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The Role of Non-Performing Asset, Capital, Adequacy and Insolvency Risk on Bank Performance: A Case Study in Indonesia

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Abstract

The study examines the impact of bank-level factors like non-performing assets, capital adequacy, and insolvency risk on bank performance. This study employs a quantitative method with panel data regression. The data was taken from the annual financial statements of state-owned commercial banks and private commercial banks in Indonesia from 2015 to 2019 using a purposive sampling method with a total sample of 470 observations. The result of the study shows that non-performing assets (NPA) have a significant negative impact on bank performance. Capital adequacy has a significant negative impact on bank performance. Insolvency risk for a bank means it cannot repay its depositors because its liabilities are greater than its assets; therefore, it has a significant impact on bank performance. This study is expected to help banks to understand how to manage the risks they face and to maintain their performance. This study uses 'size' and 'age of bank' as control variables and for credit risk and insolvency risk, *Z*-Score is used.

Keywords: Bank Performance, Non-Performing Asset, Capital Adequacy, Insolvency Risk

JEL Classification Code: D22, D24, G01, G21, G32

1. Introduction

The banking system plays an important role in the modern economic world. Banks collect the savings of the individuals and lend them out to a business. Thus, the banks play an important role in the creation of new capital (or capital formation) in a country and thus help the growth process. A bank can accept different types of deposits such as current deposits, recurring deposits, savings, and fixed deposits. Banks use depositors' money to make loans. The amount of interest the banks collect on the loans is greater than the amount of interest they pay to customers with savings accounts—and the difference is the banks' profit (Singh, 2015). The functions of banks include the payment system, financial intermediation, and financial services (Al-Qudah, 2020; Shah et al., 2020).

Banks are a financial intermediary—that is, an institution that operates between a saver who deposits money in a bank and a borrower who receives a loan from that bank. Digitization is becoming the norm for credit processes. Credit management is one of the most critical functions of any business. Advances in technology have transformed the credit management process in recent years making it more efficient and easier to manage. Many banks have made credit processes easier through digitization (Chabachib et al., 2020). However, the ease and speed provided turns out to have its own risk where the loan interest is higher than the average bank credit interest; the higher the interest, the higher the credit risk. With higher interest rates, interest payments on loans are more expensive. Therefore, this discourages people from borrowing and spending. People who already have loans will have less disposable income because they spend more on interest payments (Rahman et al., 2020).

Credit risk refers to the risk of default or non-payment or non-adherence to contractual obligations by a borrower.

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The revenue of banks comes primarily from interest on loans and accordingly, loans form a major source of credit risk. The credit risk can be examined using the non-performing asset (NPA) ratio, which is expressed as a percentage of total advances. It gives us an idea of how much of the total advances is not recoverable. Thus, the NPA ratio is a reflection of the overall bank efficiency and performance (Bawa et al., 2019; Chabachib et al., 2019). The NPA has a direct impact on the bank's profitability, liquidity, and equity. The increased NPAs put pressure on the recycling of funds and reduces the ability of banks for lending more and thus results in lesser interest income. Thus, the increased incidence of NPAs not only affects the performance of the banks but also affects the economy as a whole (Pasha & Srivenkataramana, 2014).

In addition to the NPA, the bank's credit risk can be examined through the bank's capital adequacy ratio (CAR). CAR is the ratio of a bank's capital in relation to its risk-weighted assets and current liabilities. It is decided by central banks and bank regulators to prevent commercial banks from taking excess leverage and becoming insolvent in the process. A bank with a high CAR is considered to be above the minimum requirements needed to suggest solvency. Generally, a bank with a high capital adequacy ratio is considered safe and likely to meet its financial obligations (Dabo et al., 2018). In the banking sector, insolvency risk means the probability that the bank can no longer fulfill its financial obligations to depositors. The most common cause of bank failure occurs when the value of the bank's assets falls to below the market value of the bank's liabilities, which are the bank's obligations to creditors and depositors (Tan, 2016). Based on various risks faced by banks, this study aims to analyze and determine the role of non-performing assets (NPA), capital adequacy, and insolvency risk on the bank's performance measured by three ratios: Return on Asset (ROA), Return on Equity (ROE), and Net Interest Margin (NIM).

2. Literature Review

Caldararo (2013) stated "Banks are generally considered by most people to be utilities that allow the transmission of value daily in modern society; however, banks also seem to create devastating events such as a credit crisis. This is one of the reasons why it is necessary to save or protect banks during economic and financial crises" (p.1). Banks cannot avoid providing loans as this is one of the services that generate the largest income for banks. Short-term borrowing has often been blamed for precipitating financial crises. Institutions like banks that want to enhance their ability to provide liquidity and credit to high-risk borrowers have to borrow short-term. Thus, the increasing illiquidity of the investment being financed (or the deteriorating credit quality of borrowers) necessitates short-term financing and causes the susceptibility to crises (bankruptcy or insolvency).

