Credit Risk and Commercial Bank Performance: Evidence from ASEAN

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Abstract

This study aims to examine the relationship between credit risk and the performance of commercial banks in the ASEAN (Association of Southeast Asian Nations) region. 113 commercial banks across Malaysia, Singapore, Thailand, Philippines, and Vietnam are covered for analysis purposes. The study quantifies the credit risk using three commonly seen metrics i.e. capital adequacy ratio, loan to deposit ratio, and non-performing loan. Capital adequacy ratio and loan to deposit ratio could present the riskiness of the funding strategy of banks, while non-performing loan represents the overall customer payments past due as the potential result of risk-taking behaviour. Panel data analysis covering the years 2016-2020 for the above-mentioned bank sample is employed in examining the relationships. The result indicates that all the above metrics have a significant relationship with commercial bank performance, proxied by return on equity and return on assets, largely consistent with the underlying expectations. While the risk-taking behaviour may enhance the return measure of profitability, it would at the same time expose a bank to the downside risk as reflected by a higher level of non-performing loans. The study could provide empirical evidence to the managers and regulators in the region for a better understanding of banks' risks in formulating better policies to foster prudent management and decision making.

Keywords: Credit Risk, Bank Performance, Capital Adequacy, Non-Performing Loan, ASEAN

Introduction

Commercial banks act as financial intermediaries that grant loans, accept deposits and also provide basic financial products. They offer customers different types of loans and create liquidity (Chen et al., 2019). The functions of banks are crucial and may lead to economic collapse or decline. Banks may face the risk of debt default due to credit risk, that is, borrowers fail to repay as required (Al-Yatama et al., 2020). The main cause of the 2007 global financial crisis was the massive credit losses suffered by financial institutions, due to excessive risk exposures (Kusi et al., 2017). The recent coronavirus pandemic (COVID-19) has drastically impacted overall economic trends, including the banking sector. The performance of ASEAN commercial banks started to slow down in 2020. Policy measures adopted by the ASEAN (Association of Southeast Asian Nations) economies would alleviate some negative influences due to COVID-19, but they may not mitigate the profound growth of recession or credit risks in most industries (see Moody's Investors Service, 2020). The outbreak had caused uncertainties in financial markets and triggered capital outflows. The purpose of this study is

to investigate the relationship between credit risk and the performance of commercial banks in the ASEAN in the interest of understanding long-term sustainability. This paper makes use of the common credit risk measurements to evaluate their impacts on bank-level performance in the region. By contributing to the still limited research covering the region, the findings of this study may further raise the awareness and understanding of the importance of credit risk management towards bank performance.

Credit risk can be interpreted as the risk caused by the inability to pay for all or a major portion of the principal amount and profits initially provided, or the risk of not being able to gain back profit from bank investments. Banks must ensure that their creditors fulfil their obligations to reduce the possibility of losses on uncollectible loans that may lead to bankruptcy (Abu-Alrop and Kokh, 2020). Al Zaidanin (2020) indicates that the risks of financial institutions are not specific as the risks faced by the financial sector are diverse. These financial risks may include credit risk, operational risk, exposure risk, investment risk, interest risk, and market risk. Credit risk is identified as the main risk in banking institutions, being the degree to which the value of debt instruments or derivatives changes due to debtors' and counterparties' credit value variation, and can be evaluated by bank loans. Bank management needs to assess the financial condition of the borrower before the loan, excessive reliance on collateral, and the ability of banks to pursue fines on the borrower. Celik (2019) indicates that the concept of credit risk analysis can be defined as the concept of assessing the risk in the credit transaction. Credit risk measurement is crucial for a financial institution in making its credit decisions. It will affect future impairment, capital requirements, and profits of an institution. Among studies that find a significant negative association between credit risk and the performance of banks are such as by (Anwar and Murwaningsari, 2019; Vellanita et al., 2019; Saleh and Winarso, 2021). While the importance of credit risk has widely been recognised in the current literature of banking system, it is now becoming more relevant and crucial in the period of uncertainty, complicated by various challenging factors but not limited to the ongoing pandemic impacts, geopolitical risk, increasing cost of borrowing, inflation risk, and potential recession. Some even worry that the rising mortgage defaults and non-performing loan (NPL) levels in the banking sector that creates the credit market uneasy in China may lead to another Lehman-like crisis, and eventually cause a global financial instability. The world may need to understand credit risk now more than ever.

