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CAPITAL ADEQUACY, LIQUIDITY CREATION, AND PANDEMIC CRISES: AN EMPIRICAL STUDY ON INDONESIAN RURAL BANKS

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ABSTRACT
The aim of this article is to examine the relationship between capital adequacy, liquidity creation, and the pandemic crisis in Rural Banks. There are 435 banks as samples from 2019 – 2021. For hypothesis testing, I use regression techniques within-estimator and two-stage least square to overcome heterogeneity and endogeneity problems. The results support the theory of financial fragility crowding out so that capital adequacy is negatively associated with liquidity creation. In fact, the nexus is greater during the covid-19 pandemic crisis. In the end, this research has theoretical and practical implications.

Keywords: Capital Adequacy; Liquidity Creation; The covid-19 pandemic crises

INTRODUCTION

The role of banks as intermediary institutions is related to the transformation function (Bossone, 2001; Werner, 2016). When transforming short-term funding into long-term financing, banks turn liquidity and risk. For example, banks accept liquid deposits and allocate them to long-term loans. In addition, the bank issues commitments to provide loans in a certain amount and time to improve intermediation performance. Berger & Bouwman (2009) define this mechanism as the creation of liquidity (liquidity creation).

Liquidity creation can trigger the risk of bank failure (Zheng et al., 2019). Basel III, which consists of regulatory, supervisory, and risk management mechanisms, are implemented to mitigate the default risk. One of the implementations of the agreement is the obligation of banks to increase capital adequacy which is counter to the economic cycle (BCBS, 2010, 2011). This is intended to support intermediation performance through credit expansion and banking stability against potential crises (Bekiros et al., 2018; Shim, 2013).

Previous studies found that the relation between capital and liquidity creation is inconclusive. Some concluded that capital is negatively associated with liquidity creation (Fungáčová et al., 2017; Toh, 2019; Umar et al., 2018). The negative effect of buffer capital on liquidity creation is supported by the financial-fragility crowding-out view. The theory states that if the capital adequacy is high, banks tend to switch to long-term equity, thus eliminating the role of short-term liabilities to create liquidity. In other studies, capital is positively related to liquidity creation (Bui et al., 2017; Ovi et al., 2020; Shim, 2013). The risk absorption theory underlies the positive effect of buffer capital on liquidity creation. The consequence of the high intensity of liquidity creation is the low quality of earning assets. Therefore, banks will increase capital to be safer when creating liquidity.

The covid-19 pandemic can indirectly be a stress test for the banking industry. Li et al. (2020) examined the role of banks in the United States during the pandemic. When many companies need additional funding to anticipate cash flow disruptions due to the pandemic, the banking sector can meet the demand for liquidity. Due to better capital conditions before the COVID-19 crisis than the 2008 global financial crisis and supported by funding stability and liquidity injection by the central bank, the role of banks has become increasingly essential.

In Indonesia, there has been a decline in the banking intermediation role since the pandemic was first announced in March 2020 (Figure 1). This was marked by drastically

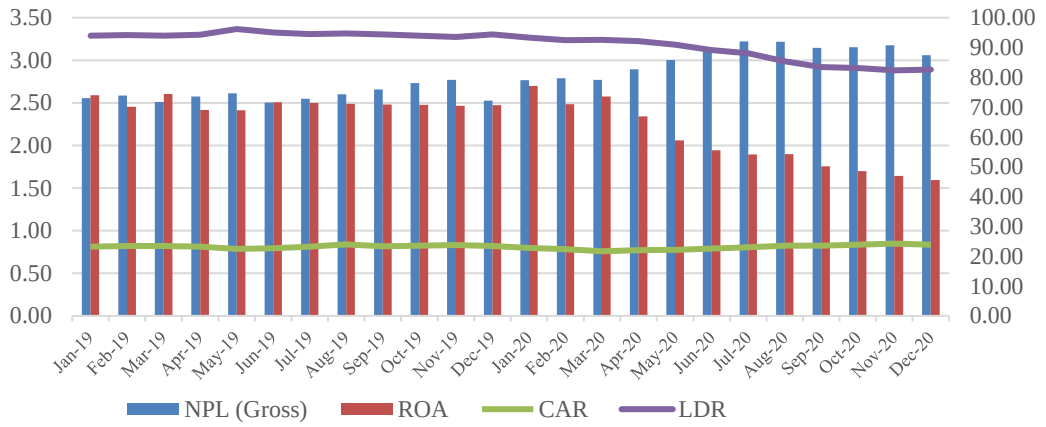

Figure 1. Indonesian Bank's Indicators
Source: Statistics of Financial System Stability (2021)

decrease in the loan-to-deposit ratio (LDR). From the NPL indictor, nonperforming loans also increased thus reducing bank profitability (ROA). Meanwhile, a reasonably good indicator is shown in the capital adequacy ratio (CAR) which tends to be stable and high before the pandemic until the end of 2020. However, a high CAR and a low LDR can be interpreted that bank accumulate their capital adequacy by dropping credit allocation to mitigate potential losses due to increased bad loans.