Various risks faced by banks must be managed properly to reduce the amount of loss that may be caused (Chabachib et al., 2019). Based on the risk management theory, risk refers to situations where the possible consequences of decisions that have been made or may be taken are unknown. That is the likelihood of variation in the occurrence of an event, which may have either positive or negative consequences. Risk management in banking is theoretically defined as the logical development and execution of a plan to deal with potential losses. Usually, the focus of the risk management practices in the banking industry is to manage an institution's exposure to losses or risk and to protect the value of its assets (Tursoy, 2018).

2.1. Hypothesis Development

2.1.1. The Effect of Non-Performing Assets (NPAs) on Bank Performance

A non-performing asset (NPA) is a loan or advance for which the principal or interest payment remained overdue for a specified period, usually 90 days (Dawn, 2018). The increase of non-performing assets is always a problem to the banks and it has a direct impact on the profitability of banks. A high level of non-performing assets (NPA) will affect the net worth of a bank as it is required to maintain the required level of capital adequacy. The NPA level is measured using the ratio of Gross NPA (GNPA) and Net NPA (NNPA), both of which have a negative impact on bank performance. Several studies conducted using the NPA as an independent variable were found to have a significant negative impact on bank performance. Pervez and Bansal (2019) examined the impact of the bank's capital and risk on the performance of Indian banks. It was found that the capital adequacy ratio (CAR) had a negative relationship with the performance of the banks.

NNPA negatively impacted banks' profitability and productivity. The rapid increase in the NPA has impacted lending capacity as well as the profitability of the banks. Kumari et al. (2017) examined the relationship between NPAs and financial performance (ROA) of selected public and private-sector banks. Their results revealed that there is a significant and positive impact of GNPA on the financial performance of the Indian banking sector. Similarly, NNPA has the same impact on the financial performance of the Indian banking sector. Overall, the study found a positive and significant impact of NPAs on the financial performance of banks. Singh (2015) also found a negative relationship between Net NPA and bank ROA in India which is also in accordance with the results of a study conducted by Gnawali (2018) who examined the impact of NPA on banks' (public and private banks) profitability (measured by ROA and ROE).

The results showed a negative impact of NPA on banks' performance. The result showed that the higher the NPAs, the lower the banks' profitability. Based on the explanation above, the following are the hypotheses that can be formulated:

H1a: *Gross Non-Performing Asset (GNPA) has a significant and negative relationship with ROA of State-Owned Commercial Banks and National Private Commercial Banks.*

H1b: *Gross Non-Performing Asset (GNPA has a significant and negative relationship with ROE of State-Owned Commercial Banks and National Private Commercial Banks.*

H1c: *Gross Non-Performing Asset (GNPA has a significant and negative relationship with NIM of State-Owned Commercial Banks and National Private Commercial Banks.*

H1d: *Net Non-Performing Asset (NNPA) has a significant and negative relationship with ROA of State-Owned Commercial Banks and National Private Commercial Banks.*

H1e: *Net Non-Performing Asset (NNPA) has a significant and negative relationship with ROE of State-Owned Commercial Banks and National Private Commercial Banks.*

H1f: *Net Non-Performing Asset (NNPA) has a significant and negative relationship with NIM of State-Owned Commercial Banks and National Private Commercial Banks.*

2.1.2. The Effect of Capital Adequacy Ratio (CAR) on Bank Performance

CAR is the ratio of a bank's capital in relation to its risk-weighted assets and current liabilities and indicator of the bank's ability to cover its decline in assets as a result of bank losses caused by risky asset (Wahyudi, Nofendi, Robiyanto, & Hersugondo, 2018). It is decided by central banks and bank regulators to prevent commercial banks from taking excess leverage and becoming insolvent in the process. It can be used as a measure of financial performance or the strength and financial stability of a bank. Olalekan and Adeyinka (2013) showed a positive and significant relationship between capital adequacy and profitability of financial institutions in Nigeria (Kyule, 2015). This shows that capital adequacy is a prerequisite for the financial health of the bank. A minimum CAR is critical is to make sure that banks have enough cushion to absorb a reasonable amount of losses before they become insolvent and consequently lose depositors' funds. The capital adequacy ratios ensure the efficiency and stability of a nation's financial system by lowering the risk of banks becoming insolvent.