In the research about the impact of credit risk on financial performance of Chinese banks, Isanzu (2017) suggests that credit risk management has improved due to the use of prudent techniques in reducing the negative impact of credit risk on bank financial performance in the past few years. The study also discovers that NPL and capital adequacy ratio (CAR) as the credit risk indicators have a significant consequence on financial performance. Therefore, managers should focus more on improving CAR to have a better financial performance and reduce NPL. Another research by Al-Eitan and Bani-Khalid (2019) reveals that credit risk has a negative and significant impact on return on assets (ROA) and return on equity (ROE) of 13 commercial banks in the Amman Stock Exchange. Focusing on the rural banks in Bandung City, the study by Saleh and Winarso (2021) shows that NPL and loan to deposit ratio (LDR) have an influence on the profitability of a rural bank overall, with NPL having a highly significant effect on ROA of rural banks in Bandung. Abu-Alrop and Kokh (2020) conduct a research on 85 Russian commercial banks and discover that credit risk has an impact on the performance indicators. Credit risk contributed 51% to the formation of performance indicators in the case of ROA and 50% in the case of ROE. Vellanita et al (2019) also examine the relationship between CAR, LDR and NPL towards ROE at Bank Central Asia.

The findings of the research indicate that CAR, LDR and NPL have a strong and substantial negative influence on ROE.

CAR is a core indicator of a bank's financial strength and consists of types of financial capital that are considered the most reliable and liquid. Isanzu (2017) suggests that the ratio has a positive and significant impact on the ROA. Besides, Anwar and Murwaningsari (2019) find the same as the CAR is used to bear the risk of loss that the bank may face. Credit risk is the probability of loss triggered by the debtor's default. The higher the CAR, the greater the bank's ability to bear credit or yield asset risk. If the CAR value is high, the bank can fund its operating activities and contribute significantly to profitability. On the other hand, a research by Vellanita et al. (2019) investigates that CAR has a strong and significant negative effect on bank profitability which examines in ROE. Therefore, this study hypothesizes that there is a significant relationship between capital adequacy and the financial performance of commercial banks in ASEAN. Other the other hand, LDR describes the extent to which banks use depositors' money to provide loans to customers (Ali, 2017). LDR can be used as an intermediary to measure the performance of a bank, which is an institution that connects those who have excess funds with those who need funds. LDR is used to evaluate the liquidity of a bank by dividing the amount of credit provided by the bank by the third-party funds. Vellanita et al. (2019) state that LDR has a negative and significant impact on the ROE as the higher the bank-channelled credit, the lower the profitability of the bank. Another study reveals that total capital deposited in the form of credit that the bank can collect can be used to measure the LDR value of the financial institution. The increment in LDR may not necessarily cause the funds paid to third-party funds higher. It suggests that LDR may not affect bank performance (Saleh and Winarso, 2021). Therefore, this study hypothesized that there is a significant relationship between loan to deposit and the financial performance of commercial banks in ASEAN.

The researcher considered the NPL ratio as one of the most crucial indicators of bank credit risk and loan quality. A lower ratio indicates better asset quality and lower risk of suspicious loans; thus, an institution with low credit risk will have better financial performance (Isanzu, 2017). According to the findings by Wood and Skinner (2018), the LDR, ROA, credit growth, and reserve ratio have a significant relationship with NPL. Nowadays, the global banking environment is highly competitive, excessively flexible credit rationing policies may also be the primary cause for the high rate of NPL. This is significant for the going concern and profitability of financial institutions thereby banks need to focus more on credit risk management from different aspects. The global economic level of NPL will be affected by the financial and economic crisis. The study by Al-Eitan and Bani-Khalid (2019) suggests that NPL has a negative and significant impact on ROA and ROE. In fact, the level of loan losses has a negative impact on bank profitability, indicating that NPL reflects credit risk. The smaller the NPL, the smaller the credit risk that the bank bears. Similarly, under the study of Anwar and Murwaningsari (2019), they consider that credit risk is derived from various credits that fall into the NPL aspect. The existence of NPL in a certain amount will reduce the stability of the bank. Another study by Isanzu (2017) shows a similar, indicating that a high level of NPL reduces the bank's profitability. A lower NPL ratio indicates lower credit risk, thus rising the financial performance of banks with lower asset quality and doubtful loans. Therefore, this study hypothesized that there is a significant relationship between NPL and the financial performance of commercial banks in ASEAN.