Previous studies examined the relationship between capital adequacy and liquidity creation in commercial banks. To the best of my knowledge, there has not been much research on Rural Banks (BPR) in Indonesia. In fact, the role of rural banks is very important in providing liquidity for the MSMEs (Micro, Small and Medium Enterprises).

LITERATURE REVIEW

Capital Adequacy and Liquidity Creation

The BASEL III agreement recommends a capital buffer so that credit distribution is not disrupted when the economy is in recession (BCBS, 2011; Ovi et al., 2020). Technically, buffer capital is the excess of the capital adequacy ratio (capital adequacy ratio) to the minimum capital requirement ratio required by the regulator (Coffinet et al., 2012) and is generated by reducing the loan portfolio during a booming period. In addition to absorbing potential losses, buffer capital is used as a signal of bank soundness (Lindquist, 2004) and a source of internal funding during crisis periods (Shim, 2013). Therefore, authorities apply market discipline by requiring a minimum capital adequacy ratio.

Basically, a bank is a profit-oriented financial institution for the prosperity of shareholders. In addition, these institutions have an essential role in the economy, namely liquidity creation (Berger & Bouwman, 2009). Banks can utilize the on-balance sheet (ONBS) and off-balance sheet (OFBS) mechanisms to create liquidity. On the balance sheet (ONBS), banks allocate portfolios to productive assets that are relatively less liquid with funding sources from liquid liabilities. Banks can also issue loan commitments through OFBS activities so that the credit facility can be withdrawn in a specified amount and period. Banks as liquidity providers for the economy need to be supported by adequate capital so that their role can persist in various business cycles (Davydov et al., 2018; Zheng et al., 2019). Therefore, a study on the interaction between capital adequacy (CAR) and liquidity creation (LQC) is necessary.

The risk absorption theory states that the capital adequacy ratio has a positive effect on the creation of liquidity. As a cushion (Bui et al., 2017; Ovi et al., 2020; Shim,

2013), capital is expected to absorb potential losses caused by the process of creating liquidity (Berger & Bouwman, 2009). The high intensity of liquidity creation is positively correlated with high non-performing loans. If many borrowers fail to pay, excess capital can absorb the losses incurred so that it does not have an impact on bank operations.

Several studies examined the negative relationship between capital adequacy and liquidity creation in Malaysia (Toh, 2019), Russia (Fungáčová et al., 2017), United States (Evans & Haq, 2021) and BRICS countries (Brazil, Russia, India, China). , and South Africa) (Umar et al., 2018). The study findings conclude that the higher the capital adequacy ratio, the lower the liquidity creation performance. This negative association is in line with the theory of financial fragility crowding out.

The theory of financial fragility crowding out was initiated by Diamond & Rajan (2000). Large bank capital reduces the possibility of financial distress but also impedes the creation of liquidity. This theory is inseparable from the ability of banks to collect private information from borrowers so that they have the bargaining power to determine or even reduce the interest rate on the funding. On the other hand, deposits are a source of short-term funding that is vulnerable to bank runs. To mitigate moral hazard behavior by banks, depositors ask banks to be more expansive in credit allocation with guaranteed funding stability. However, in conditions of high capital adequacy ratios, banks tend to switch to long-term equities, thus hampering the creation of liquidity. The first hypothesis is structured as follows: Capital adequacy is negatively associated with bank's liquidity creation (Hypothesis 1).

Pandemic Crisis as Moderating Factor Between Capital Adequacy and Liquidity Creation

The pandemic crisis caused by the massive spread of the Covid-19 virus forced governments in various countries to implement lockdowns. With this policy, virus transmission can be controlled. In Indonesia, the government has imposed large-scale social restrictions (PSBB) to suppress community mobility and activities. On the one hand, this policy has proven to be able to suppress the transmission of the virus. On the other hand, economic activity will be disrupted so that it has an impact on the financial sector from the capital market (He et al., 2020; Narayan et al., 2021) to banking (Elnahass et al., 2021). Even though the government has tried various stimuli, the economy is still contracted quite big (Olivia et al., 2020). Therefore, the banking sector also made many adjustments to survive amidst the shocks of the pandemic crisis.

