, several models are developed under PCSE estimation. From model-7 to model-10, BCA is negatively associated with the level of NPLs, and BCI and BOCR are positively associated with the level of NPLs in high-income countries. However, no bank-specific factor is found to be statistically significant in explaining the changes in the level of NPLs in this group. The negative associations between GDP and COVID-19 and the level of NPLs are found statistically significant at a 10% significance level in a few models in this group. However, both GDP and COVID-19 are statistically significant at 1% and 5% significance levels, respectively, in high-income countries. IR is found statistically insignificant in this group like high-income countries.

Table 4. Regression outputs of upper-middle-income countries

Particular	OLS	PCSE estimation			
	M-6	M-7	M-8	M-9	M-10
BCA	0.5700***	-0.0153	-0.0105	-0.0172	-0.0526
	(0.000)	(0.881)	(0.921)	(0.873)	(0.609)
BCI	0.0302	0.0211	0.0147	0.0122	0.0124
	(0.207)	(0.278)	(0.479)	(0.548)	(0.539)
BOCR	-0.0541	-0.0046	0.0050	0.0063	0.0037
	(0.321)	(0.787)	(0.731)	(0.652)	(0.799)
GDP	-0.1603***	-0.0348*	-0.0322*	-0.0296	-0.0308*
	(0.002)	(0.064)	(0.096)	(0.118)	(0.096)

IR	-0.0935*	-0.0401	-0.0513	-0.0559	-0.0463
	(0.050)	(0.254)	(0.154)	(0.122)	(0.191)
COVID_DUM2	-2.5555***	-0.5629*	-0.6772*	-0.5545	-0.5537
	(0.000)	(0.098)	(0.056)	(0.116)	(0.107)
CCI	-1.5392*	-2.6910***			
	(0.060)	(0.000)			
GEI	-3.3434***		-1.4413**		
	(0.000)		(0.039)		
RQI	1.0620			-1.4049*	
	(0.228)			(0.079)	
RLI	2.5223**				-1.9501**
	(0.033)				(0.014)
PSAVTI	0.7767*	-0.1816	-0.5293	-0.6058*	-0.4077
	(0.091)	(0.610)	(0.105)	(0.066)	(0.236)
VAI	-1.0719*	0.6031	0.0866	0.2737	0.4670
	(0.057)	(0.208)	(0.847)	(0.649)	(0.416)
C	-0.3071	5.7764***	5.8202***	6.1793***	6.1975***
	(0.842)	(0.000)	(0.000)	(0.000)	(0.000)
F-stat / Wald Chi^2	9.38	43.57	20.26	23.44	26.66
Probability	0.000	0.000	0.0163	0.0052	0.0016
R^2	0.2335	0.4605	0.4068	0.3962	0.4004
Breusch-Pagan, chi^2	45.65***				
	(0.000)				
Wooldridge, chi^2	93.570***				
	(0.000)				
Pesaran (20015) CD	6.295***				
	(0.000)				

Note(s): *, **, and *** denote associations that are significant at the 10%, 5%, and 1% levels of significance, respectively.

In Models 7 and 10, CCI and RLI are found statistically significant at 1% and 5% levels of significance, respectively, and the resulting coefficients of CCI and RLI in this group are higher than those in high-income countries. These findings signify that control of corruption and the rule of law are more effective in controlling the level of NPLs in upper-middle-income countries than in high-income countries. The negative associations between GEI in model-8 and RQI in model-9 are found statistically significant at 5% and 10% levels of significance, respectively, and those findings represent that GEI and RQI are less effective in controlling the level of NPLs in this group than in high-income countries. Although the coefficient of PSAVTI in each model is negative, like in high-income countries, it is found significant at a 10% significance level, unlike the high-income group in model-9. The positive association between VAI and the level of NPLs in this group is statistically insignificant, like the high-income group. The significant association between country governance indicators and the level of NPLs proves the significance of external dependence on the banking sector, as explained by **the Resource Dependence Theory** (Pfeffer & Salancik, 1978).

4.4 Measurement of Association in Lower-middle-income Countries

This part represents the impacts of the country governance indicators on the level of NPLs in lower-middle-income countries. Model-11 is developed under OLS estimation but fails to overcome the Breusch-Pagan test for heteroskedasticity and the Wooldridge test for first-order serial correlation at a 1% significance level**.** Moreover, Pesaran's (2015) cross-sectional dependence is significant at a 1% significance level. Although VIF values of all the independent variables are below five, the correlation matrix for this group shows that RLI has a statistically significant high degree of positive correlation with CCI and GEI. So, to ensure greater robustness in the estimation, model-12 and 13 are developed under PCSE estimation and presented in Table 5. Both models found BCA and BOCR statistically insignificant, explaining the changes in NPLs in high-income and upper-middle-income countries. In contrast, the positive association between BCI ratio and the level of NPLs is statistically significant at a 5% level significance compared to marginally significant in high-income countries and insignificant in upper-middle-income countries. This finding shows that if the bank-to-income ratio increases, which indicates operating inefficiency, the level of NPLs will increase. This significant positive association states that increased operating efficiency at the bank level in lower-middle-income countries can significantly reduce NPLs.