The main objective of this study is to investigate the relationship between credit risk and the performance of commercial banks in the ASEAN markets. The bank performance is

measured using ROA and ROE, while the credit risk is measured using CAR, LDR and NPL. This study carried out is to determine the importance of the impact of credit risk on the stability of the ASEAN financial industry. By providing additional empirical evidence in the Southeast Asian region, it is hoped that this study will contribute to a deeper understanding of various credit risk impacts to the banking system. Specifically, the study can be helpful to commercial banks in identifying which variables have a significant impact on the performance of banks in order to derive some useful guidance before issuing loans. It provides relevant information and understanding to enable banks to respond and improve their management systems by strengthening loan oversight and providing consulting services to customers. Besides, this study can be useful to researchers as it helps to improve their banking research framework, especially between risk management and bank performance. Investigating credit risk is a continuing effort in promoting sustainability of banking stability, encompassing developing and developed economies. Furthermore, this research provides important information for the ASEAN regulators that assists in achieving national bank management goals, thereby promoting financial stability. Therefore, the policymakers will be able to predict and estimate the credit risk level of their banking system, thus managing the risk of NPL through improving loan quality. The variable measurements and descriptions, model specifications and data sources will be discussed in the next section. The following section discusses the results whereas the final section concludes with a summary of findings and related implications.

Data and Methodology

In this research, the secondary data from a total of 113 commercial banks from five ASEAN countries, including Malaysia, Singapore, Thailand, Philippines, and Vietnam, is collected to investigate the impacts of credit risk on performance in the region. This is after excluding five banks due to the financial year end changes. Data of the constituents for five consecutive years starting the year 2016 to the year 2020 is collected. A total of 565 observations is thus available. There are 26 banks from Malaysia, 30 from the Philippines, 16 from Singapore, 13 from Thailand and 28 from Vietnam. The data used is retrieved from the annual reports, Thomson Reuters Datastream, World Development Indicators and Department of Statistics Malaysia. Figure 1 indicates the conceptual framework of this study. The dependent variable of this research focuses on the performance of commercial banks. Return on assets (ROA) is one of the ratios used to evaluate the profitability of the bank's status. A higher ratio of ROA indicated better financial performance (Isanzu, 2017). Besides, return on equity (ROE) will also be taken as the measurement of financial performance in banks' ability to obtain profits. It can be used to reflect the bank's profitability and stability by measuring bank net income after tax with its own capital to show the efficiency of the use of bank capital (Vellanita et al., 2019). Both the ROA and ROE are commonly used to measure bank profitability (see Bagh et al., 2017; Nwude and Okeke, 2018; De Leon, 2020). Profitability performance is a revealing indicator of a bank's competitive position in the banking market and its management quality. For the independent variables, capital adequacy ratio (CAR), loan to deposit (LDR) and non-performing loans (NPL) are selected as the credit risk measurement to examine the performance of banks. They are suitable and relevant for the selected study region and have available data sources according to reporting standards in examining the impact of credit risk on bank financial performance (Al-Eitan and Bani-Khalid, 2019).
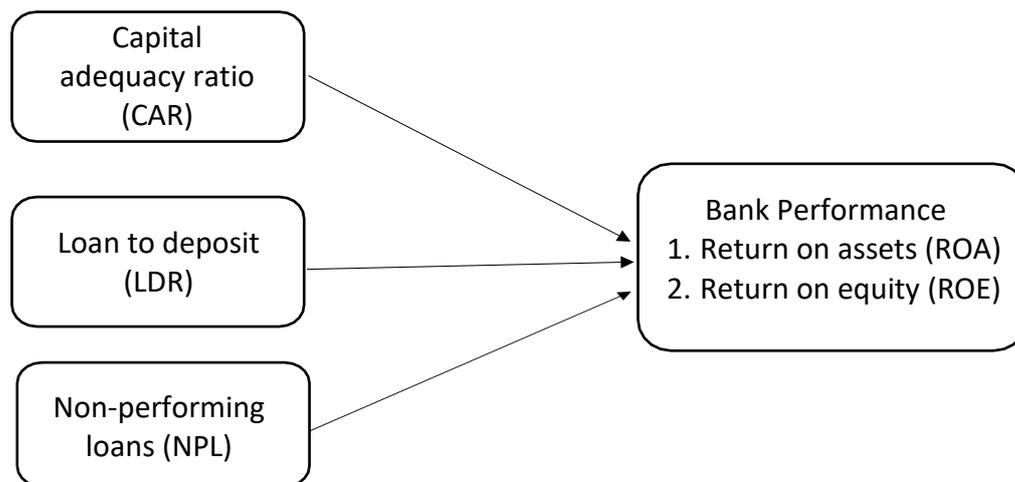
Figure 1: Conceptual Framework on the relationship between credit risk and bank performance