Generally, a bank with a high capital adequacy ratio is considered safe and likely to meet its financial obligations. According to the risk-return trade-off theory, a higher risk is associated with a greater probability of higher return and lower risk with a greater probability of smaller return. This trade-off which an investor faces between risk and return while considering investment decisions is called the risk-return trade-off. The theory claims that an optimal capital structure is the objectively best mix of debt, preferred stock, and common stock that maximizes a company's market value while minimizing its cost of capital. The higher the company's debt, the higher the value indicated by the value of the company's shares. However, too much debt increases the financial risk to shareholders and the return on equity that they require.

In reality, a continuous increase in debt will not increase the firm value because it increases the risk of the company which leads to declining company performance. In accordance with the previous researches, CAR was found to have a significant negative relationship with ROE and NIM (Tan & Anchor, 2016). Million et al. (2015) found a significant negative relationship between CAR and ROE. Similarly, Li and Zou (2014) also found a negative relationship between CAR and ROA and ROE. Alshatti (2015) also found a negative relationship between CAR and ROA and ROE in commercial banks in Jordan.

H2a: *Capital Adequacy has a significant and negative relationship with the ROA of State-Owned Commercial Banks and National Private Commercial Banks.*

H2b: *Capital Adequacy has a significant and negative relationship with the ROE of State-Owned Commercial Banks and National Private Commercial Banks.*

H2c: *Capital Adequacy has a significant and negative relationship with NIM of State-Owned Commercial Banks and National Private Commercial Banks.*

2.1.3. The Effect of Insolvency Risk on Bank Performance

Insolvency or bankruptcy occurs when a bank cannot fulfill its obligations in its operations. It also implies that the cost of funds is greater than the profit. The bank cannot pay its debts as they fall due, even though its assets may be worth more than its liabilities. The bank ends up owing more than it owns or is owed to them; this means its assets are worth less than its liabilities. Therefore, this situation leads to insolvency for banks (Tursoy, 2018). Insolvency risk, in this study, is measured using the *Z*-Score ratio by Altman for emerging markets. The higher the *Z*-Score results, the healthier and more stable the bank is. Thus, bank performance will also increase. Chotalia (2014) measured the financial health of private sector banks with the help of the Altman *Z*-score model and concluded that the private sector banks which are under study fall in 'Grey Zone' as per *Z*-score criteria and there is the possibility of financial distress in some private sector banks.

Tan and Floros (2014) who used the *Z*-Score as a risk indicator found a significant and positive relationship between the ROA and ROE as the indicators of profitability in the banking industry. Besides, Fang et al. (2019) contributed to the empirical literature on bank profitability by testing

the joint-impact of different types of risk, competition in different banking markets, and different types of efficiency on bank profitability using a sample of commercial banks from 2003–2017. They found that there is a positive relationship between bank profitability, cost efficiency, banking sector development, stock market development, and inflation in China. They also found that the positive impact of cost efficiency on profitability is stronger when banks undertake higher levels of risk and face more competition. The study found that the insolvency risk had a positive relationship with bank performance as measured by ROA and NIM.

H3a: *Insolvency risk has a significant and positive relationship with the ROE of State-Owned Commercial Banks and National Private Commercial Banks.*

H3b: *Insolvency risk has a significant and positive relationship with the ROE of State-Owned Commercial Banks and National Private Commercial Banks.*

H3c: *Insolvency risk has a significant and positive relationship with NIM of State-Owned Commercial Banks and National Private Commercial Banks.*

2.1.4. Bank Age and Bank Size as Control Variables

Age is the length of time when something already exists. The age of a company refers to the number of years of establishment (Ilaboya & Ohiokha, 2016). Bank age also refers to the total number of years the bank has been operating (Kumari et al., 2017).

Several empirical studies illustrate the importance of age in company performance, which confirmed a significant and positive relationship between company age and profitability (Ilaboya & Ohiokha, 2016). Bank size can be seen from the total number of assets (in Rupiah) the bank has each year. A negative relationship between company size and profitability was confirmed. When an organization gets larger, bureaucracy increases and will cause strong resistance and ultimately reduce the rate of profit (Ilaboya & Ohiokha, 2016). However, some studies revealed the opposite (Menicucci & Paolucci, 2016).

