



# Bank Concentration and Bank Stability during the COVID-19 Pandemic

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## Abstract

**Objectives:** The banking sector has been impacted more negatively by the COVID-19 pandemic. At the same time, bank concentration and capitalization stabilize banking systems during times of crisis. This study evaluated the monthly financial reports of all commercial banks in Indonesia to investigate the joint impact of the COVID-19 pandemic and bank concentration on bank stability. Moreover, this study was conducted to determine whether adequate capitalization could enhance the positive effect of the interaction between COVID-19 and bank concentration during the pandemic. **Methods/Analysis:** Using 108 commercial banks between March 2020 and May 2021, data were analyzed using the fixed-effects estimator with heteroskedasticity and within-panel serial correlations for robust standard errors. Several robustness checks were performed to ensure that the results were accurate and consistent. **Findings:** Subsequently, the impact of the pandemic and bank concentration was determined to be significant and adverse, though their interplay was strong enough to promote bank stability. This highlights the importance of adequate capitalization in enhancing the beneficial effects of the interaction between COVID-19 and bank concentration on bank stability. **Novelty/Improvement:** Hence, these findings contribute to the literature on bank stability and have important policy implications for the banking sector during this pandemic.

**JEL Classifications:** E51, G20, G21.

## Keywords:

COVID-19;  
Bank Concentration;  
Bank Stability;  
Banking Sector;  
Financial Market.

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## 1- Introduction

The direct and indirect economic impacts of the COVID-19 pandemic on various countries and industries have had severe consequences for the global economy. According to Baldwin and Di Mauro [1], the COVID-19 outbreak has reduced global productivity due to the imposition of social restrictions. Additionally, small businesses saw a significant drop in revenue [2, 3]. The IMF predicts that the global economy will contract by 3 percent in 2020/21, developed economies will contract by 6.1 percent, and the eurozone economy will contract by 7.5 percent [4]. The unemployment rate paints a different picture of the magnitude and speed of this upheaval. Similarly, Fernandes [5] reported that GDP growth forecasts could fall by 3-5 percent depending on the country.

Specifically, the COVID-19 pandemic has had a more significant adverse effect on the financial sectors than the Global Financial Crisis of 2008-2009. The great uncertainty and economic losses associated with the pandemic have made markets highly volatile and unpredictable [6-9]. This has resulted in more significant economic uncertainty, leading to higher bank risk [10-12]. Although various policies have been implemented to address the health crisis and mitigate the negative effects of the pandemic, empirical studies need to be conducted to ascertain whether the pandemic has a negative impact on bank stability. On the other side, bank concentration may play an important role in promoting

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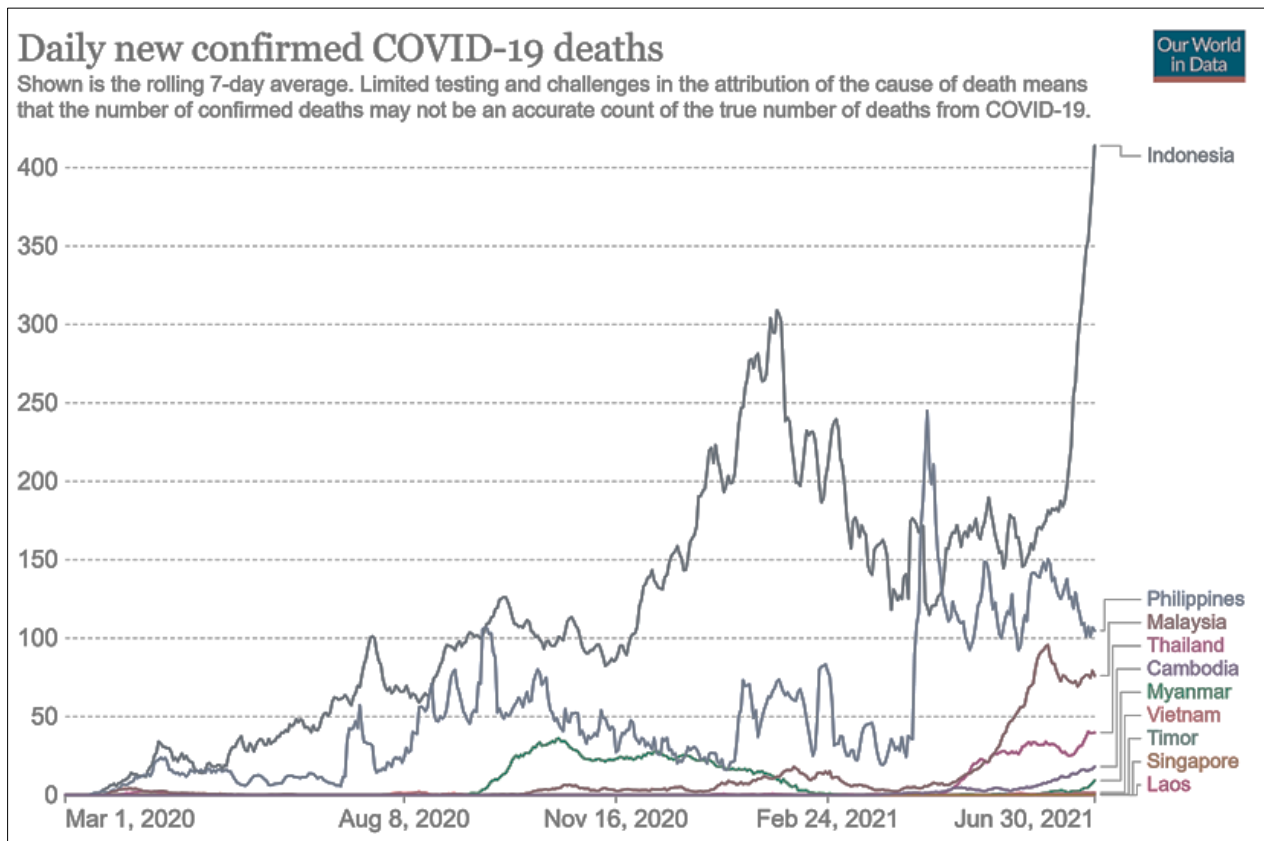
bank stability in times of crisis. Like pandemics, Caballero & Simsek [13] showed that the global financial crisis had a contagious impact. However, previous studies have revealed an inconsistent relationship between bank concentration and bank stability. On the one hand, Ben Ali [14] and Beck et al. [15] showed that bank concentration helps stabilize banking systems during times of global financial crisis. Consolidation has also been regularly employed as a banking reform strategy in Asia to address financial crises [20]. On the other hand, previous studies on this effect have failed to unanimously favor the concentration–fragility hypotheses [16–18].