ROA represents the bank-generated net income level and determines how the bank uses its assets to generate profits over time. It is calculated as a percentage of net income and total assets. It provides their investors a clearer view of the effectiveness of a company in converting its invested funds into net income. The increase gives an impact on the company's profitability, then increases in the profitability enjoyed by shareholders (Ali, 2017; Saleh and Winarso, 2021). As it reflects the return on all assets' funding generated by the company, it shows the level of efficiency through the company's return on equivalent total assets. When total assets are equal to the sum of debt and equity, ROA will indicate the extent to which a company can convert its borrowings into profits (Dao and Nguyen, 2020). ROE is a common method for determining the effectiveness of bank revenue generation based on various elements of shareholder equity. It is calculated as a percentage of net income to shareholders' equity. The higher ratio in ROE indicates that the bank has a good utilization of its equity capital. However, it may also indicate that the company has high leverage and debt amount. Banks with higher leverage could have a lower ROA but a higher ROE. Most banks have developed significant financial leverage in order to improve the competitiveness of ROE (Al-Eitan and Bani-Khalid, 2019). A higher return on equity may also contribute to a higher stock value in terms of valuation.

Capital adequacy refers to the amount of the commercial bank's equity and reserves that hold against its risky assets. CAR determines a bank's ability to withstand a reduction in the capital on reserve to sustain a certain amount of losses before they become insolvent. Central banks and bank regulators will be deciding to control CAR to avoid commercial banks from taking on excessive debt and getting into insolvency. It is used to estimate the health by evaluating the bank's equity capital's ability to respond to emergency events. It shows the bank's capability to sustain losses or confront financial risks. Banks with higher CAR will have a higher ability in handling financial risks (Irawati et al., 2019). CAR serves as the basis for assessing the prospects of relevant banks for continuous operations and shows the amount of capital that is needed by the bank to meet their need and cover operating expenses. Bank capital as a business entity should be used to secure against the possibility of losses caused by variations in bank assets that may be mainly driven by third-party loans such as community

funds (Anwar and Murwaningsari, 2019). It is a ratio that indicates the ability of a bank to use its own capital to deal with credit risks (Baldwin et al., 2019). The ratio can be calculated from the bank's capital to its risk-weighted assets. Customers will be considering the ratio of capital adequacy as it is used to evaluate the level of security and the bank's ability to return funds.

LDR is a common statistical performance indicator used to assess a bank's liquidity and reflects the bank's fund use policy. It shows the ratio between the total amount of credit provided by the bank and the third-party funds received by the bank (Ali, 2017; Ayem and Wahyuni, 2017). The third-party funds include savings, time deposits, and certificates of deposit excluding interbank lending. The credit service amount provided will be the total credit allowable excluding credit to other banks. The higher the LDR indicates the riskier the bank's liquidity condition, however, the lower the LDR indicates the lack of effectiveness of the bank in providing credit. The ratio can be determined by comparing the bank's total loans with its total deposits, indicating the percentage of the credit portfolio derived from third-party funds. Any increment in this ratio indicates that the loan amount of the bank increases more than the amount of deposit value and the bank uses more funds for loans. This situation may reflect the poor liquidity of banks (Wood and Skinner, 2018). However, banks' loanable funds are not only derived from deposits. When the amount of loan higher indicates that the value of the bank's assets value will be higher as the interest on the loan may increase bank income. Normally, LDR ranges between 50% and 75% (Fahruri, 2017). If the ratio is too high, the bank may not have enough liquidity to cope with any unexpected funding needs or economic crisis. If it is too low, the bank may not be earning an optimal return.