3. Research Methods and Materials

3.1. Definition Operational Variable

This study used three independent variables: non-performing assets (NPA), capital adequacy, and insolvency risk; two control variables consisting of bank size and bank age; as well as one dependent variable namely bank performance measured using the ratio of ROA, ROE, and NIM. Non-performing assets (NPA) refers to assets or loans that stop generating income in the form of interest and the number of principal loans to banks (Riyazuddin, 2019). The NPA is also known as non-performing loans (NPL). NPA refers to loans or advances that are in default or arrears. A loan is in arrears when principal or interest payments are late or missed (Bag & Islam, 2017). NPAs can be classified as sub-standard assets, doubtful assets, or loss assets, depending on the length of time overdue and the probability of repayment. In this study, the NPA is measured by two ratios: Gross NPA (GNPA) and Net NPA (NNPA). Banks can either keep the NPAs in their books in the hope that they may be able to recover it or make provisions for it. The system of identification of NPA should be on an ongoing basis. Banks should also make provisions for NPAs so that the income and expenditure and the P&L account and balance sheet for the year end reflects the provision made for NPAs. They will be elaborated as follows:

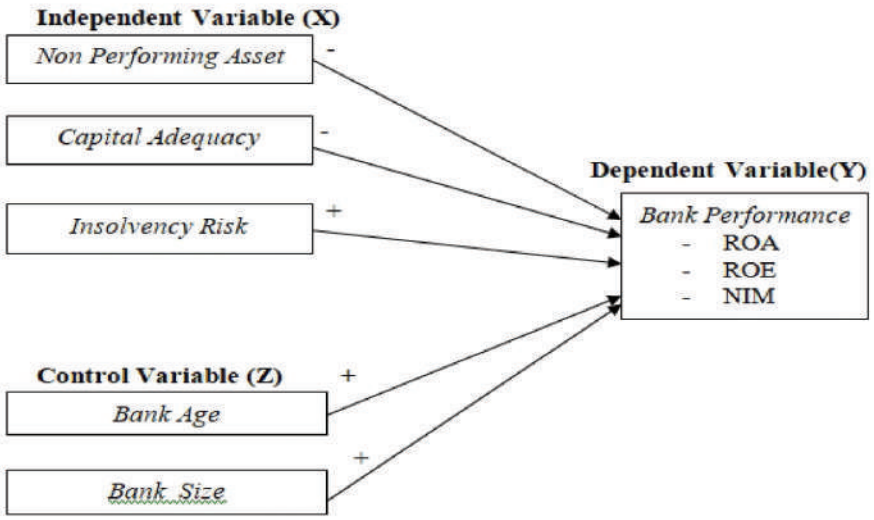

Figure 1: Theoretical Framework

Gross NPA (GNPA): The amount of non-performing loans included in the substandard, doubtful, and loss category (Kumari et al., 2017). The Gross NPA can be calculated as follows:

$$\text{Gross NPA} = \frac{\text{Gross NPA}}{\text{Total Loans}}$$

Net NPA (NNPA): The amount of non-performing loans in the substandard, doubtful, and loss category of the subtracted by credit provision (Kumari et al., 2017). The Net NPA can be calculated as follows:

$$\text{Net NPS} = \frac{\text{Gross NPA} - \text{Provisions}}{\text{Total Loans} - \text{Provisions}}$$

The GNPA ratio is a ratio that reflects the quality of loans made by banks. While the Net NPA ratio is a ratio that reflects the overall loan quality. NNPA is a better indicator of the health of the bank (Shaban, 2018).

Bank capital is the difference between a bank's assets and its liabilities, and it represents the net worth of the bank or its equity value to investors. Capital Adequacy' is therefore the statutory minimum capital reserve that a financial institution or investment firm must have available and regulatory capital adequacy provisions thus require relevant firms to maintain these minimum levels of capital, calculated as a percentage of its risk-weighted assets (Udom & Eze, 2018). Capital Adequacy Ratio (CAR), also known as Capital to Risk-Weighted Asset Ratio, measures the financial strength of a bank using its capital and assets. The ratio measures a bank's financial stability by measuring its available capital as a percentage of its risk-weighted credit exposure (Ullah & Bagh, 2019).

Insolvency is the state of being unable to pay the debts, by a person/company at maturity. The insolvency risk of a company could be indicated as a probability that the company would be insolvent within the next 12 months (Rochon et al., 2017). A *Z*-score is a numerical measurement that describes a value's relationship to the mean of a group of values. It gives you an idea of how far from the mean a data point is. Based on the objectives of this study, *Z*-Score was used to measure the distance of a bank from bankruptcy. The *Z*-Score is used as an indicator of insolvency risk because it is the best indicator in terms of stability, where the *Z*-Score is an inverse proxy of bankruptcy risk. Therefore, it could be assumed that the *Z*-Score would have a positive relationship with bank profitability (Manousaridis, 2017).

