



“The impact of COVID-19 and bank capital ratio on loan changes of ASEAN-5’s banking industry”

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THE IMPACT OF COVID-19 AND BANK CAPITAL RATIO ON LOAN CHANGES OF ASEAN-5'S BANKING INDUSTRY

Abstract

The COVID-19 pandemic has affected economies around the world, including the banking industry, and this depends on various factors. The aim of this study is to understand the influence of COVID-19 independently and through the moderation of bank capital ratios on changes in loans of Association of Southeast Asian Nations 5 (ASEAN-5) banking industry players. The study uses a sample of 86 banking companies listed on the stock markets of Indonesia, Malaysia, the Philippines, Singapore, and Thailand from the first quarter of 2018 to the fourth quarter of 2020 by employing the panel data regression technique. The results showed that COVID-19 had a significant negative effect on changes in bank lending. However, a bank's capital ratio was not found to play a role in moderating the effect of COVID-19 on changes in bank lending. These findings have three main implications: (i) the role of the government in recapitalization and liquidity injection can eliminate differences in behavior between banks with the classification of capital ratios; (ii) there are no signs of zombie lending in ASEAN-5's banking industry; and (iii) regulating incentives to change bank lending behavior in future crises must take into account that bank capital categorization will not be effective.

Keywords

bank, crisis, exposure, COVID-19, capital ratio

JEL Classification

G20, G21, G28

INTRODUCTION

The COVID-19 pandemic has caused governments around the world to take extreme measures to contain the spread of the SARS-CoV-2 virus. Previous research by Dursum-de Neef and Schandlbauer (2021) looked at how the banking industry in the European Union changed its lending behavior during the pandemic. The study found that, in aggregate, banks in the European Union lowered their lending rates in the first quarter of 2020 in reaction to the crisis, but banks in countries with higher exposure to COVID-19 experienced lower loan changes. In looking at the differences in the impact of COVID-19 on loan responses, it is necessary to pay attention to the capital characteristics of each bank. A good capital ratio is believed to provide an additional margin of safety for large banking systems to absorb potential losses arising from changes in risk levels (Buehler et al., 2009).

In particular, the moderating effect of bank capital on lending behavior in the crisis era becomes a research topic resulting in two different views. On the one hand, a growing literature suggests that banking industry participants with lower capital ratios need to issue loans to troubled companies and customers so that:

- (i) customers can continue to repay existing loans; and
- (ii) institutions can reduce their exposure to credit default risks.

On the other hand, several studies document that banks with lower capital ratios will be perceived as riskier than banks with higher capital ratios, and, therefore, they will be more difficult to find accessible sources of financing during a recession.

Meanwhile, Southeast Asia is an important trade and economic center with a rich history of its strategic positioning ranging as far back as the colonialism period. Filled with newly industrialized, rapidly developing countries, Southeast Asia is the world's fastest-growing economic region, sizing up to become the sixth largest economy in the world with a value of USD 3.1 trillion in 2020; growing almost three times in 13 years (IMF, 2020). One of the prerequisites for optimizing economic growth comes in the form of an effective banking industry (Beck & Levine, 2004; Berger & Sedunov, 2017; Jayaratne & Strahan, 1996). Banks play an important role in a country's economy as the core financial intermediary, which brings together the supply and demand for money through a system of deposits and loans, and, therefore, it is important to investigate the issue in the context of Southeast Asian banks.

With the information at hand, the two main issues that will be the focus of discussion in this study are:

- (i) Does COVID-19 have any influence on changes in loans of ASEAN-5 banks?
- (ii) Does the capital ratio moderate an impact of COVID-19 on changes in loans of ASEAN-5 banks during the COVID-19 period?

1. LITERATURE REVIEW AND HYPOTHESES

The COVID-19 pandemic has pushed governments around the world to implement measures to limit the spread of the virus, including social mobility limitations, lockdowns, and business closures. As a consequence, the business sector as a whole faced a significant reduction in income, while households were prone to job losses and a decline in disposable income. According to Goodell (2020), the banking industry becomes one of the most susceptible sectors, as it is associated with an increasing non-performing loan ratio and the potential for bank runs. These further lead to

- (i) a growing level of risk taken by banks; and
- (ii) a decline in non-interest income, thus giving negative and significant effects on banks' solvability and profitability.

This should become the concern of various parties as the effectiveness of the sector is highly crucial for optimizing economic growth (Beck & Levine, 2004; Berger & Sedunov, 2017; Jayaratne & Strahan, 1996).

Referring to the vulnerability of the banking industry towards the COVID-19 pandemic, sev-

eral studies attempt to examine the impact of the COVID-19 pandemic on the banking industry in different aspects. A study by Duan et al. (2021) that examines more than 1,500 global banks found a positive and significant impact of the COVID-19 pandemic on the industry's systematic risk level through the credit risk channel. Their additional analysis demonstrates that the detrimental effect is particularly severe in the cases of banks with a higher loan, higher risk, and less capitalization. Meanwhile, Wang et al. (2021), Demir and Danisman (2021), and Berger et al. (2021) focus on how COVID-19 relates to the market values of bank stocks. Another stream of literature investigates the impact of COVID-19 crisis on banks' capitalization. Acharya and Steffen (2020), for example, documented that after the pandemic hit, banks in the United States adjusted the minimum credit level and increased cash holdings.