Banks' credit defaults are usually related to the issues in NPL (Isanzu, 2017). NPL refers to credit repayments that cannot be collected in accordance with credit agreements. Since the debtor is unable to repay the principal and interest, failure in credit repayment will result in deferred payment. Credit risk also known as default risk derived from diverse credits that fall under the category of NPL. High amounts of NPL will increase the financial risk and reduce the creditworthiness of the relevant banks. The credit risk level of NPL can be used to assess the degree to which banks' productive assets can satisfy existing problematic loans (Anwar and Murwaningsari, 2019). Uncertainty in the repayment of the credit or outstanding payment of the borrowers on loans agreement will increase the credit risk of the financial institution. The credit risk measurement can be carried out for multiple periods to observe the variation of the company's liquidity over time. By calculating the amount of NPL, the liquidity ratio can be assessed. NPL are caused by deliberate factors, or they may be caused by the unfulfilled obligations of debtors. NPL refers to the total amount of loans in which commercial banks not able to collect debt for at least 90 days and 180 days of repayment for consumer loans. The NPL ratio compare the amount of NPL to the total amount of outstanding loans (Saleh and Winarso, 2021). It evaluates the portion of the total amount of outstanding loans that are non-performing or suspicious in the bank's loan portfolio. It assesses a bank's ability to collect loan repayments and the quality of its loans.

As we need to find out the relationship between credit risk and profitability of commercial banks, regression analysis will be used to test the proposed hypotheses. For credit risk indicators, CAR, LDR and NPL will be taken as independent variables while profitability indicators, ROA, and ROE will be taken as dependent variables. The models involved in this study are as follows:

$$ROA_{it} = \beta_0 + \beta_1\, CAR_{it} + \beta_2\, LDR_{it} + \beta_3\, NPL_{it} + \varepsilon \qquad (1)$$
$$ROE_{it} = \beta_0 + \beta_1\, CAR_{it} + \beta_2\, LDR_{it} + \beta_3\, NPL_{it} + \varepsilon \qquad (2)$$

Where ROA is return on assets, ROE is return on equity, CAR is capital adequacy ratio, LDR is loan to deposit ratio, NPL is non-performing loan, β_n is the coefficient of respective independent variables, and ε is standard error. i denote firms and t denotes time. ROA is calculated as a percentage of net income to total assets. ROE is calculated as a percentage of net income to shareholders' equity. CAR can be measured by dividing bank capital with risk-weighted assets. LDR is measured by dividing total credit with a total deposit of the bank. NPL is measured by dividing non-performing loans by total loans. Our sample data consists of observations across firms and over time. As such, this study applies panel data regressions in estimating the relationship between bank performance and credit risk indicators. Panel data integrates the aspects of the two into one model by collecting data from multiple identical items over time. When comparing time-series data to cross-sectional data, the usage of panel data offers showed some of their advantages. They increase the degree of freedom and the number of views to increase the intensity of the test. Table 1 shows the summary of descriptive statistics involving the number of observations, minimum, maximum, mean, and standard deviation values of the studied variables.

Table 1
Descriptive statistics

	N	Minimum	Maximum	Mean	Standard Deviation
CAR	565	7.20	31.98	15.996	3.7787
LDR	565	0.04	2.01	0.845	0.2646
NPL	565	0.00	9.07	1.895	1.3262
ROA	565	-2.54	2.99	0.925	0.5519
ROE	565	-4.54	28.94	9.307	5.3775

Findings and Discussion

The correlation matrix suggests that there are some significant relationships among the sets of tested variables (see Table 2). The performance measures of ROA and ROE indicate a strong correlation of 0.71. Meanwhile, there are significant relationships found between the dependent variables and credit risk measures in this study. However, no multicollinearity problem seems to exist as the only significant correlation among the pairs of independent variables is just 0.20. Table 3 presents the result of independent variables' variance inflation factor (VIF), a measure of the degree to which the estimated regression coefficient is inflated because of collinearity. The values of VIF of the independent variables are relatively small and close to 1, thus again suggesting no evidence of multicollinearity issue among the tested variables.