Altman's *Z*-Score model is a numerical measurement that is used to predict the chances of a business going bankrupt in the next two years. The estimated *Z*-Score is a modified version of the Altman *Z*-Score developed in 2002 and has been widely used to assess the risk of service industries including retail, banking, and financial institutions. The EM *Z*-Score model used is a model for non-manufacturing and emerging markets. By applying the *Z*- score model and EM score model a business' bankruptcy can be predicted. Both models can completely predict the sign of a possible bankruptcy that may occur and is effective when two years of information were used than one year (Ghosh & Adhikari, 2018). The model can be explained as follows:

$$Z = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4 + 3.25$$

Where,
X_1 = (current assets - current liabilities) / total assets
X_2 = retained earnings / total assets
X_3 = income before interest and tax / total assets
X_4 = market value of equity / total debt

3.2. Sampling

The population used in this study is banking companies classified as a State-Owned Commercial Bank and a National Private Commercial Bank in Indonesia from 2015 to 2019. Both State-Owned and Private Commercial Banks had the following characteristics:

1. It is not an Islamic bank
2. Has complete annual reports from 2015–2019

Based on the characteristics mentioned above, the number of banks that could meet the criteria were 94 banks, consisting of 29 state-owned commercial banks and 65 national private banks.

3.3. Analysis Method

The hypotheses were tested using panel data regression analysis by dividing them into three research models based on each dependent variable, as follows:

$$\text{ROA} = \alpha + \beta\text{GNPA} + \beta\text{NNPA} + \beta\text{CAR} + \beta\text{INSOLVENCY} + \beta\,\text{SIZE} + \beta\,\text{AGE} + \beta\,\text{DUMMY} + \varepsilon$$

$$\text{ROE} = \alpha + \beta\text{GNPA} + \beta\text{NNPA} + \beta\text{CAR} + \beta\text{INSOLVENCY} + \beta\,\text{SIZE} + \beta\,\text{AGE} + \beta\,\text{DUMMY} + \varepsilon$$

$$\text{NIM} = \alpha + \beta\text{GNPA} + \beta\text{NNPA} + \beta\text{CAR} + \beta\text{INSOLVENCY} + \beta\,\text{SIZE} + \beta\,\text{AGE} + \beta\,\text{DUMMY} + \varepsilon$$

Where,
ROA : return on total assets
ROE : return on shareholder equity
NIM : total net interest income-total interest costs to total earning assets
α : constant
β : coefficient

i : cross-sectional dimension
ε : error
GNPA : total gross NPA to total loans
NNPA : total gross NPA minus the provision
CAR : capital to risk-weighted assets
INSOLVENCY : insolvency risk measured by *Z*-score using (current assets – current debt) / total assets, retained earnings / total assets, income before interest and taxes / total assets, and the book value of equity/total debt.
SIZE : total assets owned by the bank
AGE: bank age
DUMMY : the variable that explains the difference between a state-owned commercial bank and a private commercial bank, where 1 refers to a private commercial bank and 0 is a state-owned commercial bank.

4. Result and Discussion

The data used in this study was panel data. It refers to a combination of time series data and cross-section. Based on the results of descriptive statistical analysis, there are 470 observations obtained from 94 samples from the five-year study period (2015 to 2019). Table 1 explains that the GNPA and NNPA are indicators of measuring NPA that show the ability of banks to manage credit risk. Based on 470 observations from 94 banks, it shows that the average GNPA and NNPA are 2.53% and 1.61%, where these values show the average level of the banks' NPAs/NPLs for five years. This indicated that overall, banks were able to manage their credit risk well because the level of problem loans was still within normal limits. However, the maximum value of GNPA is 15.8% and NNPA is 10.6% which were considered high, and that banks have too many loans that have become non-functional or are not rendering any interest income to the bank. The minimum value of GNPA and NNPA is 0, indicating that the banks were able to manage their assets well and they do not face credit risk from the assets included in the loans provided by the banks.

The CAR refers to the capital adequacy ratio which critical in ensuring that banks have enough cushion to absorb a reasonable amount of losses before they become insolvent and consequently lose depositors' funds. Based on Basel III, the capital adequacy ratio must be in the range of 12% to 14%. In the table above, the maximum value of CAR is 145.81%, and the minimum value is 3.21%. This minimum value is far below Basel III's CAR requirement. The CAR with a value of 3.21% is the capital adequacy ratio of IBK Indonesia Bank in 2019. The insolvency risk in this study was measured using a *Z*-Score – an inverse proxy of bankruptcy risk. A higher *Z*-score indicated that the bank was getting healthier. The average insolvency measured by the *Z*-Score is 5.44, which indicated that the research objects were healthy banks. The highest *Z*-Score is of CCB Bank in 2017 which is 14,833, while the lowest *Z*-Score is of Bank Trust Indonesia in 2015, which is 0.991.