Table 5. Regression outputs of lower-middle-income countries

Particular	**OLS**	**PCSE estimation**	
	M-11	**M-12**	**M-13**
BCA	0.0354	-0.0813	-0.0884
	(0.728)	(0.209)	(0.239)
BCI	0.0103	0.0497**	0.0515**
	(0.700)	(0.020)	(0.016)
BOCR	0.6540***	-0.0054	-0.0766
	(0.004)	(0.980)	(0.730)
GDP	-0.2543***	-0.1005**	-0.1053**
	(0.003)	(0.010)	(0.012)
IR	0.0827	0.1440**	0.1638**
	(0.227)	(0.035)	(0.019)
COVID_DUM2	-0.5980	-0.3634	-0.3812
	(0.490)	(0.576)	(0.571)
CCI	-0.8162	1.8533***	
	(0.476)	(0.003)	
GEI	-1.1953	-0.3288	
	(0.336)	(0.735)	
RQI	-3.5132***	0.2228	
	(0.001)	(0.824)	
RLI	7.1625***		2.3479**
	(0.000)		(0.013)
PSAVTI	-2.2232***	-0.9053*	-0.8868*
	(0.000)	(0.060)	(0.051)
VAI	0.1203	-0.0053	-0.6909
	(0.838)	(0.992)	(0.188)
C	4.2572**	5.6944***	4.9605***
	(0.014)	(0.000)	(0.000)

F-stat / Wald Chi^2	7.80	40.95	49.40
Probability	0.000	0.000	0.000
R^2	0.2121	0.6154	0.5495
Breusch-Pagan, chi2	26.45		
	(0.000)		
Wooldridge, chi^2	9.466		
	(0.005)		
Pesaran (20015) CD	3.233		
	(0.001)		

Note(s): *, **, and *** denote associations that are significant at the 10%, 5%, and 1% levels of significance, respectively.

The GDP growth rate, which is found statistically significant at 1% and 10% levels of significance in high-income and upper-middle-income countries, respectively, is found statistically significant at a 5% level of significance in this group. The significant negative association means that increased GDP significantly reduces the level of NPLs of the banks in this group. The insignificant negative association between IR and the level of NPLs in high-income and upper-middle-income countries has turned positive in lower-middle-income countries, but the resulting association is statistically insignificant. The negative association between COVID-19 and the level of NPLs, which is found significant in high-income and marginally significant in upper-middle-income countries, becomes statistically insignificant in lower-middle-income countries, meaning that although the level of NPLs in lower-middle-income countries reduces during COVID-19 period, this reduction is not statistically significant.

The significant negative association between CCI and the level of NPLs in high-income and upper-middle-income countries has turned into a positive one, and the association is significant at a 1% significance level in lower-middle-income countries. The exact change in the nature of the association between RLI and the level of NPLs in this group and the positive association is significant at a 5% significance level. Table 2 shows that lower-middle-income countries have the lowest average value for CCI (negative), which denotes a high level of corruption. The resulting statistical association characteristically means that improvement in control of corruption and rule of law will enhance the level of NPLs in lower-middle-income countries, which is against the findings for high-income and upper-middle-income countries. The significant positive association between CCI and RLI and the level of NPLs can be explained by the **Collective Action Theory** and **Legal Theory of Finance,** respectively. Our descriptive statistics (in Table 2) show that lower-middle-income countries have the lowest average value for CCI (negative), which denotes a high level of corruption and the weakest form of control in this regard. The **Collective Action Theory** explains that corruption resists anti-corruption activities when the level of corruption is very high in some countries, where an individual rationalises his/her corruption based on what other people do in the same situation. Similarly, the average value of RLI is negative (a weak form of RLI) and lower than high-income and upper-middle-income groups. The **Legal Theory of Finance** states that enforcement of faulty financial rules deteriorates the financial stability of the banking sector.

Eventually, this study finds that enforcing weak laws and rules in this group of countries increases the level of NPLs, and little improvement in RLI will not be fruitful in controlling the level of NPLs in lower-middle-income countries.