Table 2
Correlation matrix

Variables	CAR	LDR	NPL	ROE	ROA
CAR	1.0000				
LDR	0.0180	1.0000			
NPL	-0.0250	0.2040**	1.0000		
ROE	-0.250**	0.0250	-0.1240**	1.0000	
ROA	0.083*	0.0920*	-0.0350	0.7050**	1.0000

** denotes significance at the 0.01 level.
* denotes significance at the 0.05 level.

Table 3
Tolerance and VIF values

Independent Variables	Collinearity Statistics	
	Tolerance	VIF
CAR	0.999	1.001
LDR	0.958	1.044
NPL	0.958	1.044

Heteroscedasticity is commonly encountered in cross-sectional data. It should be avoided in regression analysis to ensure the reliability of the T-test and F-test. The variance is no longer constant and varies from observation to observation if the assumption of homoscedasticity is not satisfied. One of the suggested ways to test for homoscedasticity is through the Breusch-Pagan-Godfrey test. The computed F-statistic's p-value needs to be above the significance level of 0.05 to accept the null hypothesis that no significant difference in its error variance. The p-values of F-statistics are found to be 0.06 and 0.19, suggesting no heteroscedasticity issue in the test. Autocorrelation is a data analysis that represents the relationship between values of the same variable based on related objects. One of the classical linear regression model's assumptions is that the error term at one time is uncorrelated to the error term at another time or any other error term in the past. The Breusch-Godfrey Serial Correlation LM test shows that the p-values of the F-test and chi-square test are both above the significance level of 0.05, being 0.1859 and 0.1841 for ROA and 0.0893 and 0.0879 for ROE. It fails to reject the null hypothesis and suggests no autocorrelation occurs for these variables.

Multiple panel data regression analysis is an extension of simple linear regression used to examine the relationship between two or more variables. In the study, the independent variables will be used to explain the changes in the dependent variables. To select a reliable regression analysis between pooled model and the random effects model, the Breusch-Pagan LM test can be applied to determine how the data could be poolable. Breusch-Pagan LM test for random effects model based on pooled OLS residuals, while estimation of the alternative model involves generalized least squares either based on a two-step procedure or maximum likelihood. The result in Table 4 shows all three types of test hypotheses having a low p-value that is below 0.05, suggesting that the random effects model is preferable instead of the pooled model.

Table 4
Breusch-Pagan LM test

Lagrange Multiplier Test for Random Effects			
	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	571.7307	4.790387	576.5211
	(0.0000)	(0.0286)	(0.0000)

As the Breusch-Pagan LM test indicates that the random effects model is more appropriate over the pooled model, the Hausman test is carried out to detect possible endogenous regressors in the regression model. Ordinary least squares estimators will be unreliable if a model occurs to be endogenous, as OLS assumes no correlation between a predictor variable and the error term. Thus, the detection of endogenous is important in

deciding the more suitable regression method. The Hausman test can determine whether the fixed effects model or the random effects model is more proper to be adopted in the analysis. Table 5 shows a p-value of the Hausman test on ROA at 0.0583 and a p-value of ROE at 0.2415. Both the p-values are greater than 0.05, suggesting that the random-effects model is more appropriate over the fixed-effect model for further regression analysis in this study.

Table 5
Hausman test

Test cross-section random effects: ROA			
Test Summary	Chi-sq. Statistic	Chi-sq. d.f.	Prob.
Cross-section random	7.473135	3	0.0583

Test cross-section random effects: ROE			
Test Summary	Chi-sq. Statistic	Chi-sq. d.f.	Prob.
Cross-section random	4.192042	3	0.2415

Table 6 presents the regression result of CAR, LDR and NPL on the ROA, while Table 7 presents the regression result on ROE. R-squared is the coefficient of determination that represents the proportion of variance in the dependent variable explained by one or more independent variables in the regression model. Multiple regression with numbers of independent variables requires adjustment of the R-squared to compare the descriptive power of regression models of diverse numbers of predictors. The values closer to 1 is being more it fits, and values closer to 0 is being less it fits. According to the regression analysis on ROA, the values of R-squared and adjusted R-squared are 0.7112 and 0.7086 respectively. The value of R-squared in 0.7112 implies that 71.12% of the variation in return on assets of commercial banks of ASEAN can be explained by the chosen explanatory variables in this model. For regression analysis on ROE, the values of R-squared and adjusted R-squared are 0.7098 and 0.7072 respectively. The value of R-squared in 0.7098 implies that 70.98% of the variation in return on equities of commercial banks of ASEAN can be explained by the chosen explanatory variables in this model.