It is also important to understand the overall impact of COVID-19 on bank lending. Several theories have emerged regarding how banks respond to their loan supply, particularly how bank loans become a transmission channel for monetary policy through the bank lending channel theory. Credit channels are traditionally characterized into two separate forms: the

balance sheet channel and the bank lending channel (Bernanke & Gertler, 1995). The bank lending channel theory emphasizes the potential amplification effect that may be generated by the banking sector through the government's loan supply-setting policies, which can directly affect loan levels within the industry (Ananou et al., 2021). Banks then have the function of addressing information problems in the credit market by acting as screening agents to determine creditworthiness, so policy agents rely on banks as the main channel for effective credit transfer (Mishkin, 1996).

To understand the relationship between the COVID-19 crisis and bank lending behavior, the existing literature on previous crises can be reviewed. An economic crisis is a situation that needs to be navigated cautiously by the banking industry due to the potential declines in actual and perceptual assets' value. In this highly regulated industry, banks are required to have a proper system to manage risks, including credit risk, so that they are able to mitigate losses that might occur during crisis periods. Evidence from earlier crises has shown contradictory views regarding the impact of negative macroeconomic shocks on banks' lending behavior. On the one hand, research from previous crises found a general decrease in credit that stemmed from:

- (i) shocks to debtor guarantees that affect a company's ability to raise capital due to significant agency and information problems (Bernanke & Gertler, 1989; Ozili & Arun, 2020; Ari et al., 2021); and
- (ii) shocks on bank capital, which affects the supply of bank loans as banks find it difficult to find additional capital (Ivashina & Scharfstein, 2009).

Kahle and Stulz (2012), however, found no evidence of a surprise on the supply side of credit, but a shock in the demand for credit.

Nevertheless, it should be noted that the condition during the economic crisis caused by the COVID-19 pandemic has several fundamental differences from that of previous crises, which

potentially can yield a different nature of the relationship between the crisis and bank lending behavior. First, the liquidity risk in the industry is relatively easier to manage due to the central banks' expansive policy aimed to support the economy since the beginning of the pandemic (Berger et al., 2021). Second, the economic pressure is not due to endogenous factors but instead triggered by an exogenous factor in the form of a global health crisis. The banking sector is able to secure a significant amount of government funds that are specifically allocated for recovery. Moreover, the overall banking sector tended to be better capitalized and thus can accommodate increased risk and a higher loan demand (Çolak & Öztekin, 2021).

The above arguments on the different natures of the crisis caused by the COVID-19 pandemic have motivated several studies to investigate its impact on bank lending. Using a sample of banks from 125 countries, Colak and Oztekin (2021) applied a difference-in-differences methodology and found a significant decrease in bank lending in countries more affected by the COVID-19 health crisis. According to the study, banking institutions became very hesitant to lend in a pandemic situation, resulting in a negative shock to loan growth even after taking into account the monetary and fiscal stimulus controls issued by governments. Thus, the study concludes that the COVID-19 crisis caused a massive decline in credit growth. This finding is in line with that of Beck and Keil (2022), Horvath et al. (2020), and Hasan et al. (2021). However, Dursum-de Neef and Schandlbauer's (2021) study found that, although European banks reduced their supply of new loans massively in the first quarter of 2020, banks with higher exposure to COVID-19 infections decreased their lending less. This contrasts with the analysis of Beck and Keil (2021) and Colak and Oztekin (2021), which actually concluded that banks located in geographic areas with higher rates of COVID-19 infection reduced their new loans significantly.

As mentioned above, banks were generally better capitalized during the COVID-19 crisis. A strong capitalization base has taken an important part in the strategy formulation for banks,

as it allows cushions to withstand external shocks. Bank capital acts as a defensive mechanism against idiosyncratic and systematic risks that may occur from changes in the economy and financial structures; an example would be deposit sensitivity to market risks (Diamond & Rajan, 1999). A good capital ratio provides an additional margin of safety for large banking systems to absorb potential losses arising from changes in risk levels (Buehler et al., 2009). In addition, Bitar et al. (2018) found a positive association between a bank's capital-to-risk-weighted asset ratio with its operational efficiency and profitability.