The dependent variables in this study are ROA, ROE, and NIM which have an average of 1.29, 7.47, and 5.44 respectively. An average ROE of 7.47 shows that the bank benefited from its ability to manage existing equity of 7.47%. An average NIM of 5.44 shows that the bank gets a net interest profit of 5.44% from each of its productive assets. A higher NIM showed that the management of the bank's productive assets was good, indicated by a high-interest income. This study used both bank size and bank age as control variables. Bank size was examined using the natural logarithm of total assets, while the bank age was examined from the year the bank was established until the year of the study period.

4.1. The Effect of Bank Size and Bank Age on Bank Performance

Partially, the bank size as a control variable has an insignificant positive relationship with ROA and ROE, but it has a significant negative relationship with NIM. The bank age has a significant positive relationship with ROA, ROE, and NIM. It showed that the longer the bank was established, the higher the performance it had.

Table 1: Analysis of Descriptive Statistics

Variable	N	Average	Median	Maximum	Minimum	Standard Deviation
GNPA	470	2.531366	2.2	15.8	0	2.343634
NNPA	470	1.555368	1.295	10.6	0	1.491416
CAR	470	25.52864	21.13	145.81	3.21	15.90798
INSOLVENCY	470	5.214436	4.9285	14.833	0.991	1.445467
ROA	470	1.291936	1.69	5.1	–73	4.007801
ROE	470	7.46617	8.345	34.1	–83.79	14.87094
NIM	470	5.444532	5.12	18.02	0.24	2.155665
SIZE	470	30.56112	30.517	36.423	26.166	1.642532
AGE	470	41.79787	46	123	5	19.2728

Table 2: Results of Random Effect Panel Data Regression (ROA)

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
C	–2.495499	4.384586	–0.569153	0.5695
AGE	0.032007	0.013359	2.395819	0.0170
SIZE	0.052229	0.145232	0.359624	0.7193
CAR	–0.000621	0.016395	–0.037889	0.9698
GNPA	–0.285511	0.105413	–2.708490	0.0070
NNPA	0.072679	0.167683	0.433428	0.6649
INSOLVENCY	0.406468	0.176049	2.308827	0.0214
DUMMY	–0.926257	0.520720	–1.778801	0.0759
Effects Specification				
			S.D.	Rho
Cross-section random			1.455891	0.1517
Idiosyncratic random			3.443026	0.8483
Weighted Statistics				
R-squared	0.080591	Mean dependent var.		0.938747
Adjusted *R*-squared	0.066661	S.D. dependent var		3.596617
S.E. of regression	3.474673	Sum squared resid		5577.889
F-statistic	5.785243	Durbin-Watson stat		2.441170
Prob(*F*-statistic)	0.000002			
Unweighted Statistics				
R-squared	0.131364	Mean dependent var		1.291936
Sum squared resid	6543.690	Durbin-Watson stat		2.080871

4.2. The Effect of Non-Performing Asset (NPA) on Bank Performance

The results of the hypothesis testing for NPA variables measured by GNPA show a significant negative relationship with ROA and ROE, both with and without control variables, but a significant positive relationship with NIM. Therefore, hypotheses 1a and 1b can be supported empirically on all models. The results of this study are in accordance with research conducted by Kumari et al. (2017) who found a significant negative relationship between GNPA and NNPA and bank performance measured by ROA. The results of this study support the results of the studies conducted by Dawn (2018). Hypothesis 1c is rejected because there is no significant negative relationship between GNPA and NIM in the existing model. This insignificant result is consistent with the research conducted by Manu and Maheshwari (2018).

The results of hypothesis testing for NPA variables measured by NNPA show a significant negative relationship with ROA, ROE, and NIM in all existing models. Thus, hypothesis 1d, 1e, and 1f are supported empirically. The results of this study are consistent with Kumari et al. (2017) who examined the relationship between NPA and the performance of banks in the Indian banking industry. They found a significant negative relationship between GNPA and NNPA and ROA in private banks. Besides, these results also support Pervez and Bansal (2019) who used NNPA as an indicator to measure credit risk and found a significant negative relationship with NIM in the Indian banking industry. The results of this study also support researches conducted by Singh (2015) and Dawn (2018).