Table 6
Random effects model regression result on ROA

Dependent Variable: ROA				
Total panel (balanced) observations: 565				
Variables	Coefficient	Std. Error	t-statistic	Prob.
C	0.541942	0.161909	3.347193	***0.0009
CAR	0.002927	0.006984	0.419077	0.6753
LDR	0.513147	0.119685	4.287489	***0.0000
NPL	-0.051285	0.017138	-2.992485	***0.0029
Weighted Statistics				
Root MSE	0.288869	R-squared		0.711184
Mean dependent var	0.245118	Adjusted R-squared		0.708600
S.D. dependent var	0.295777	S.E. of regression		0.289897
Sum squared resid	47.14667	F-statistic		8.703467
Durbin-Watson stat	1.856773	Prob (F-statistic)		0.000012

Note: *, **, *** denotes rejection of null hypothesis at 10%, 5% and 1% significance level.

Table 7
Random effects model regression result on ROE

Dependent Variable: ROE				
Total panel (balanced) observations: 565				
Variables	Coefficient	Std. Error	t-statistic	Prob.
C	13.02321	1.561614	8.339584	***0.0000
CAR	-0.335237	0.067974	-4.931880	***0.0000
LDR	3.251346	1.153796	2.817956	***0.0005
NPL	-0.580668	0.167885	-3.458714	***0.0006
Weighted Statistics				
Root MSE	2.857306	R-squared		0.709760
Mean dependent var	2.628800	Adjusted R-squared		0.707162
S.D. dependent var	2.979833	S.E. of regression		2.867474
Sum squared resid	4612.771	F-statistic		16.02175
Durbin-Watson stat	1.915376	Prob (F-statistic)		0.000000

*Note: *, **, *** denotes rejection of null hypothesis at 10%, 5% and 1% significance level.*

Both F-statistics indicate that the overall regression model is significant at the 1% level. The significant value that is close to 0 reflects that there is no probability of the correlation between the independent and dependent variables being caused by random sampling error. From Table 6, it can be seen that LDR and NPL show a significant relationship with commercial banks' performance in the ASEAN-5 region. Both variables are significant at 1% with the p-value of 0.0000 and 0.0029 respectively. CAR is found to be not significant to the ROA performance. The coefficient of LDR is observed at 0.5131, with a significant p-value at a 1% level. When the LDR rises by a percent while other things are equal, the ROA performance of the sampled ASEAN commercial banks would decrease by 0.0051%. In short, a statistically significant result means that there is sufficient evidence to support a positive relationship between LDR and ROA ratios. As indicated by the aforementioned studies, the increases in LDR might lift the banks' financial performance, as the loans to deposit refer to the ability of a bank to provide loans to their customers. Thus, high loans to deposit could increase the ROA of commercial banks. Though credit risk can be indicated by the probability of default in total loans provided to the borrowers, this credit risk measure of LDR reveals that ASEAN banks tend to generate benefits with a higher amount of loans, albeit associated with higher risk. The coefficient of NPL is -0.0513 and significant at the level of 1 %. The results reveal that a percent increase in NPL is associated with a decrease in ROA by 0.05%, indicating a significant inverse relationship between NPL and ROA. Similar results were found by Isanzu (2017); Al-Eitan and Bani-Khalid (2019); Anwar and Murwaningsari (2019); Abu-Alrop and Kokh (2020); Saleh and Winarso (2021), supporting that non-performing loans adversely impact the performance of commercial banks.

Table 7 indicates that all the explanatory variables of credit risk show significant association with the bank performance at 1% level. All the p-values are close to zero. A negative coefficient of CAR at -0.3352 indicates that a percent increase in CAR is significantly associated with a 0.34% drop in ROE performance. As per previous studies, the variable of CAR is expected to have a negative correlation with financial performance as a bank with high CAR is considered to be above the minimum requirement for proposed solvency. Bank capital has made an important contribution to the stability of financial markets by protecting individual institutions from the impact of individual failures and reducing the risk of inter-