There exist two major strands of literature with opposing views concerning the impact of a bank's capitalization towards lending behavior during a crisis period. On one hand, studies documented that banks with worse capitalization will experience a decline in loans during crises, as they face difficulties in securing funds. According to a study by Meh and Moran (2010) that researched banks' lending behavior post-Global Financial Crisis, a bank's capitalization ratio has a positive relationship with its ability to source funds; therefore, acting as a more effective lending channel during crisis periods. Cornett et al. (2011) demonstrated that banks that rely more on stable funding, including capital, have higher levels of loans during the Global Financial Crisis. Gambacorta and Marques-Ibanez (2011) found that banks with weak capitalization tend to have a more intense limitation on bank loans during the crisis period. Kick et al. (2020) found a positive and significant effect of variations in the capital position of a bank on the bank's credit supply levels. The research adds that an increase in the capitalization ratio of a bank by 1% will positively affect loan supply by an average of 0.066 to 0.102%. A similar observation has also been documented in the case of Southeast Asian banks by Toh and Zhang (2021). These findings are also related to that of Abbas et al. (2021), who concluded that a bank's capital ratio is negatively correlated with non-performing loan and loan loss provision as the proxies of risk.

On the other hand, the existence of banks with worse capitalization ratios has been found by

other studies to be linked with an increase in loans to its borrowers during crises, for them to avoid having to write off loans and bad debts. This phenomenon is often referred to as zombie lending (Becker & Ivashina, 2021; Caballero et al., 2008). Schivardi et al. (2017), through their analysis of bank behavior during the 2009 Eurozone financial crisis, found that undercapitalized banks have a much lower probability to decrease their loan for firms and clients with difficulties in paying off their loans, in order to stall an increase in non-performing loans. A study by Hsieh and Lee (2020) in the context of Asian and Latin American banks shows that banks consistently increased their loans to support the continuity of the businesses of their debtors. The research from Dursum-de Neef and Schandlbauer (2021) studies whether the level of bank capitalization can influence lending behavior in a period of crisis. Results show that banks with worse capitalization rates in the European Union experienced a significantly lower decline in lending rates during the COVID-19 crisis period (defined as the first to the third quarter of 2020) than those with better capitalization rates. These are in line with the finding by Banerjee and Hoffman (2018), where banks with nearly minimum capitalization ratio tended to exhibit zombie lending to cope with the regulatory pressure after the Eurozone crisis in 2009.

The existing literature has provided evidence of the impact of COVID-19 on lending behavior and its relationship with the level of bank capital with differing results. Given that the nature of the correlations between these variables might be different in other contexts, particularly in emerging economies such as ASEAN-5, further investigations on this topic are needed. Southeast Asia provides an important geographical context as it is one of the world's fastest-growing economic regions, sizing up to become the sixth largest economy in the world with a value of USD 3.1 trillion in 2020; growing almost three times in 13 years (IMF, 2020). This is the gap that this study aims to fill in, by also considering several determinant factors of bank loans (see for example: Abedifar et al., 2013; Barth et al., 2013; Beltrame et al., 2018; Dietrich & Wanzenried, 2011; Dursum-de Neef

& Schandlbauer, 2021; Ianotta et al., 2007; Tan & Floros, 2013; Walther, 2016). Based on the above explanations, the hypotheses of this study are:

- H1: COVID-19 has a significant impact on loan changes of banks.
- H2: Bank capitalization moderates the impact of COVID-19 on loan changes of banks.

2. RESEARCH DATA AND METHODOLOGY

This study covers an observation period from Q1 2018 to Q4 2020 to get a full picture of lending behavior before and during the COVID-19 crisis period in the first quarter of 2020. The research includes 86 banking companies as subjects listed on five domestic exchanges in Malaysia, Indonesia, Philippines, Singapore, and Thailand, totaling 1,032 observations. Research data are obtained from S&P Capital IQ.

This study uses unbalanced panel data as several banks have not provided complete data in the observation period. To determine the most appropriate panel data estimation method, this study carries out the Chow, Hausman, and Breusch Pagan Lagrange Multiplier tests (Gujarati & Porter, 2008; Brooks, 2019). The following regression model will be used to test the impact of COVID-19 to loan changes of banks (Equation 1) and the moderating role of capitalization ratios of banks (Equation 2):

$$DELTA LOAN_{it} = \alpha + \beta_1 \cdot COVID_t + \gamma \cdot X_{i,t-1} + \theta \cdot COUNTRY_{i,t-1} + \varepsilon_{i,t}, \tag{1}$$

$$DELTA LOAN_{i,t} = \alpha + \beta_1 \cdot COVID_{i,t} + \beta_2 \cdot HIGHCAPITALCOVID_{i,t} + \gamma \cdot X_{i,t-1} + \theta \cdot COUNTRY_{i,t-1} + \varepsilon_{i,t}, \tag{2}$$

with the following variable defined:

$$DELTA LOAN_{i,t} = \ln \left(1 + \frac{(LOAN_{i,t} - LOAN_{i,t-1})}{TOTALASSET_{i,t-1}} \right), \tag{3}$$

where $LOAN_t$ is the level of the loan of bank i at period t and $TOTALASSET_{i,t}$ is the total asset of bank i at time t . $COVID_t = A$ An independent variable representing COVID-19, that is defined with two indicators:

- (i) $COVID_DUMMY_t$, a dummy variable indicating 1 during the four quarters of 2020 and 0 otherwise, representing the economic crisis (Çolak & Öztekin, 2021; Dursum-de Neef & Schandlbauer, 2021);
- (ii) $COVID_EXPOSURE_t$, a variable representing the change in the number of COVID-19 cases ($COVID_{infections_t}$) per 1 million people (adjusted using the natural logarithm) in the country of domicile of the bank (Çolak & Öztekin, 2021; Demir & Danisman, 2021; Dursum-de Neef & Schandlbauer, 2021; Li et al., 2020).

$$COVID_EXPOSURE_t = \ln \left(1 + \frac{COVID_{infections_t}}{1,000,000} \right) - \ln \left(1 + \frac{COVID_{infections_{t-1}}}{1,000,000} \right). \tag{4}$$

$X_{i,t-1} = A$ set of control variables that represents a bank's specific characteristics that include capital adequacy, asset quality, management, earnings, liquidity, market risk sensitivity (Beltrame et al., 2018; Dietrich & Wanzenried, 2011; Dursum-de Neef & Schandlbauer, 2021; Ianotta et al., 2007; Walther, 2016), and bank size (Abedifar et al., 2013; Barth et al., 2013; Tan & Floros, 2013).

$COUNTRY_{i,t-1} = A$ set of control variables that represents a bank's country of domicile characteristics that include GDP per capita, GDP growth, interest rates, and credit-to-GDP ratios.

$HIGHCAPITALCOVID_t = A$ variable that represents the moderating role of capitalization ratios for banking institutions during COVID-19, measured utilizing similar indicators defined in $COVID_t$; however, this only applies by interaction to banks with capitalization ratios above the industry median.

Table 1 provides further details on the operationalization of these variables.

Table 1. Variables' operationalization

Variable	Description
Dependent variable	
<i>DELTALOAN</i>	Natural logarithm of the ratio of change in loan to total assets
Independent variables	
<i>COVID_EXPOSURE</i>	Natural logarithm of change in COVID-19 cases per 1,000,000 inhabitants in the country where a bank is located
<i>COVID_DUMMY</i>	Dummy variable with a value equals to 1 for Q1-Q4 2020, 0 otherwise
<i>COVIDCAPITAL_EXPOSURE</i>	Natural logarithm of the change of COVID-19 case per 1 million for banks with above-median capitalization
<i>COVIDCAPITAL_DUMMY</i>	Dummy variable with a value equals to 1 if bank's capital ratio is above the median during the first to the fourth quarter of 2020, 0 otherwise
Control variable	
<i>CAPITAL_ADEQUACY</i>	Capital to asset ratio
<i>ASSET_QUALITY</i>	Loan loss provision to total loan ratio
<i>MANAGEMENT</i>	Interest income to asset ratio
<i>EARNINGS</i>	Net income to asset ratio
<i>LIQUIDITY</i>	Cash to asset ratio
<i>SENSITIVITY</i>	Deposit to asset ratio
<i>SIZE</i>	Natural logarithm of total asset
<i>GDPPERCAPITA</i>	Natural logarithm of GDP per capita
<i>GDPGROWTH</i>	GDP growth
<i>INTEREST</i>	Interest rate
<i>CREDIT</i>	Credit to GDP ratio

3. RESULTS AND DISCUSSION

Table 2 shows the descriptive statistics of variables used in this study to examine the impact of COVID-19 on loan changes, moderated by a bank's capital ratio in ASEAN-5 countries. The sample covers the period of 2018–2020 on a quarterly basis. The total number of observations from all countries examined in this study is 1,032, which comprises 86 banks. The research subjects are mostly large Southeast Asian banks, with an average asset value (*SIZE*) of USD 35 billion. The smallest bank by assets in the research subset has assets worth USD51 million (Bank Aladin, Tbk., an asset-light digital bank based in Indonesia). Meanwhile, the largest bank has total assets of USD 491 billion

(DBS Group Holdings, a Singapore-based multinational bank). This highlights the comprehensive nature of the research, covering a large swathe of bank archetypes, especially with the rise of digital banks in recent years in Southeast Asia.

Meanwhile, Figure 1 provides an illustration of changes in loans during the COVID-19 pandemic. In the first quarter of 2020 when COVID-19 first appeared, an average reduction in loan levels was found among all banking institutions by 5.5%. Of the 86 research subjects, 69 banks experienced a reduction in loans at this time. Diving a bit deeper into loan levels of banking institutions also shows that on average, banks with capital to assets ratio under the industry median reduced their