The other three country governance indicators, PSAVTI, VAI, and GEI, are negatively associated with the level of NPLs in this group. However, only PSAVTI is found statistically significant at a 10% significance level, which means that improvement in the political stability and absence of violence or terrorism index can marginally reduce NPLs in lower-middle-income countries. The insignificant positive association between VAI and the level of NPLs in high-income and upper-middle-income countries has turned into an insignificant negative association in lower-middle-income countries, which shows that improvement in VAI can reduce NPLs in this group but is not statistically significant. Furthermore, the significant negative association between RQI and the level of NPLs in high-income and upper-middle-income countries becomes insignificant positive in lower-middle-income countries, which signifies that regulatory policies are not functioning to control the level of NPLs in this group.

4.5 Comparative Findings and Implication of the Study

The significant negative impact of CCI, GEI, RQI, and RLI on the level of NPLs in high-income and upper-middle-income countries is consistent with the findings of Cerulli et al. (2020) and Schiantarelli et al. (2020) (for RLI), with the findings of Forson et al. (2022) for GEI and RQI, with the findings of Ghosh et al. (2023) for CCI, GEI, RQI, RLI and with the findings of Ozili (2018) for RQI, GEI, RLI. However, the associations of CCI, RQI, and RLI with the level of NPLs are negative in high-income and upper-middle-income countries and positive in lower-middle-income countries. The positive association between CCI and the level of NPLs is consistent with the findings of Ozili (2018) but inconsistent with the findings of Ghosh et al. (2023). The negative association of PSAVTI with the level of NPLs is significant in Ozili (2018). Still, it has become insignificant in high-income countries and marginally significant in lower-middle-income countries. The insignificant positive association between VAI and the level of NPLs in high-income and upper-middle-income countries is found to be statistically insignificant negative in lower-middle-income countries.

The regression analysis clearly shows that although a country's governance plays a substantial role in controlling the level of NPLs in the banking sector, the impacts of country governance indicators are equally influential in controlling the level of NPLs in those groups of countries. A country's income-generating capability in this regard can play a significant role. While policymaking at the country level regarding the control of NPLs in the banking sectors, various countries need to think differently about applying country governance indicators as a controlling mechanism. Moreover, as lower-middle-income countries are suffering from higher levels of NPLs (shown in Table 2), the significant positive associations of CCI and RLI with the level of NPLs demands an in-depth investigation on why improvement in some country governance indicators blowbacks to control the level of NPLs of the banks in lower-middle-income countries.

5. Conclusion

This study aims to measure the impacts of country governance indicators on the level of NPLs in high-income, upper-middle-income, and low-middle-income countries. From the regression analysis, we find that country governance indicators, such as CCI, GEI RQI, and RLI, negatively affect the level of NPLs in high-income and upper-middle-income countries, and the associations are statistically significant. However, CCI and RLI backfire in lower-middle-income countries, showing significant positive associations between CCI and RLI and the level of NPLs. Moreover, PSAVTI, found insignificant in high-income countries, is marginally significant in upper-middle-income and lower-middle-income countries. Furthermore, GEI and RQI, which are significant in explaining the changes in the level of NPLs in high-income and upper-middle-income countries, become statistically insignificant in lower-middle-income countries. Our findings represent that the country's governance plays a significant role in controlling the level of NPLs in high-income and upper-middle-income countries but not in lower-middle-income countries. That is, the role of country governance in controlling the level of NPLs differs among these three groups of countries. We want to note that this study uses country-level data from the World Bank. The researchers can explore the relationship between the country's governance and the level of NPLs using individual bank-level data for bank-specific factors for different kinds of banks (i.e., private, public, commercial, and Islamic banks). They can also examine the moderating impact of the country's income level on those associations. The findings of this study have practical implications in policy formulation at the national level for the financial sector development in different countries.

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Authors contributions

Mr. Protap Kumar Ghosh was responsible for writing the introduction, literature review, data analysis and empirical findings. Dr. Fakarudin Bin Kamarudin was responsible for the methodology and conclusion. Dr. Saira Binti Kharuddin was responsible for revising the text, and improving discussion and references.

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Appendix

Table A1. represents the VIF test outputs of each group of countries for multicollinearity diagnostic

High-income		**Upper-middle-income**		**Lower-middle-income**	
Variables	**VIF**	**Variables**	**VIF**	**Variables**	**VIF**
RLI	13.67	RLI	7.4	RLI	4.88
GEI	10.24	GEI	4.37	CCI	4.33
CCI	6.83	RQI	4.09	GEI	3.19
RQI	6.17	CCI	3.64	BOCR	2.48
VAI	2.62	VAI	2.85	RQI	2.39
BCI	1.77	PSAVTI	1.98	BCI	1.8
PSAVTI	1.59	BCI	1.75	VAI	1.76
BOCR	1.45	BOCR	1.42	PSAVTI	1.48
IR	1.33	IR	1.2	BCA	1.33
COVID_DUM2	1.12	GDP	1.19	IR	1.29
GDP	1.09	COVID_DUM2	1.17	GDP	1.26
BCA	1.04	BCA	1.04	COVID_DUM2	1.21
Mean VIF	4.08	Mean VIF	2.67	Mean VIF	2.28

Note(s): The VIF test is done after OLS estimation to check the level of multicollinearity among the regressors, and the presence of multicollinearity has been double-checked, developing multiple correlation matrices for each group.