This study also considered several models by including control variables and without control variables. The following is the results of several panel data regression models for each dependent variable:

4.3. The Effect of Capital Adequacy on Bank Performance

The second hypothesis testing related to capital adequacy measured by the capital adequacy ratio (CAR) has a negative relationship with bank performance. This research finds no significant negative relationship between CAR and ROA, thus, hypothesis 2a is rejected. These results are consistent with Alshatti (2015) who used capital adequacy as an indicator to measure the credit risk and found an insignificant relationship between CAR and ROA in commercial banks in Jordan. However, there is a significant negative relationship with ROE in model 5 without control variables. Therefore, hypothesis 2b is supported empirically. Further, there is a significant negative relationship with NIM, both with and

without the control variable. Therefore, hypothesis 2c is supported empirically. The results of this study are consistent with the study by Tan and Anchor (2016) who examined the impact of risk and competition on bank profitability in China. The results of this study confirmed that there is a significant negative relationship between the CAR and ROE and NIM. Besides, Pervez and Bansal (2019) had found a significant negative relationship between CAR and ROE in banks in India. This study also supported the results of research conducted by Getahun et al. (2015) and Million et al. (2015).

Table 3: Results of ROA Panel Data Regression Test

Variable	1st Model	2nd Model	3rd Model	4th Model	5th Model	6th Model	7th Model	8th Model	9th Model	10th Model
SIZE	0,052 (0,36)	0,114 (0,728)	0,051 (0,353)	0,062 (0,425)	0,063 (0,666)					
AGE	0,032 (2,396)**	0,038 (2,637)*	0,036 (2,646)*	0,036 (2,573)**	0,032 (2,33)**					
CAR	–0,001 (–0,038)	0,024 (1,681)***				0,015 (1,081)				–0,012 (–0,763)
GNPA	–0,286 (–2,708)*		–0,294 (–3,655)*				–0,297 (–3,654)*			–0,280 (–2,648)*
NNPA	0,073 (0,433)			–0,274 (–2,132)**				–0,284 (–2,187)**		0,0524 (0,312)
Insolvency	0,406 (2,309)**				0,471 (3,209)*				0,506 (3,420)*	0,509 (2,960)*
Dummy	–0,926 (–1,779)***	–0,847 (–1,477)	–6,686 (–1,296)	–70,709 (–1,309)	–1,009 (–1848)***	–1,473 (–2,612)*	–1,29 (–2,556)**	–1,315 (–2,551)**	–1,580 (–3,067)*	–1,437 (–2,922)*
R	0,081	0,037	0,062	0,043	0,055	0,015	0,042	0,024	0,038	0,064
Adjusted *R*	0,067	0,029	0,054	0,035	0,047	0,011	0,038	0,020	0,034	0,054
F-statistic	5,785	4,595	7,679	5,269	6,775	3,629	10,176	5,792	9,308	6,378
Prob (*F*-statistic)	0,000002	0,001402	0,000005	0,000371	0,000026	0,027294	0,000047	0,003275	0,000109	0,000010

Note: *t*-statistic values are in brackets; *, **, *** sequentially represent a significance level of 1%, 5%, 10%.

Table 4: Results of ROE Panel Data Regression Test

Variable	1st Model	2nd Model	3rd Model	4th Model	5th Model	6th Model	7th Model	8th Model	9th Model	10th Model
SIZE	0,514 (0,907)	0,804 (1,304)	0,765 (1,388)	0,899 (1,567)	0,796 (1,335)					
AGE	0,108 (1,937)***	0,136 (2,223)**	0,127 (2,356)**	0,122 (2,141)**	0,117 (1,953)***					
CAR	–0,106 (–1,864)***	0,009 (0,172)				–0,019 (–0,378)				–0,142 (–2,569)**
GNPA	–2,438 (–7,642)*		–2,286 (–9,004)*				–2,297 (–8,953)*			–2,430 (–7,607)*
NNPA	0,599 (1,179)			–1,874 (–4,404)*				–1,875 (–4,355)*		0,582 (1,145)
Insolvency	1,639 (2,660)*				1,623 (2,991)*				1,752 (3,183)*	1,975 (3,249)*
Dummy	–8,510 (–3,853)*	–8,546 (–3,521)*	–7,991 (–3,685)*	–8,264 (–3,676)*	–9,451 (–3,964)*	–10,984 (–4,601)*	–10,454 (–5,00)*	–10,714 (–4,959)*	–11,819 (–5,183)*	–10,44 (–4,98)*
R	0,223	0,068	0,211	0,111	0,087	0,045	0,188	0,088	0,068	0,21
Adjusted *R*	0,211	0,060	0,204	0,104	0,079	0,041	0,185	0,084	0,064	0,202
F-statistic	18,967	8,503	31,025	14,579	11,141	11,098	54,206	22,474	17,046	24,693
Prob (*F*-Statistic)	0,000000	0,000001	0,000000	0,000000	0,000000	0,000020	0,000000	0,000000	0,000000	0,000000

Note: *t*-statistic values are in brackets; *, **, *** sequentially represent a significance level of 1%, 5%, 10%.