Table 2. Descriptive statistics

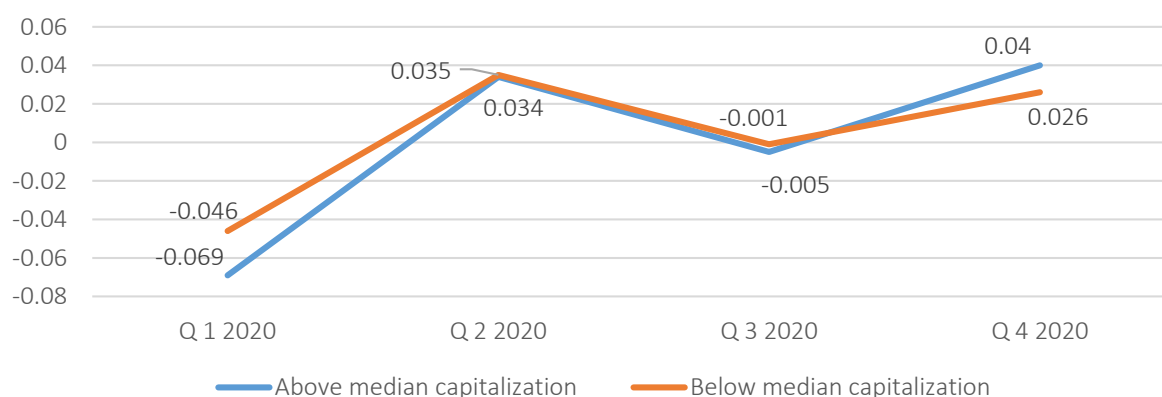
Variable	Obs.	Mean	Median	Std. dev.	Min	Max
2018–2019						
<i>DELTALOAN</i>	686	0.011	0.012	0.085	-1.270	0.639
<i>CAPITAL_ADEQUACY</i>	686	0.154	0.133	0.088	0.014	0.833
<i>ASSET_QUALITY</i>	679	0.028	0.023	0.019	0.002	0.136
<i>MANAGEMENT</i>	671	0.016	0.017	0.008	0.000	0.085
<i>EARNINGS</i>	682	0.002	0.003	0.008	-0.114	0.064
<i>LIQUIDITY</i>	685	0.062	0.049	0.052	0.000	0.322
<i>SENSITIVITY</i>	685	0.722	0.744	0.130	0.000	0.887
<i>SIZE</i>	686	8.740	9.126	2.173	3.791	12.948
<i>GDPPERCAPITA</i>	686	7.181	6.895	0.627	6.616	9.734
<i>GDPGROWTH</i>	686	0.067	0.075	0.044	-0.121	0.165
<i>INTEREST</i>	686	0.031	0.000	0.115	-0.252	0.714
<i>CREDIT</i>	686	1.192	1.187	0.230	0.823	1.693

Table 2 (cont.). Descriptive statistics

Variable	Obs.	Mean	Median	Std. dev.	Min	Max
2020						
<i>DELTA LOAN</i>	343	0.002	0.009	0.063	-0.344	0.249
<i>COVID_DUMMY</i>	343	1.000	1.000	0.000	1.000	1.000
<i>COVID_EXPOSURE</i>	343	1.735	1.872	1.530	-2.804	5.140
<i>COVIDCAPITAL_DUMMY</i>	343	0.516	1.000	0.500	0.000	1.000
<i>CAPITAL_ADEQUACY</i>	342	0.166	0.135	0.115	0.049	0.898
<i>ASSET_QUALITY</i>	328	0.037	0.031	0.028	0.003	0.197
<i>MANAGEMENT</i>	328	0.016	0.015	0.007	0.000	0.066
<i>EARNINGS</i>	342	0.002	0.002	0.007	-0.078	0.029
<i>LIQUIDITY</i>	339	0.064	0.052	0.052	0.000	0.333
<i>SENSITIVITY</i>	339	0.697	0.739	0.163	0.000	0.866
<i>SIZE</i>	343	8.823	9.097	2.149	3.780	13.078
<i>GDPPERCAPITA</i>	343	7.160	6.914	0.609	6.617	9.716
<i>GDPGROWTH</i>	343	-0.013	-0.020	0.081	-0.188	0.144
<i>INTEREST</i>	343	-0.118	-0.059	0.128	-0.803	0.000
<i>CREDIT</i>	343	1.263	1.237	0.241	0.865	1.879
Total						
<i>DELTA LOAN</i>	1,029	0.008	0.011	0.079	-1.270	0.639
<i>CAPITAL_ADEQUACY</i>	1,028	0.158	0.133	0.098	0.014	0.898
<i>ASSET_QUALITY</i>	1,007	0.031	0.025	0.023	0.002	0.197
<i>MANAGEMENT</i>	999	0.016	0.016	0.008	0.000	0.085
<i>EARNINGS</i>	1,024	0.002	0.002	0.007	-0.114	0.064
<i>LIQUIDITY</i>	1,024	0.063	0.050	0.052	0.000	0.333
<i>SENSITIVITY</i>	1,024	0.714	0.741	0.142	0.000	0.887
<i>SIZE</i>	1,029	8.768	9.122	2.164	3.780	13.078
<i>GDPPERCAPITA</i>	1,029	7.174	6.897	0.621	6.616	9.734
<i>GDPGROWTH</i>	1,029	0.040	0.058	0.070	-0.188	0.165
<i>INTEREST</i>	1,029	-0.019	0.000	0.138	-0.803	0.714
<i>CREDIT</i>	1,029	1.216	1.196	0.236	0.823	1.879