bank leakage. The negative significant values between capital adequacy and bank performance show that banks with low CAR value tend to benefit from the credit risk undertaken. However, a high bank's CAR shows that it is more likely to withstand credit risk. Adopting a lower CAR may improve the profitability for the shareholders, but at the expense of higher risk. It could also explain the risk-taking behavior of the banks. Interestingly, CAR may not have a significant impact on the ROA performance when all sources of capital are taken into consideration. The coefficient of LDR shows a value of 3.2513, indicating that there is a positive relationship between LDR and ROE. The p-value of 0.0005 implies that there is a significant evidence that supports such a positive relationship. An incremental percent in LDR is associated to an increase in ROE by 0.0325%. Meanwhile, NPL shows a negative correlation with ROE. Such a finding is consistent with some of the past studies, such as (Al-Eitan and Bani-Khalid, 2019; Vellanita et al., 2019; Abu-Alrop and Kokh, 2020). The result conveys that an increase in the NPL ratio would lead to an average decrease in ROE. A percent increase in NPL is associated to the decrease in ROE by 0.58%. The coefficient is highly significant at the 1% level among these ASEAN commercial banks.

In short, the regression results on the bank performance indicate that all the variables of CAR, LDR and NPL have a significant relationship with the financial performance of commercial banks in the studied region. The sources of credit risk for a commercial bank may come from the quality of the loan, management of capital, levels of liquidity and capital, credit assessment, and bank lending practice (Jonathan and Michael, 2018). Credit risk can be measured in a different context of economic exposures. This means that credit risk does not always occur in isolation; it can be driven by a liquidity issue. The same source that causes credit risk for banks may also expose them to other risks. The measures of capital adequacy, loans to deposit and NPL show the significant relationship between credit risk towards bank profitability. The negative relationship between NPL and bank performance indicates a bank with a high uncovering loan will lead to low profitability of a commercial bank in ASEAN. Thus, loan service management must be properly implemented to lower the value of NPL to maintain the profitability of banks.

Conclusion and Implications
The purpose of this study is to look into how credit risk may affect banking performance in the ASEAN region. It investigates how the financial performance of commercial banks is impacted by capital adequacy, LDR, and NPL. Capital adequacy is the amount of equity and other reserves held by a bank against its risky assets, while those reserves would be able to protect depositors from unexpected losses. The result suggests that capital adequacy would negatively affect the financial performance of the banks, consistent with the findings by (Million et al., 2015; Vellanita et al., 2019). The effectiveness and profitability of banks would be harmed if they hold more capital than is necessary. The prevailing negative correlation between CAR and ROE occurs may be due to the exceeding reserves on the necessary amount in order to cover unexpected risks that banks may encounter. LDR would positively affect the financial performance of a commercial bank. This ratio represents a bank's capabilities to withstand deposit withdrawals as well as its willingness to meet loan demand by reducing cash assets. The increases in this ratio might increase the banks' financial performance and it may be due to the interest charged by banks tending to be higher than the interest charges paid to depositors. The positive and statistical correlation of LDR with bank profitability means that commercial banks tend to benefit from credit risk by transferring loan losses. NPL is classified as one of the major indicators of credit risk by measuring the bank loans and

advances that are non-performing. The analysis shows a negative relationship to the bank's performance. It is consistent with the findings by Al-Eitan and Bani-Khalid (2019); Vellanita et al (2019); Abu-Alrop and Kokh (2020) that the higher the NPL value, the lower the bank credit quality. NPL will reduce the bank's profitability by reducing the bank's available funds for investment and operations. Hence, it indicates that NPL reduces the profitability of financial performance as it causes banks to incur losses in operating activities. If a bank is in a poor financial position, it deteriorates the bank's financial status by causing liquidity risks on both the asset and liability sides as depositors can make withdrawals on demand and banks must accomplish their responsibilities to loan borrowers as required. The primary causes of the past banking crisis incidents include a lack of experience, bad lending behaviour, an increased proclivity to take on higher organizational risks, and a lack of appropriate credit risk assessment systems. However, most banks tend to take unnecessary risks to survive and maintain their profits in this highly competitive environment. For policy implications, it is thus recommended that the banks adopt strong credit risk management and loan service processes as the credit quality of a commercial bank is important to sustain its long-term performance. In the period of uncertainty when there are increasing default events and NPL levels, banks shall proactively implement efficient provisioning and risk management procedures to evaluate and effectively support distressed debtors whenever possible for the good of all stakeholders. Regulators, on the other hand, could develop risk management guidelines and impose proper monitoring mechanisms for a healthier banking system.

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