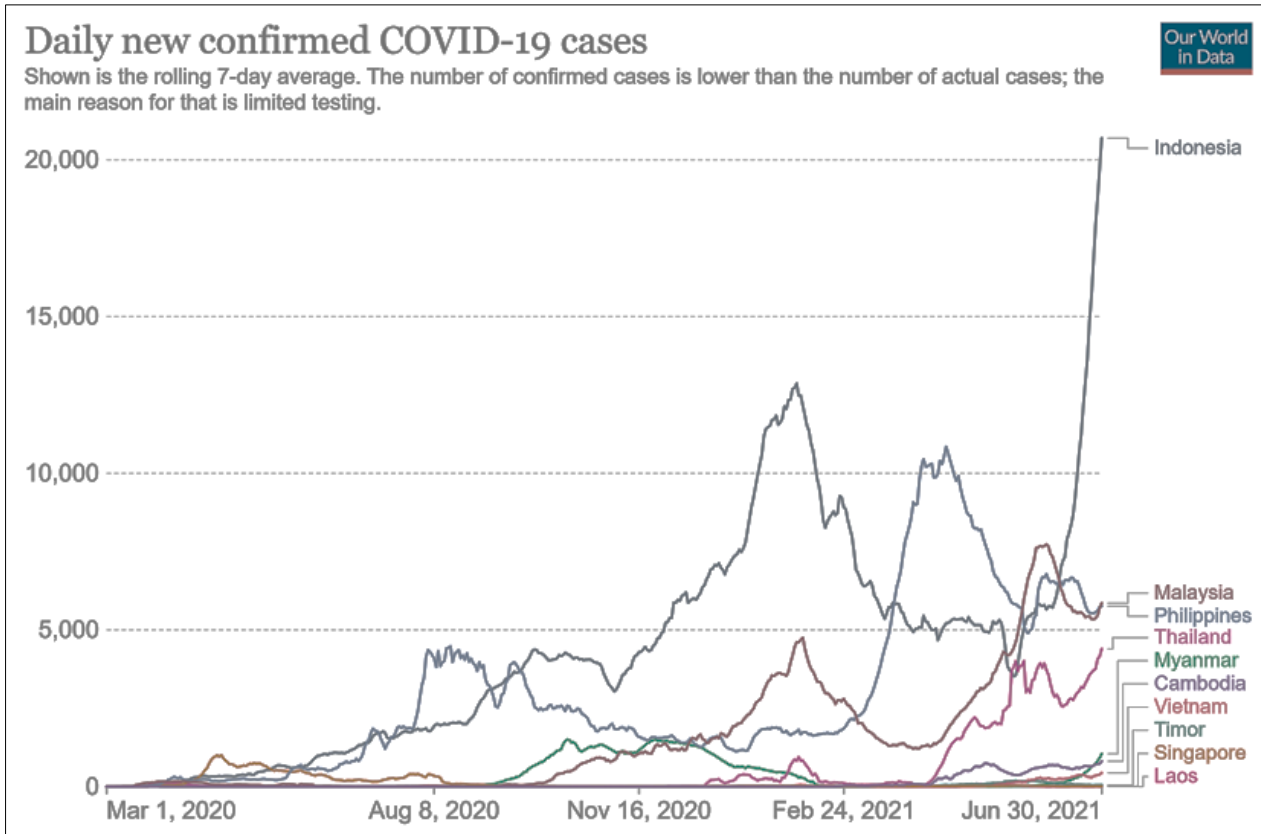
Rather than directly assessing the individual impacts of the COVID-19 pandemic or bank concentration on bank stability, this study extended the existing literature by examining their combined effect. This is to explore more deeply the role of bank concentration in times of health crisis. Furthermore, it also explored the existence of a difference in the interplay of COVID-19 and bank concentration on stability based on bank capitalization, allowing the formulation of policy recommendations according to these variations.