level of loans less than banks with higher capital to assets ratio. In the first quarter of 2020, banks with capital ratios above the median reduced its loan by 6.9%, while those below the median reduced its loan only by 4.6%. The analysis of the COVID-19 infection rate (*COVID_EXPOSURE*) shows differing peaks of infection intensity in each country. Indonesia, Malaysia, and Thailand

showed peak infection cases (1,650, 3,105, and 47 infections per 1 million people) in Q4 2020. Singapore showed the peak of infection cases (7,881 total infections per 1 million people) in Q2 2020, and the Philippines showed the peak of infection cases (2,469 total infections per 1 million people) in the Q3 2020 period. The emergence of COVID-19 and the economic crisis that followed

**Figure 1.** Bank loan levels

caused a negative impact on the economies of the five countries of the study subjects, with negative average GDP growth and deteriorating GDP per capita figures in 2020.

3.1. Regression results

Based on the Chow, Hausman, and Breusch Pagan Lagrange Multiplier tests, the appropriate estimation method for the regression models is the fixed effect model. The results of the research related to the effect of COVID-19 on bank lending in ASEAN-5 countries are divided into two main regression variables that represent:

- (i) the presence of a crisis due to COVID (*COVID_DUMMY*); and
- (ii) changes in the level of exposure to COVID (*COVID_EXPOSURE*).

The regression results in columns (1) and (2) in Table 3 show that both models have a significant F-value at the 1% level. The R-squared metric shows how well the independent variables can explain the changes that occur in the loan supply variable. The regression results show that the two main components of these variables have significant and negative impacts on the level of bank lending in ASEAN-5 countries. The *COVID_DUMMY* coefficient in column (1)

shows significantly that banking institutions in ASEAN-5 countries reduced their loan growth by 3.58% during the COVID-19 crisis relative to the non-COVID period. Considering that during the study time frame there was a loan growth of 0.8% quarter-on-quarter across the sample, this result illustrates the negative effect of the COVID-19 crisis on bank credit supply. On the other hand, the *COVID_EXPOSURE* coefficient in column (2) shows that a 1% change in the COVID-19 infection rate reduces the change in bank institutional loans by 0.053%.

Columns (3) and (4) in Table 3 describe the results of statistical tests of the influence model of the independent variables *COVID_t* and *HIGHCAPITALCOVID_t* on the lending of banking institutions. The regression results show that both models have a significant F-value at the 1% level. R-squared shows how well the independent variables can explain the changes that occur in the loan supply variable. The regression results show that statistically, adding the original model with the *HIGHCAPITALCOVID_t* component still shows a negative and significant effect of the *COVID_DUMMY* and *COVID_EXPOSURE* variables on bank lending. In addition, the control variables *CAPITAL_ADEQUACY*, *MANAGEMENT*, *SIZE*, *GDPGROWTH*, and *CREDIT* were still found to have a significant effect on loans. However, the interaction variable of the ratio of bank capitalization

Table 3. Regression results

Variable	Coefficients (Standard error)			
	(1)	(2)	(3)	(4)
<i>COVID_DUMMY</i>	-0.036*** (0.007)	-	-0.033*** (0.009)	-
<i>COVID_EXPOSURE</i>	-	-0.005*** (0.002)	-	-0.004* (0.002)
<i>COVIDCAPITAL_DUMMY</i>	-	-	-0.005 (0.008)	-
<i>COVIDCAPITAL_EXPOSURE</i>	-	-	-	-0.003 (0.003)
<i>CAPITAL_ADEQUACY</i>	0.313** (0.123)	0.315** (0.130)	0.319** (0.124)	0.320** (0.131)
<i>ASSET_QUALITY</i>	0.343 (0.323)	0.297 (0.329)	0.348 (0.325)	0.306 (0.330)
<i>MANAGEMENT</i>	5.157** (2.379)	5.214** (2.330)	5.138** (2.393)	5.200** (2.332)
<i>EARNINGS</i>	0.427 (0.345)	0.413 (0.324)	0.432 (0.342)	0.423 (0.320)

Table 3 (cont.). Regression results

Variable	Coefficients (Standard error)			
	(1)	(2)	(3)	(4)
LIQUIDITY	-0.046 (0.102)	-0.042 (0.104)	-0.043 (0.103)	-0.040 (0.103)
SENSITIVITY	-0.019 (0.076)	-0.000 (0.081)	-0.018 (0.076)	0.000 (0.080)
SIZE	-0.079** (0.036)	-0.087** (0.038)	-0.079** (0.037)	-0.086** (0.038)
GDPPERCAPITA	0.012 (0.061)	-0.015 (0.064)	0.014 (0.060)	-0.013 (0.065)
GDPGROWTH	0.041* (0.023)	0.084*** (0.027)	-0.039* (0.023)	0.077*** (0.027)
INTEREST	-0.019 (0.023)	-0.010 (0.023)	-0.017 (0.023)	-0.009 (0.023)
CREDIT	0.430*** (0.116)	0.194** (0.094)	0.430*** (0.116)	0.197** (0.094)
CONSTANT	-0.022 (0.364)	0.502 (0.366)	-0.038 (0.356)	0.481 (0.360)
Observation	996	996	996	996
R-squared	0.1375	0.1247	0.1359	0.1251
F-value	0.000	0.000	0.000	0.000