Table 5: Results of NIM Panel Data Regression Test

Variable	1st Model	2nd Model	3rd Model	4th Model	5th Model	6th Model	7th Model	8th Model	9th Model	10th Model
SIZE	–0,179 (–2,373)**	–0,185 (–2,465)**	–0,175 (–2,295)**	–0,166 (–2,163)**	–0,174 (–2,297)**					
AGE	0,015 (1,577)	0,021 (2,214)**	0,020 (2,067)**	0,019 (2,063)**	0,019 (1,948)***					
CAR	–0,017 (–2,801)*	–0,005 (–1,027)				–0,005 (–0,954)				–0,016 (–2,735)*
GNPA	0,064 (2,181)**		0,029 (1,184)				0,029 (1,189)			0,071 (2,381)**
NNPA	–0,079 (–1,671)***			–0,031 (–0,757)				–0,043 (–1,068)		–0,098 (–2,064)**
Insolvency	0,225 (3,421)*				0,122 (2,165)**				0,128 (2,256)	0,226 (3,429)*
Dummy	–2,023 (–5,109)*	–1,915 (–4,908)*	–1,963 (–4,851)*	–1,945 (–4,833)*	–2,026 (–5,076)*	–2,152 (–5,669)*	–2,192 (–5,555)*	–2,174 (–5,533)*	–2,235 (–5,778)*	–2,170 (–5,647)*
R	0,113	0,087	0,083	0,82	0,092	0,067	0,064	0,064	0,073	0,098
Adjusted *R*	0,099	0,079	0,075	0,75	0,084	0,063	0,060	0,060	0,069	0,088
F-statistic	8,426	11,073	10,538	10,449	11,729	16,700	16,042	16,032	18,509	10,105
Prob (*F*-statistic)	0,000000	0,000000	0,000000	0,000000	0,000000	0,000000	0,0000000	0,000000	0,000000	0,000000

Note: *t*-statistic values are in brackets; *, **, *** sequentially represent a significance level of 1%, 5%, 10%.

4.4. The Effect of Insolvency Risk on Bank Performance

The third hypothesis testing related to insolvency risk as measured by the *Z*-Score indicator is found to have a significant positive relationship on each model, both with and without control variables with performance as measured by ROA, ROE, and NIM. This showed that the higher the *Z*-Score, the healthier the bank. Then, hypothesis 3a, 3b, and 3c are supported empirically. The results of this study support the study conducted by Tan and Floros (2014) who used the *Z*-Score as an indicator of risk measurement and found a significant positive relationship between insolvency risk and ROA and ROE in the Chinese banking industry. Besides, the results of this study also support Tan and Anchor (2016) who confirmed that there was a significant positive relationship between insolvency risk measured by using *Z*-Score and the profitability of commercial banks in China measured by ROA.

Further, research conducted by Shair et al. (2019) was in line with this study where there was a significant positive relationship between insolvency risk and ROA, ROE, and NIM in the Pakistani banking industry. This implied that with the control variables and independent variables used in this study, the performance of private commercial banks was lower than that of the state-owned commercial banks. The results of this study are consistent with the results of research conducted by Ekinci and Poyraz (2019) who found that credit risk, liquidity risk, and bank capital variables have an impact on bank profitability. The results indicated a significant negative relationship between private banks, especially foreign private banks, and the performance of banks in Turkey However, these results are contradictory to the results of research conducted by Pervez and Bansal (2019) who showed that the performance of private and foreign banks is better compared to public sector banks in India.

5. Conclusion

The results of this study indicated that the non-performing asset (NPA), as a whole, has a negative effect on the bank performance (measured by ROA, ROE, and NIM) of both State-Owned Commercial Banks and Private Commercial Banks. The NPA was measured using two ratios - GNPA and NNPA. However, GNPA was found to have no significant relationship with ROA. From these results, it can be concluded that the higher the level of problem loans, the lower the bank performance. Further, capital adequacy was found to have a significant and negative relationship with ROE and NIM, while no relationship was found with ROA. This indicated that the higher the CAR, the lower the ROE and NIM. This study finds that insolvency risk has a significant and positive relationship with ROA, ROE, and NIM for both State-Owned Commercial Banks and Private Commercial Banks. By using the *Z*-Score as an indicator of insolvency risk measurement

(an inverse proxy of insolvency or bankruptcy risk), it was found that a higher *Z*-Score value indicates that the bank would have a better level of health. The results of this study confirm that the level of bank health has a positive influence on bank performance. Therefore, the healthier the bank, the higher the ROE, ROE, and NIM generated.

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