This study contributes to the empirical literature in two ways. First, this study is the first to investigate the joint impact of the COVID-19 pandemic and bank concentration on bank stability. The COVID-19 pandemic–bank stability nexus and bank concentration–stability nexus have been studied separately [11,12, 14–20]. On the one hand, some studies found that banks support the "concentration–stability" hypothesis. On the other hand, several studies found that banks support the "concentration–fragility" hypothesis. Meanwhile, some studies examine only the impact of the COVID-19 pandemic on bank stability [21]. Hence, this paper aims to fill this gap. Second, this study was performed to investigate the ability of adequate capitalization to enhance the beneficial effect of the interaction between COVID-19 and bank concentration on bank stability during the pandemic. Indeed, previous studies have examined the role of bank capitalization during the global financial crisis [22–25]. However, the role of bank capitalization during the COVID-19 pandemic remains unexplored.

For several reasons, this study's emphasis on the Indonesian context is critical. First, Indonesia has the highest number of active COVID-19 cases in Southeast Asia, as shown in Figure 1. Second, banking is critical to the country's development and dominates its financial sector [26]. Third, Indonesia has a lengthy history of addressing the issue of banking consolidation [27]. Finally, Indonesian banking plays an important role in influencing global banking performance and stability. This is due to the fact that its performance and profitability surpass those of the Asia-Pacific banking industry, which has likewise outperformed the world banking industry over the previous decade [28].

In Section 2, the existing literature on the influence of COVID-19 and bank concentration on bank stability was reviewed, while Section 3 discussed the data and empirical model. Subsequently, section 4 provided empirical results, related discussions, and several robustness checks, while Section 6 summarized the findings.





**Figure 1. Daily new confirmed Covid-19 deaths and cases in Southeast Asia-Source: <https://ourworldindata.org>– Last update 30th June 2021**

## 2- Literature Review

Numerous studies on COVID-19 demonstrate a major impact on the financial system, including stock returns and market reaction. Schell et al. [29] and Heyden & Heyden [30] revealed the significant negative reaction of stocks to the pandemic using an even study focused on the financial market's reaction to COVID-19. Salisu & Vo [31] showed that health news is used to predict stock returns during the pandemic. This study also revealed that health news had negative and statistically significant impacts on the stock performance during the pandemic. Erdem [32] reported that Covid-19 had decreased the rate of return on stock returns in countries, particularly in less free countries. In addition, Narayan et al. [33] observed a correlation between negative stock market returns and government actions connected to COVID-19, such as travel restrictions, stimulus packages, and country lockdown. Studies by Baek et al. [34], Ashraf [35], Al-Awadhi, et al. [36], Topcus & Gulal [37], Mazur et al. [38], Othman et al. [39], He et al. [40], Cepoi [41], Anh & Gan [42], Alfaro et al. [43], and Demirguc-Kunt et al. [44] also showed the significant impact of COVID-19 on volatility and stock market return.

Recent literature has discussed COVID-19 extensively. However, limited research has been conducted on the potential impact of COVID-19 on financial institutions, particularly bank stability. Several studies focus on systemic risk [6], stock return [44], credit risk [45], and the capital stock option of the bank [46], while Scherf et al. [47] focus on national lockdown restrictions in the news. They discovered a negative reaction in the stock market as a result of the lockdown restrictions announcement. Maria et al. [21] discovered that no financial institution is resistant to the detrimental effects of the COVID-19 pandemic. Meanwhile, Duan et al. [48] found that the COVID-19 pandemic has increased bank systemic risk. Using the international evidence, Elnahass et al. [11] showed differential effects on bank stability, with geographical disparities and bank characteristics having distinct consequences. Similarly, Ozsoy et al. [12] identified a decline in bank stability in terms of liquidity injection assistance and regional exposure as a result of COVID-19. They believed that the presence of liquidity injection could assist the bank in improving its capacity to expand loans and stability. In addition, they also found a distinction in impact between regions with low and high COVID-19 exposure.

Meanwhile, the role of bank concentration on bank stability during the COVID-19 pandemic remains unexplored. Although Ben Ali [15] concluded that bank concentration contributes to the stability of banking systems during times of crisis, many studies on this relationship exhibit mixed results. Some studies found that banks support the hypothesis of "concentration–stability". For instance, Beck et al. [14] demonstrated that a concentrated banking system would be easier to monitor than a dispersed type. This will result in more effective banking supervision and cause the risk of

contagion and systemic crises to become less pronounced in concentrated markets. Another related hypothesis is that the bank's higher market power will result in greater profits in a more concentrated system, thereby serving as protection against adverse shocks and increasing the franchise value. Therefore, according to the stability-concentration hypothesis, banks with high concentration ratios are more resistant to crises and financial instability than banks with lower concentration ratios. [14, 15, 19, 20]. Conversely, the "concentration-fragility" hypothesis argues that lower levels of concentration in the banking system's structure may decrease financial instability [16-18].

Therefore, this study examined whether the interplay of COVID19, bank concentration, and bank stability depend on bank capitalization, using the implications of the global financial crisis (2008/2009) as a complement. Indeed, some studies emphasize bank capitalization during the COVID-19 pandemic. For instance, Carletti et al. [49] revealed that following the global financial crisis, banks considerably boosted their capital ratios, making them potentially more resistant to pandemic shocks. Demir & Danisman [50] showed that banks with more capital had more resilient stock prices during the COVID-19 pandemic. Kozak [51] showed that banks in Central Eastern South European have sufficient equity capital to sustain a 12 percent increase in non-performing loans as a result of the COVID-19 epidemic. However, the role of bank capitalization to enhance the beneficial effect of the interaction between COVID-19 and bank concentration on bank stability during the COVID-19 pandemic remains unexplored.