Note: Standard errors are provided in parentheses; ***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively.

with the crisis and COVID-19 infection was found to have no significant effect on changes in the level of bank institutional loans. Therefore, these findings do not match the estimation results found by Dursum-de Neef and Schandlbauer (2021), signaling a difference in bank lending behavior in Southeast Asia compared to the European Union.

3.2. Analysis and discussion

The result of this study showed that the COVID-19 crisis had a negative and significant effect on changes in bank lending. This is in line with the analysis of Colak and Oztekin (2021), which found a phenomenon of a broad decline in the level of global loan supply in the first to the third quarter of 2020, and that of Dursum-de Neef and Schandlbauer (2021), which found a marked decline in the level of loan supply in the European Union banking industry due to the COVID-19 crisis. Based on previous literature, an economic crisis can negatively affect credit supply through two specific mechanisms:

(i) shocks to debtor guarantees that affect a firm's ability to raise capital due to significant

agency problems and information problems (Bernanke & Gertler, 1989), or

(ii) shocks to bank capital, which affects the supply of bank loans as banks find it difficult to source additional capital (Ivashina & Scharfstein, 2009).

The results also found that the intensity of exposure to COVID-19 had a negative and significant effect on changes in bank lending. These results are in line with those of Li et al. (2020), Colak and Oztekin (2021), and Beck and Keil (2022), who found that banks located in geographic areas with higher rates of COVID-19 infection reduced their new loans significantly. According to Colak and Oztekin (2021), this phenomenon occurred due to the industry's risk-aversion bias, which encourages banking institutions to prioritize precaution during times of intense COVID-19 spread. Therefore, even though the industry is in a relatively stable and healthy condition thanks to government stimulus and pre-COVID capitalization, banks still have a tendency to be more cautious during those times. Beck and Keil (2022) also added that more intensive COVID-19 infections

tend to force the government to carry out social distancing initiatives that have an impact on economic stagnation. The existence of this lockdown channel became a concern for banking institutions when looking at prospective borrowers, given the context of the business conditions faced by prospective debtors becoming less promising. However, this finding is in contrast to the results of a study by Dursum-de Neef and Schandlbauer (2021), which found that banks in the European Union region with higher exposure to COVID-19 decreased their lending less. Therefore, this may imply structural differences in the characteristics of the European Union banking industry compared to that of the ASEAN-5 region, which may come in differing levels of government policy to contain the health and economic crisis, intensity of interconnection of banking networks, or even the fact that each region faced different types of COVID-19 that can affect the severity of the pandemic regionally. It should also be taken into account that, in 2020, the COVID-19 pandemic accelerated much faster in the European Union than in the Southeast Asia region.

Findings from the research model indicate that there is no difference in changes in the loan of banking players with higher capitalization ratios with lower capitalized banks in the ASEAN-5 banking industry. This result contradicts the study by Dursum-de Neef and Schandlbauer (2021), which found that bank capital ratios significantly intensified the decline in bank lending in the European Union during the COVID-19 period. Therefore, there are implications for differences in the characteristics of the European Union banking industry with the ASEAN-5 region, which can come in factors of government policy, interconnection of banking networks, or different types of viruses that can affect the severity of the pandemic regionally. Based on the author's analysis, there are three important implications obtained from these findings.

First, the context of the COVID-19 economic crisis as an exogenous phenomenon has enabled the ASEAN-5 banking sector to secure funds and capital cushions from the government's liquidity injection program as well as maintain a better level of capital to accommodate rising risks and emerging debt demands (Colak & Oztekin, 2021). Kapan and

Minoiu (2018) found that government assistance to the banking industry in the form of bank recapitalization can significantly reduce the loan supply gap between high-capital and low-capitalized banks. Given the emergence of expansionary monetary policy during the COVID-19 crisis, the role of banks as transmission agents of monetary policy can be used to maintain the supply of loans from each banking actor. The robustness test conducted by Dursum-de Neef and Schandlbauer (2021) also found that massive economic support, easing of capital requirements and adjustments to government bankruptcy regulations during the pandemic could help offset differences in the loan responses of better-capitalized and lower-capitalized banks. This also supports the implication that recapitalization and injection of liquidity from the government can eliminate differences in lending behavior between banks with different capital classifications.