As stipulated in BASEL III, capital adequacy plays an important role in supporting banking stability. Cao & Chou (2022) proved that banks with high capital adequacy tend to be more resilient to the shocks of the pandemic crisis. The role of capital as a buffer is used to absorb losses. When increasing capital adequacy, banks will accumulate capital adequacy by reducing their portfolio of high-risk assets during crisis periods. the capital owned by the bank is sufficient to absorb losses due to uncollected loans. If the relationship between capital adequacy and the creation of liquidity was negative before the crisis, then during the crisis the relationship might be stronger. The negative relationship between capital adequacy and liquidity creation will be stronger during pandemic crises (Hypothesis 2).

METHODS

This section discusses data sources, sampling criteria, and operational definitions of each variable. The study uses quarterly bank financial reports issued by the Financial Services Authority (OJK). The sample is rural banks published by the OJK from the 1st quarter of 2019 to the 1st quarter of 2021 on Java Island. The reason for only using the samples on the island is that 75% of Indonesia's rural banks are concentrated on Java Island. During the period, there were 435 banks with a total of 3492 observations. Information on financial statement items and ratios specific to banking is available on the websites. Table 1 contains operational definitions of the dependent variable, independent

variable, and control variable. Each explanation is based on references to previous research.

The main objective of this research is to examine the one-way effect of capital adequacy on liquidity creation in Indonesian Rural Banks. However, the theory of liquidity substitution assumes that liquid liabilities are a stable funding. Hence, banks use it as a substitute for capital (Distinguin et al., 2013). For that reason, liquidity creation has a negative effect on capital adequacy (Casu et al., 2019; Fu et al., 2016; Horváth et al., 2014; Le, 2019; Mohanty & Mahakud, 2021) so the relationship between capital adequacy and liquidity creation is bi-directional. Therefore, this study utilizes the two-stage least square (2SLS) approach to mitigate the bias caused by the bi-directional nexus.

Table 1. Operational Definitions

	Definitions
Liquidity creation (LQC)	Liquidity creation can be used to measure intermediation performance and bank output. Berger & Bouwman (2009) proposed four measures, namely i. CATFAT: loans and deferred payments are grouped by category and include elements of off-balance sheet activities. ii. CATNONFAT: loans and deferred payments are grouped by category and exclude elements of off-balance sheet activities. iii. MATFAT: loans and deferred payments are grouped by maturity and include elements of off-balance sheet activities. iv. MATNONFAT: loans and deferred payments are grouped by maturity and exclude elements of off-balance sheet activities. In its application, most studies use CATFAT and CATNONFAT with the following formula: (Gupta & Kashiramka, 2020; Nguyen et al., 2020; Zheng et al., 2019): $CATFAT_{it}=[(0,5\times ILA_{it})+(0\times SLA_{it})-(0,5\times LA_{it})]+$ $[(0,5\times LL_{it})+(0\times SLL_{it})-(0,5\times ILL_{it})]-(0,5\times EC_{it})+$ $[(0,5\times IOBS_{it})+(0\times SOBS_{it})-(0,5\times LOBS_{it})]/TA$ $CATNONFAT_{it}=\{[(0,5\times ILA_{it})+(0\times SLA_{it})-(0,5\times LA_{it})]+$ $[(0,5\times LL_{it})+(0\times SLL_{it})-(0,5\times SIL_{it})]-(0,5\times EC_{it})\}/TA$ ILA: illiquid assets; SLA: semi-liquid assets; LA: liquid assets; LL: liquid liabilities; SLL: semi-liquid liabilities; ILL: illiquid liabilities; EC: equity capital; IOBS: illiquid off-balance-sheet transactions; SOBS: semi-liquid off-balance-sheet transactions; LOBS: liquid off-balance-sheet transactions and; TA: total asset.
Capital Adequacy (CAR)	Capital buffer adequacy can be calculated as follow: $CAR_{it} = \frac{Tier\ 1 + Tier\ 2}{RWA}$ Tier 1: common share capital; Tier 2: subordination debt, *hybrid capital*, and loan loss reverse; and RWA: risk-weighted asset
Instrumental Variables (IV)	Instrument variables have an important role to test simultaneous equations. The condition of the instrument variable is that it is correlated with endogenous variables (in this research it is CAR) but not with the error term. CAR is instrumented with loan specifications (LA) and average CAR (MCAR) (Le, 2019; Shim, 2013). LA can be calculated as the ratio of total credit to total assets. MCAR is calculated from the mean of CAR for each district/city and quarter.
Control Variables	Several previous studies suggest CAMELS ratios (capital adequacy; asset quality; management efficiency; earnings; liquidity; sensitivity to market risk) as control variables (Distinguin et al., 2013; Gupta & Kashiramka, 2020; Zheng et al., 2019): NPL : ratio of non-performing loans to total loans CTI : ratio of operating expenses to operating income NIM: ratio of net profit to total interest income FGR: funding growth rate.