The similarities between the global financial crisis (2008/2009) and the COVID-19 pandemic are their contagious financial and economic distress effects. According to Caballero & Simsek [13], the global financial crisis was contagious, much like a pandemic. Aldasoro et al. [52] noted that COVID-19 produces a complex and varied set of consequences and threatens the stability of the banking system. Furthermore, a large number of studies demonstrated that the financial crisis had different effects on banking stability depending on bank capitalization. Berger & Bouwman [22] discovered that banks with adequate capitalization fared better during the global financial crisis. Garel & Petit-Romec [23] also demonstrated that increased overall bank capital correlated with improved performance during the global financial crisis. By contrast, the supply of bank capital by short-term institutional investors results in diminished economic gain and eventually poor capital performance. Demircuc-Kunt et al. [24] documented that a greater capital position was related to superior stock market performance throughout the crisis, particularly for larger banks. Beltratti & Stul [25] observed that the excellent quality of bank capitalization and widespread government support were critical for continued lending during the crisis period. Hence, bank capitalization is important in explaining bank stability.

### 3- Data, Variables, and Methodology

This study obtains an unbalanced panel dataset covering 108 commercial banks in Indonesia (i.e. 97 conventional banks and 11 Islamic banks). These banks cover all Islamic and conventional banks in Indonesia. Between March 2020 and May 2021, banks' characteristics were obtained from the monthly financial reports of the Indonesian Financial Services Authority. This date was selected because the first COVID-19 case has been confirmed in Indonesia (March 2, 2020), which marked the beginning of the pandemic.

According to Saif-Alyousfi et al. [53], Soedarmono et al. [54], Yudaruddin [55] and Maria et al. [56] two dependent variables reflect bank stability (ZSCORE), namely the construction for bank  $i$  at month  $t$ , which are based on the following formula:

$$ZROA_{i,t} = \frac{ROA_{i,t} + EQTA_{i,t}}{SDROA_{i,t}} \quad (1)$$

$$ZROE_{i,t} = \frac{1 + ROE_{i,t}}{SDROE_{i,t}} \quad (2)$$

where ROE and ROA are bank  $i$ 's return on assets and return on equity between March 2020 and May 2021, ROE and ROA are the return on equity and return on assets for bank  $i$ . The ratio of total equity to assets is EQTA. Using a three-month rolling window, SDROE and SDROA represent the standard deviation of the bank's return on equity and assets, respectively. Higher ZROE and ZROA ratios correlate with a bank's soundness, whereas lower ratios indicate susceptibility to insolvency risks.

Subsequently, COVID-19 and bank concentration are used as the independent variables to explain the parameters of interest. Despite the fact that the duration of the outbreak in each nation differs, a number of studies use the monthly increase in confirmed cases as a proxy for the pandemic of COVID-19 [35, 36, 42]. Following Uhde & Heimeshoff [17], bank concentration was measured by the Herfindahl Hirschman Index of bank assets (HHI), in which lower values indicate a smaller concentration.

This study also examined several bank-specific control and macroeconomic variables. The first variable was SIZE (size of the bank), where small banks are riskier than large banks because large banks are more diversified [27, 56]. The second variable was the ratio of non-Interest Income to Total Assets (NII), which enhanced bank stability [57, 58]. The third variable was OEOI (operating expenses to operating income). Berger & DeYoung [59], Fiordelisi et al. [60], Altunbas et al. [61] reported that increased inefficient banks reduces bank stability. The fourth was EQTA (Equity to

Total Asset), which was added as a control variable to adjust for the degree of bank capitalization, which has negative and positive impact on bank stability [54, 62]. The fifth was LTA (Loans to Total Assets). Lower LTA tends to decrease bank liquidity, while asset liquidity directly enhances stability by encouraging banks the reduction of balance sheet risks during crises [63]. The last variable was INF (Inflation), reported to negatively impact bank stability due to the severe cash flow problems caused for borrowers [64].

In terms of econometric methodology, the regressions were conducted in two stages. First, COVID-19, measured by the monthly growth in confirmed cases, bank concentration, and a set of control variables simultaneously as in Equation 3:

$$ZSCORE_{i,t} = \beta_0 + \beta_1 COVID19_t + \beta_2 HHI_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 NII_{i,t} + \beta_5 OEOL_{i,t} + \beta_6 EQTA_{i,t} + \beta_7 LTA_{i,t} + \beta_8 INF_{i,t} + \varepsilon_{i,j} \quad (3)$$

Equation 3 was included in the second stage by incorporating the interaction between COVID-19 and bank concentration, as shown in Equation 4. The objective was to assess the effect of bank concentration on the link between COVID-19 and bank stability. Samples that were broken down between high vs. low capitalization banks were also repeated to create a model to predict bank stability below:

$$ZSCORE = \beta_0 + \beta_1 COVID19_t + \beta_2 HHI_{i,t} + \beta_3 COVID19 * HHI_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 NII_{i,t} + \beta_6 OEOL_{i,t} + \beta_7 EQTA_{i,t} + \beta_8 LTA_{i,t} + \beta_9 INF_{i,t} + \varepsilon_{i,j} \quad (4)$$

where  $i$  represents a specific bank,  $t$  represents a month, and Bank Stability (BS) is the dependent variable. The pandemic of COVID-19 and the HHI were the independent variables, while INF, SIZE, NII, OEOL, EQTA, and LTA, represent the macroeconomic and bank-specific. Also,  $\varepsilon_i$  and  $t$  were the bank-level error terms.