Second, some indications point to the rejection of the zombie lending phenomenon in the public banking industry of ASEAN-5 countries. This is because banking players with lower capital ratios did not increase their loans significantly compared to those with better capital ratios. Thus, it cannot be proven that bank customers with lower capital ratios lend funds to zombie companies that need funds exclusively for business continuity (Banerjee & Hoffman, 2018; Caballero et al., 2008). Several factors may explain the absence of zombie lending in ASEAN-5 countries. Thanks to the industrial reshuffle after the Asian financial crisis in 1998, the Southeast Asian banking industry has one of the best capitalization and non-performing loan ratios compared to other regions globally (Zurich, 2021). Albert and Ng (2012) found that the banking industry in the Philippines has booked robust asset growth and capital ratios through macroprudential policies set by its central bank. Triggs et al. (2019) also conclude that stable economic growth, controlled inflation, low unemployment, consumer optimism and a healthier government budget are the five main factors that maintain the stability of Indonesia's financial industry. This is also influenced by the prospect of Southeast Asia's economic growth, which is much faster when compared to regions or countries that have been observed experiencing the zombie lending phenomenon, such as Japan and the European Union (World Bank, 2021).

Finally, an indication of this insignificant coefficient is that poorly capitalized banks do not reduce their borrowing more intensively than well-capitalized banks. In the context of industry stability, the discovery of this behavior has the potential to lead to an excessive reduction in the capital ratio due to the absence of more intensive loan decline for these banks.

This poses a risk that the capital ratios of these banks will fall to a dangerous level as they are close to or below the capital adequacy regulation (Basel III, 2010). Therefore, policymakers need to consider how far banks with poorer capital levels can tolerate their current lending strategy before they reach undesirable levels of risk in times of crisis.

CONCLUSION AND LIMITATIONS

This study investigates the impact of COVID-19 on changes in bank loans and how bank capital ratio moderates the relationship between these two variables in the context of ASEAN-5 countries (Indonesia, Malaysia, the Philippines, Singapore, and Thailand), using a sample of 86 listed banks in the region. The results of this study show that COVID-19 was found to have a negative and significant effect on changes in bank lending. On aggregate, banking institutions in ASEAN-5 countries reduced their loan growth by 3.58% during the COVID-19 crisis. The economic crisis is found to influence credit levels of the banking industry through two specific mechanisms: (i) significant agency and information problems (Bernanke & Gertler, 1989), or (ii) shocks to bank capital (Ivashina & Scharfstein, 2009). Changes in the level of exposure to COVID-19 are also found to have a negative and significant effect on changes in bank lending. A 1% change in the COVID-19 infection rate reduces the change in the lending of banking institutions by 0.053%. As shown by previous research, this can happen through two mechanisms:

- (i) an industry's risk-aversion bias that encourages banking players to prioritize the precautionary principle during times of worse COVID-19 infection, and
- (ii) the presence of a lockdown channel that makes the context of the business conditions faced by debtors less promising.

Meanwhile, the ratio of capital to assets was found to have no significant effect on crisis moderation nor the level of COVID-19 exposure on changes in bank lending. This result contradicts the reference study by Dursum-de Neef and Schandlbauer (2021), which found that bank capital ratios significantly intensified the decline in bank lending in the European Union during the COVID-19 period. Therefore, there are implications for differences in the characteristics of the European Union banking industry with the ASEAN-5 region, which can come in factors of government policy, interconnection of banking networks, or different types of viruses that can affect the severity of the pandemic regionally. It should also be borne in mind that in 2020, the COVID-19 pandemic accelerated much faster in the European Union than in the Southeast Asia region.

The research carried out has several limitations that can be explored in more depth by subsequent studies. First, the data used only come from banks listed on ASEAN-5 stock exchanges due to the difficulty in obtaining data from banks that are not listed. The lack of data observations may result in limited observations based on public companies only, therefore not providing the complete picture. The research subjects can be expanded in two ways, namely:

- (i) expanding the scope to all banks located in the ASEAN-5 region, or
- (ii) expanding the countries of domicile to all of Southeast Asia, adding up to ASEAN-5 countries.

Furthermore, this study analyzes the effect of changes in the total banking industry loans. Subsequent research can also focus on looking at the different effects COVID-19 has by categorizing specific loan

categories, such as commercial, corporate, or consumer loans. The study of the impact on corporate loans can also be used to expand the scope of the zombie lending literature in the banking industry in ASEAN-5 countries. Further research can also be done by looking at specific characteristics of banks and how they can moderate the effect of the economic crisis on changes in lending. The research can be expanded to see the moderating role of other bank characteristic variables, such as income diversification, loan diversification, or the ratio of non-performing loans. Future research may consider COVID-19 indicators that are considered more representative in the context of defining COVID-19 itself. For example, Dursum-de Neef and Schandlbauer (2021) performed a weighted calculation of COVID-19 exposure using the proportion of bank branches in each country in the European Union. This is certainly true, given the strong interdependence with close land connections between its member countries. COVID-19 indicators that are more in line with the contextualization of ASEAN or ASEAN-5 could also be implemented.

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