Source: Author Analysis (2022)

The two-stage least square (2SLS) involves the instrument variable (VI) to create overidentification conditions in which the number of VIs must be more than the number of endogenous variables in one equation (Wooldridge, 2018). Another condition is the assumption of exogeneity in which the VIs are theoretically correlated with endogenous variables but not with error terms (Greene, 2018; Wooldridge, 2010). In this study, the endogenous variable is capital adequacy (CAR) whereas the instrument variables used are LA and MCAR. 2SLS estimation starts from the first stage of regression called reduce-form as follows:

$$CAR_{it}=\theta_{0,1}+\theta_{1,1}LA_{it} + \theta_{1,2}MCAR_{it-1} + \theta_{1,3}NPL_{it} + \theta_{1,4}CTI_{it} + \theta_{1,5}NIM_{it}$$

$$+\theta_{1,6}DGR_{it} + \mu_{1,i} + v_{1,it} \quad (1)$$

Of equation (1), it is generated the predictive value of CAR ($\widehat{CAR}_{it}$) which is then used in the second stage of regression as follows:

$$LQC_{it}=\delta_{0,2}+\delta_{2,1}\widehat{CAR}_{it} + \delta_{2,2}NPL_{it} + \delta_{2,3}CTI_{it} + \delta_{2,4}NIM_{it} + \delta_{2,5}FGR_{it} + \mu_{1,i} + \varepsilon_{2,it} \quad (2)$$

Equations (1) and (2) are estimated using the within-estimator technique so that the intercept $\theta_{0,1}$ dan $\delta_{0,2}$ will be wiped out. Referring to Petersen (2009), the standard error is clustered at the bank level to relax the assumptions of heteroscedasticity and autocorrelation.

Several steps should be done to determine the validity of the 2SLS model. First, the endogeneity of the CAR variable is based on the value of the C statistic or the difference between the two Sargan-Hansen statistics (2SH Stat.). The null hypothesis for the endogenous test is a variable that is considered endogenous and can be treated as an exogenous variable. The second is the identification test using the Kleibergen-Paap (KP) method to test the correlation of instrument variables with endogenous variables. The third is the Hansen test to determine the validity of the instrument variables. The instrument variable is said to be valid if it is not correlated with the error term

The first hypothesis is supported if the coefficient $\delta_{2,1}$ is negatively significant. The second hypothesis testing is conducted by dividing the sample into two periods which are pre pandemic and during the pandemic. $\delta_{2,1}$ of pre pandemic is expected to be negatively significant while $\delta_{2,1}$ during the pandemic is expected to have the same direction as that of pre pandemic but its magnitude is smaller. Hence, the second hypothesis is supported.

RESULTS

Descriptive statistics

The first discussion on descriptive statistics is to identify trends of liquidity creation (CATFAT and CATNONFAT) and capital adequacy (CAR). Two indicators of liquidity creation show a downward trend from the first quarter of 2019 to the first quarter of 2021. The opposite is indicated by capital adequacy which tends to rise. The initial conclusion of the correlation between liquidity creation and capital adequacy is negative during sample periods.

Table 2 shows descriptive statistical analysis and univariate testing. When compared before and during the pandemic, all variables have significant mean differences, except NIM. For example, the mean of CATFAT and CATNONFAT during the pandemic is lower than that pre pandemic. This shows that the performance of rural bank intermediation declined during the pandemic. Meanwhile, the mean of CAR was higher during the pandemic because rural banks tend to accumulate capital adequacy to deal with increasing credit risk (NPL). The decline in intermediation performance can also be caused by a decrease in the average funding growth (FGR) during the pandemic.