Finally, panel data regression analysis is used to model the effect of predictor variables on response variables in multiple sectors observed from a research subject over a specific time period. In specific, panel-data regression approach produces time-series and cross-sectional variation from the basic panel data while reducing heteroskedasticity, multicollinearity, and estimate bias. Similar to Al-Awadhi et al. [36], the least square method of the fixed effects model (FEM) was used, and the Hausman test investigated the viability of using FEM instead of random effects regression. The fixed-effects model used the panel data to generate unbiased and consistent coefficient estimates, and the study also included month-year dummies to explain unobservable effects.

The overall flow of this research is depicted in Figure 2 as a flowchart comprised of six steps. The first through sixth of which identify the research problem, objective, and contribution. In the subsequent phase, the relevant literature review, the research methodology, the data analysis, the results and discussions, and the study's conclusions and recommendations are included, respectively.

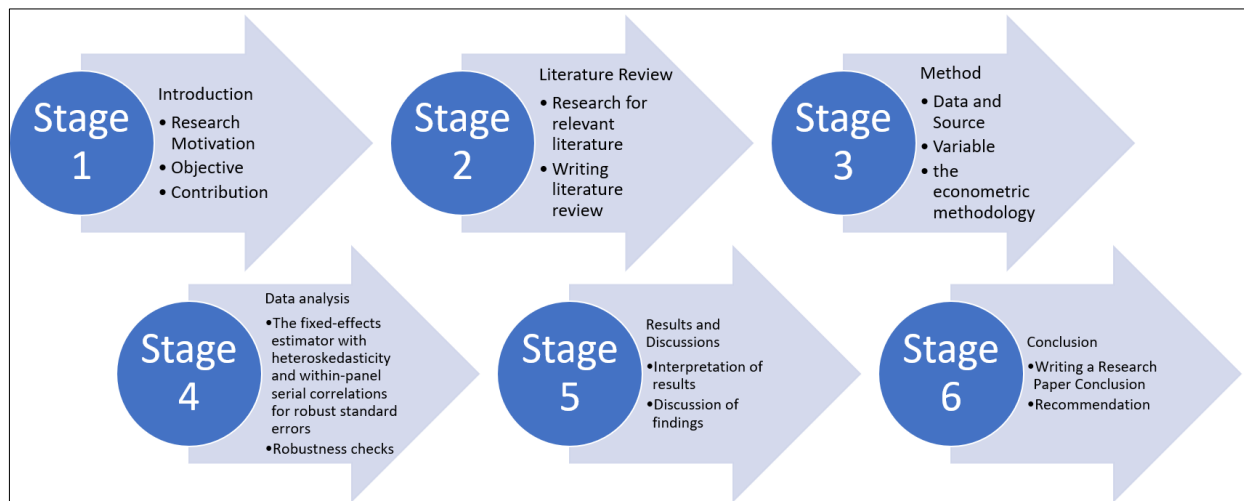


Figure 2. Research Flowchart

#### 4- Empirical Results and Robustness Checks

The average and standard deviation of all variables are summarized in Table 1. Winsorization was performed at 5% and 95% to eliminate outliers. Subsequently, the average ZROE and ZROA for the sample banks were 11.344 and 417.17, while the standard deviations were 12.625 and 715.32, respectively. The monthly growth in confirmed COVID-



19 confirmed cases generated a mean of 77.92%, while the standard deviation was 112.26%. Table 2 shows the corresponding structure of the variables, indicating that there was no multicollinearity problem since not all the independent variables considered in this study showed a significant correlation.

**Table 1. Statistical Description**

Variables	Definition	Obs.	Mean	Std. Dev.	Min.	Max.
ZROE	$ZROE = (1 + ROE)/SDROE$ ; ROE stands for return on equity, whereas SDROE is the standard deviation of the return-to-equity ratio.	1590	11.344	12.624	-3.1177	71.262
ZROA	$ZROA = (ROA + EQTA)/SDROA$ ; ROA stands for return on assets; SDROA is the standard deviation of the return-on-assets ratio and EQTA is total equity to total assets.	1590	417.17	715.32	6.3641	4817.2
COVID-19	Growth in confirmed cases (%)	1489	77.920	112.26	2.6993	462.17
HHI	Herfindahl Hirschman index of bank assets	1597	687.67	15.215	658.41	721.12
SIZE	The logarithm of total bank assets	1597	16.993	1.2618	14.574	19.485
NII	Non-interest income to total assets (%)	1597	0.9305	1.6219	0.0141	12.776
OEOI	Operating expenses to operating income (%)	1597	86.308	19.577	40.765	163.16
EQTA	Equity to total assets (%)	1597	16.610	8.1768	5.3504	56.532
LTA	Loan to total bank assets (%)	1597	54.753	14.746	16.110	77.883
INF	Consumer Price Index (CPI)	1597	105.39	0.6268	104.72	106.63

**Table 2. Correlation between Independent Variables**

COVID-19	1.0000							
HHI	-0.5662	1.0000						
SIZE	-0.0144	0.0046	1.0000					
NII	0.1723	-0.1484	0.1230	1.0000				
OEOI	0.0550	-0.0527	-0.2874	-0.0441	1.0000			
EQTA	-0.0353	0.0330	-0.3751	-0.0905	0.1050	1.0000		
LTA	0.1077	-0.0604	0.0590	-0.1035	-0.0203	-0.0201	1.0000	
INF	-0.4823	0.4631	0.0186	-0.2508	-0.0289	0.0473	-0.1333	1.0000

The regression analysis proceeded by, first, examining the relationship between the COVID-19 pandemic, bank concentration, and bank stability. This was repeated in the second stage, which was modified to include the effect of the interaction between COVID-19 and bank concentration on bank stability. The second step was repeated in the third stage, though the samples were differentiated between high and low capitalization banks. Finally, the robustness of the primary results was evaluated in four ways.