Table A2. Correlation matrix of the independent and control variables

High-income countries												
Variables	**CCI**	**GEI**	**RQI**	**RLI**	**PSAVTI**	**VAI**	**BCA**	**BCI**	**BOCR**	**GDP**	**IR**	**COVID_ DUM2**
CCI	1											
GEI	**0.882*****	1										
RQI	**0.797*****	**0.884*****	1									
RLI	**0.899*****	**0.922*****	**0.896*****	1								
PSAVTI	0.508***	0.509***	0.487***	0.504***	1							
VAI	0.522***	0.499***	0.554***	0.623***	0.423***	1						
BCA	-0.007	-0.056	-0.068	-0.061	-0.036	-0.111***	1					
BCI	0.135***	0.156***	0.130*	0.186***	-0.002	0.498***	-0.097**	1				
BOCR	-0.174***	-0.280***	-0.250***	-0.266***	-0.038	-0.004	0.027	0.282***	1			
GDP	0.009	0.016	0.007	0.002	0.017	-0.019	0.025	-0.063	0.006	1		
IR	-0.150***	-0.288***	-0.216***	-0.272***	-0.017	-0.126	0.034	-0.102**	0.331***	0.116**	1	
COVID_DUM2	-0.006	-0.037	-0.019	-0.024	-0.063	0.049	0.101	0.115**	-0.027	-0.248***	-0.002	1
Upper-middle-income countries												
	CCI	**GEI**	**RQI**	**RLI**	**PSAVTI**	**VAI**	**BCA**	**BCI**	**BOCR**	**GDP**	**IR**	**COVID_ DUM2**
CCI	1											
GEI	**0.737*****	1										

RQI	0.616***	**0.735***	1									
RLI	**0.825***	**0.807***	**0.781***	1								
PSAVTI	0.566***	0.414***	0.379***	0.640	1							
VAI	0.513***	0.373***	0.652***	0.624	0.484***	1						
BCA	-0.109***	-0.095*	-0.104**	-0.142	-0.090	-0.121**	1					
BCI	-0.068	-0.272***	-0.137**	-0.083	0.132**	0.233***	0.046	1				
BOCR	-0.136**	-0.211***	-0.175***	-0.166	-0.033	-0.072	0.090	0.490***	1			
GDP	-0.029	0.012	0.063	-0.031	-0.071	-0.052	-0.090	-0.025	0.033	1		
IR	-0.041	-0.181***	-0.243***	-0.182	-0.067	-0.251***	0.048	0.109***	0.204***	0.088	1	
COVID_DUM2	0.085*	0.048	0.032	0.089*	0.051	0.025	0.012	-0.085*	-0.099*	-0.351***	-0.071	1
Lower-middle-income countries												
	CCI	**GEI**	**RQI**	**RLI**	**PSAVTI**	**VAI**	**BCA**	**BCI**	**BOCR**	**GDP**	**IR**	**COVID_ DUM2**
CCI	1											
GEI	0.656***	1										
RQI	0.408***	0.550***	1									
RLI	**0.831***	**0.709***	0.525***	1								
PSAVTI	0.455***	0.308***	0.196***	0.345***	1							
VAI	0.474***	0.401***	0.568***	0.505***	0.110*	1						
BCA	0.003	0.022	0.153**	-0.046	0.253***	-0.017	1					
BCI	-0.225***	-0.316***	-0.001	-0.301***	-0.122**	-0.018	-0.091	1				
BOCR	-0.132**	-0.396***	0.101*	-0.201***	0.080	0.097	0.255***	0.561***	1			
GDP	-0.005	0.088	0.004	0.080	0.078	-0.022	-0.016	0.032	-0.058	1		
IR	-0.204***	-0.265***	-0.263***	-0.107*	-0.124**	-0.141**	0.068	0.003	0.201***	-0.032	1	
COVID_DUM2	-0.038	0.037	-0.006	-0.023	0.018	-0.009	0.025	-0.054	-0.090	-0.373***	0.031	1

Note(s): *, **, and *** denote correlation coefficients are significant at 10%, 5%, and 1% levels of significance, respectively.