Table 3 displays the outcomes of the baseline regression analysis of the impact of the COVID-19 pandemic, bank concentration, and control variables on bank stability. The COVID-19 pandemic was assessed by the monthly increase in the number of verified COVID-19 cases, for which the ZROE and ZROA regression findings revealed a negative and statistically significant effect on bank stability (Models 1 & 3). A rise in the number of growth-confirmed COVID-19 cases decreases the stability of banks and is consistent with prior research by Elnahass et al. [11] and Ozsoy et al. [12]. It is also consistent with the studies by Rizwana et al. [6], Wu & Alson [45], Li et al. [46], Duan et al. [48], who used different measurements to show that the COVID-19 pandemic is sharply increasing the risks of financial systems, loan-taking, and credit of banks.

**Table 3. The Impact of COVID-19 and Bank Concentration on Bank Stability; Baseline**

	ZROA		ZROE	
	1	2	3	4
COVID-19	-1.6727*** (0.2501)	-173.9263*** (23.8711)	-0.0419*** (0.0049)	-1.6394*** (0.4382)
HHI	-67.0441*** (6.6269)	-67.2689*** (6.6473)	-0.9244*** (0.1206)	-0.9265*** (0.1211)
COVID-19 * HHI		0.2594*** (0.0360)		0.0024*** (0.0006)
SIZE	179.197 (125.7778)	179.197 (125.7778)	8.0345*** (1.7605)	8.0345*** (1.7605)

NII	-14.0899*	-14.0899*	0.1116	0.1116
	(7.3872)	(7.3872)	(0.2008)	(0.2008)
OEOI	-0.5670	-0.5670	-0.0295	-0.0295
	(0.9650)	(0.9650)	(0.0278)	(0.0278)
EQTA	25.4005***	25.4005***	0.4763***	0.4763***
	(5.9617)	(5.9617)	(0.0905)	(0.0905)
LTA	3.7472	3.7472	0.0228	0.0228
	(6.0601)	(6.0601)	(0.0774)	(0.0774)
INF	2089.24***	2089.241***	17.8859***	17.8858***
	(264.8748)	(264.8748)	(5.1706)	(5.1706)
Constant	-176754.3***	-176690***	-1371.93***	-1371.34***
	(24301.18)	(24294)	(471.52)	(471.38)
Year-month FE	Yes	Yes	Yes	Yes
R-Square	0.1451	0.1451	0.3658	0.3658
Observation	1482	1482	1482	1482

Note: \*\*\* indicates the 1% significance level, \*\* 5%, and \* 10%. Robust standard errors are shown in parentheses.

As reported in Table 3, bank concentration (HHI) is another independent variable with a disadvantageous impact on bank stability. The results indicated that a decrease in bank concentration leads to an increase in bank stability, thereby supporting the concentration-fragility hypothesis. This conforms to the findings of De Nicoló et al. [16], Uhde & Heimeshoff [17], IJtsma et al. [18], who reported that high levels of concentration in the banking system's structure increase financial instability. Meanwhile, the findings of the joint impact of COVID-19 and bank concentration appeared to have a positive effect on bank stability. The results indicate that bank concentration tends to boost bank stability following an increase in the number of confirmed COVID-19 cases, thereby supporting the concentration-stability hypothesis. This shows that bank consolidation plays an important role in strengthening bank stability during the pandemic, particularly during a rise in the number of confirmed cases. These findings are consistent with the study by Ben Ali [15], which showed that bank concentration contributes to the stability of banking systems during times of crisis, as well as Beck et al. [14], who reported a reduction in a country's likelihood of experiencing a systemic banking crisis.

The difference in average bank stability based on Bank Capitalization is depicted in Figure 3. The figure shows that banks with high capitalization are more stable than those with low capitalization. Thus, bank capitalization plays a crucial role in mitigating the negative effects of the COVID-19 pandemic. In addition, the policy of bank consolidation will be effective for banks with high capitalization relative to those with low capitalization.

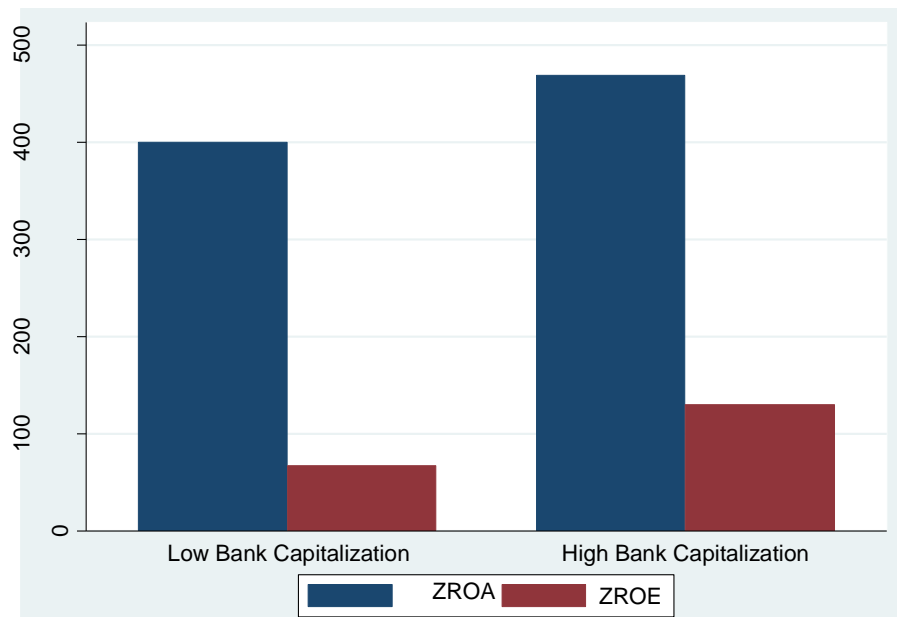


Figure 3. Average of Bank Stability by Bank Capitalization

In the next stage, this study examined the reliance of the joint impact of COVID-19 and market concentration on the degree of bank capitalization. The samples were split into high and low bank capitalization categories, and the results are presented in Table 4. According to the findings, higher growth in the number of confirmed COVID-19 cases is associated with lower ZROA and ZROE at the 1% level and is more pronounced in banks with low and high capitalization. Table 4 also shows that the adverse effect of bank consolidation on stability is more pronounced for institutions with high and low capitalization, thereby supporting the concentration-fragility hypothesis. However, the evaluation of the interaction between COVID-19 and bank concentration revealed that consolidation tends to increase stability as the number of confirmed cases rises. This finding is more pronounced in banks with high capitalization and bolsters the concentration–stability hypothesis. The results regarding the ability of adequate capitalization to enhance the beneficial effect of the interaction between COVID-19 and bank concentration are somewhat consistent with previous literature. Hence, the critical role of high capitalization during crises was emphasized [22-25].

**Table 4. The Impact of COVID-19 and Bank Concentration on Bank Stability for High and Low Capitalization**

	ZROA		ZROE	
	1	2	3	4
<b>Panel A: High Capitalization</b>				
COVID-19	-1.8229*** (0.4735)	-220.73*** (55.529)	-0.0431*** (0.0106)	-1.6681* (0.8117)
HHI	-73.9264*** (17.788)	-74.212*** (17.851)	-1.0027*** (0.2547)	-1.0048*** (0.2554)
COVID-19 * HHI		0.3297*** (0.0833)		0.0248* (0.0012)
Constant	-206462*** (65237.5)	-206380.4*** (65219.12)	-1876.65* (915.92)	-1876.04 (915.66)
Control	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
R-Square	0.1981	0.1981	0.3650	0.3650
Observation	371	371	371	371
<b>Panel B: Low Capitalization</b>				
COVID-19	-0.6392** (0.2864)	-22.951 (21.089)	-0.0315*** (0.0059)	-0.3255 (0.3176)
HHI	-11.526*** (1.9140)	-11.504*** (1.9209)	-0.3689*** (0.0258)	-0.3686*** (0.0259)
COVID-19 * HHI		0.0336 (0.0320)		0.0004 (0.0004)
Constant	14864.09 (9503.59)	15043.91.7 (9376.39)	431.53*** (148.09)	433.90*** (146.25)
Control	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
R-Square	0.1397	0.1397	0.3784	0.3784
Observation	1111	1111	1111	1111

**Note:** Low capitalization is declared in calculations where the percentage of the equity to the total asset is below the lowest 75<sup>th</sup> percentile, while high capitalization is stated for the remainders. \*\*\* indicates the 1% significance level, \*\* 5%, and \* 10%. Robust standard errors are shown in parentheses.

After observing the reliance of the joint impact of COVID-19 and market concentration on the degree of bank capitalization, robustness checks were conducted to ensure accurate and steady results. In accordance with Saif-Alyousfi et al. [54], the dependent variable was originally substituted with regularly deployed alternative bank stability measures. These included Loan Loss Provision (LLP), Standard Deviation of Return on Equity (STDVROE), and Standard Deviation of Return on Assets (STDVROA), as presented in Table 5, where higher values indicate a higher risk. Afterward, the effect of COVID-19 and bank concentration on bank stability was re-calculated using alternative death case measures, as presented in Table 6. Subsequently, the Herfindahl Hirschman Index of alternative measures of bank concentration was replaced with proportion of assets held by the three major banks, as documented in Table 7. Finally, the impact of COVID-19 and bank concentration on bank stability were re-estimated using the lag effect, as reported in Table 8. According to the results, the overall impact of the COVID-19 pandemic and bank concentration on bank stability remained unchanged.



**Table 5. Robustness Tests; Alternative Measures of Bank Stability**

	LLP		STDVROE		STDVROA	
	1	2	3	4	5	6
COVID-19	0.0002** (0.0001)	0.0751*** (0.0115)	0.0019** (0.0007)	0.6008*** (0.0880)	0.0003*** (0.0001)	0.0675*** (0.0114)
HHI	0.0243*** (0.0047)	0.0244*** (0.0047)	0.1585*** (0.0292)	0.1593*** (0.0293)	0.0181*** (0.0041)	0.0182*** (0.0041)
COVID-19 * HHI		-0.0001*** (0.0001)		-0.0009*** (0.0001)		-0.0001*** (0.0001)
Constant	86.813*** (18.148)	86.785*** (18.145)	328.06*** (91.442)	327.83*** (91.411)	22.3971* (13.1594)	22.372* (13.1555)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.1294	0.1294	0.4647	0.4647	0.5728	0.5728
Observation	1486	1486	1482	1482	1482	1482

**Note:** LLP is Loan Loss Provision, STDVROE is the standard deviation of return on equity, using a three-month rolling window. STDVROE is the standard deviation of return on assets, using a three-month rolling window. \*\*\* indicates the 1% significance level, \*\* 5%, and \* 10%. Robust standard errors are shown in parentheses.

**Table 6. Robustness Tests; Alternative Measures of COVID-19**

	ZROA		ZROE	
	1	2	3	4
DEATH	-1.9583*** (0.2928)	-202.01*** (27.073)	-0.0419*** (0.0058)	-1.9688*** (0.4961)
HHI	-66.565*** (6.5908)	-68.208*** (6.7426)	-0.9124*** (0.1202)	-0.9282*** (0.1233)
HHI * DEATH		0.3011*** (0.0408)		0.0028*** (0.0007)
Constant	-177096.6*** (24311.54)	-176031.8*** (24194.4)	-1380.52*** (471.52)	-1370.30*** (469.22)
Control	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
R-Square	0.1451	0.1451	0.3658	0.3658
Observation	1482	1482	1482	1482

**Note:** DEATH is growth in death cases (%). \*\*\* indicates the 1% significance level, \*\* 5%, and \* 10%. Robust standard errors are shown in parentheses.

**Table 7. Robustness Tests; Alternative Measures of Bank Concentration**

	ZROA		ZROE	
	1	2	3	4
COVID-19	-1.6247*** (0.2477)	-198.75*** (35.909)	-0.0412*** (0.0049)	-1.3965** (0.6426)
CR	-1688.2*** (166.82)	-1693.3*** (167.32)	-23.279*** (6.6269)	-23.314*** (3.0487)
COVID-19 * CR		5.0920*** (0.9297)		0.0359** (0.0166)
Constant	-176754.3*** (24301.18)	-176690*** (24294)	-1371.93*** (471.52)	-1371.34*** (471.38)
Control	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
R-Square	0.1451	0.1451	0.3658	0.3658
Observation	1482	1482	1482	1482

**Note:** CR is the percentage of bank assets held by the top 3 banks, \*\*\* indicates the 1% significance level, \*\* 5%, and \* 10%. Robust standard errors are shown in parentheses.

Overall, these results suggest that the COVID-19 pandemic has affected the Indonesian banking sector. Currently, global financial sector authorities assess that the financial system still possesses a number of structural risks and vulnerabilities. Consequently, an accommodating and resilient global financial system during the COVID-19 pandemic cannot be separated from the policy response implemented by the authorities to aid in the recovery of the economy and reduce the risk of financial instability. Furthermore, the study's findings provide practitioners, governments, and financial authorities with valuable information for policymaking. The banking industry can mitigate the negative effects of the COVID-19 pandemic by consolidating banks and increasing bank capital. Despite the fact that this condition cannot be separated from the strengthening of the government's COVID-19 response, empirical studies [14, 15, 19, 20] have demonstrated that the significant role of bank concentration and bank capitalization in times of crisis improves bank stability.

## 5- Conclusion

This study extends prior literature on the COVID-19 –bank stability nexus and bank concentration– bank stability nexuses by exploring 108 commercial banks between March 2020 and May 2021. To the best of our knowledge, no prior literature has been devoted to studying the joint impact of the COVID-19 pandemic and bank concentration on bank stability. Most of the previous studies focused on the impact of the COVID-19 pandemic on bank stability or bank concentration on bank stability. Hence, this paper aims to fill this gap. As an additional contribution, this study explores the link between interactions between the COVID-19 pandemic and bank concentration by differentiating bank capitalization. Indeed, previous studies have examined the role of bank capitalization in times of the COVID-19 pandemic, but they do not specifically investigate the joint impact of the COVID-19 pandemic and bank concentration on bank stability by differentiating bank capitalization.

The empirical findings show robust results regarding the negative impact of the pandemic on bank stability, highlighting a significant adverse effect. Although bank concentration caused a decrease in stability in support of the concentration-fragility hypothesis, an increase was revealed to occur as confirmed COVID-19 cases grew, thereby verifying the concentration-stability hypothesis. This finding is more pronounced in banks with high capitalizations. Therefore, this study shows the benefits of adequate capitalization in enhancing the beneficial effect of the interaction between COVID-19 and bank concentration on stability. This study also highlights some policy recommendations to improve bank stability during the COVID-19 pandemic. First, the importance of strengthening bank concentration, including through consolidation, to deal with the increase in confirmed cases. Second, the importance of strengthening bank capitalization and the need for authorities to exercise control over the financial sector, combined with measures promoting consolidation during the pandemic. Although this study provides a significant theoretical and empirical contribution, this study still has some limitations and becomes a recommendation for further research. Since this study focuses only on a single country and commercial banks, future research could explore cross countries and financial institutions such as insurance.

## 6- Declarations

### 6-1- Author Contributions

Conceptualization, S.S.R. and R.Y.; methodology, S.S.R.; software, M.H.; validation, S.S.R, R.Y. and M.H.; formal analysis, M.H.; investigation, S.S.R.; resources, R.Y.; data curation, M.H.; writing—original draft preparation, R.Y.; writing—review and editing, S.S.R.; visualization, M.H.; supervision, S.S.R.; project administration, M.H.; funding acquisition, R.Y. All authors have read and agreed to the published version of the manuscript.

### 6-2- Data Availability Statement

The data presented in this study are available on request from the corresponding author.

### 6-3- Funding

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### 6-5- Institutional Review Board Statement

Not applicable.

### 6-6-Informed Consent Statement

Not applicable.

### 6-7-Conflicts of Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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