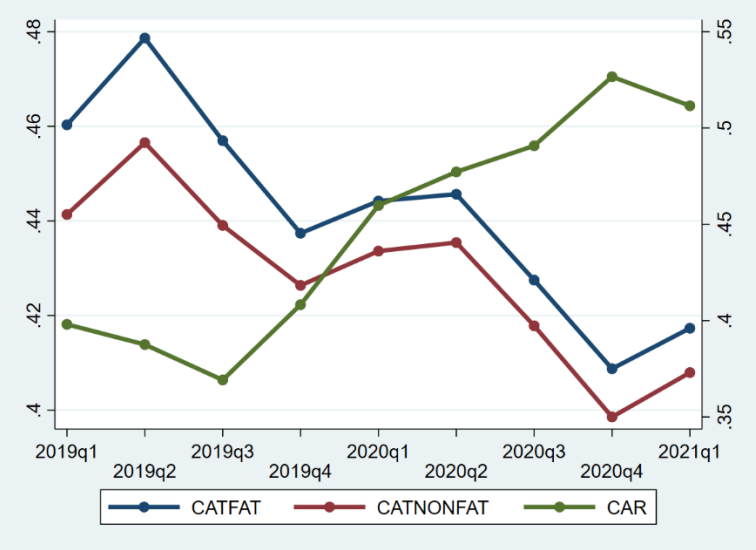

Figure 2. Trends in liquidity creation and capital adequacy
Source: Author Analysis (2022)

Table 2. Descriptive Statistical Analysis and Univariate Testing

	Obs.	mean	SD	Min.	Max.	$\bar{X}_{pre}$	$\bar{X}_{dur.}$	$\bar{X}_{slm-sbm}$
CATFAT	3492	0.44	0.27	-0.98	4.33	0.43	0.46	-0.03***
CATNONFAT	3492	0.43	0.24	-0.98	0.88	0.42	0.44	-0.02***
CAR	3492	45.14	42.72	0.06	938.80	50.61	40.77	9.84***
NPL	3492	8.09	6.73	0.00	100.00	8.50	7.76	0.74***
CTI	3492	85.00	102.46	12.88	3957.9 6	93.81	77.98	15.83***
NIM	3492	-0.06	5.31	-259.22	37.65	0.05	-0.14	0.19
FGR	3492	1.92	19.73	-184.47	360.69	0.93	2.91	-1.98***

This table shows the results of descriptive statistical analysis consisting of the mean, standard deviation (SD), minimal (min.), maximum (max.), the mean of each variable pre pandemic $(\bar{X}_{pre})$ and the mean of each variable during pandemic $(\bar{X}_{dur.})$. Other information is the mean difference test. CAR, NPL, CTI, and FGR are in percent. *, **, and *** denote significant level at 10%, 5%, and 1% respectively.
Source: Author Analysis (2022)

2SLS regression analysis

Table 3 and 4 are the results of the two-stage least square (2SLS) regression. Table 3 is the results of the first-stage regression (reduced-form). The indicators of the endogeneity test (2SH. Stat., Table 4) are statistically significant at 1% so as CAR is endogenous. The instrument variables (MCAR and LTA) are associated with CAR at a significance level of 1%. The F-Stat indicator is also significant at 1% so that the reduce-form equation can explain the endogenous variable (CAR). This result is also supported by the statistical value of Kleibergen-Paap (KP) which is significant at 1%. The validity of the IVs can be seen in the statistical value of Hansen (H.Stat., Table 4). Hansen's indicators are not significant, so the IVs used are valid. From these various tests, it is concluded that the 2SLS regression can be further interpreted.

Table 4. First-stage regression

	CAR
MCAR	0.9665***
	(23.724)
LTA	-0.5374***
	(-5.535)
NPL	-0.0022
	(-1.142)
CTI	-0.0002
	(-0.761)
NIM	0.0245***
	(2.793)
FGR	-0.0008
	(-1.527)
Obs.	3492
The num. of banks.	442
F-Stat.	155.03
F. Pval	(0.00)

This table contains first-stage regression. Standard errors are clustered within bank. t-statistic in parentheses. *, **, and *** are significant at 10%, 5%, and 1% respectively.

Source: Author Analysis (2022)

Table 5. Second-stage regression

	CATFAT			CATNONFAT		
	All	Before	During	All	Before	During
	(1)	(2)	(3)	(4)	(5)	(6)
CAR	-0.2372***	-0.2083***	-0.9584***	-0.2218***	-0.1637***	-1.0314***
	(-13.7238)	(-6.8005)	(-5.5977)	(-14.0309)	(-6.6160)	(-5.6047)
NPL	0.0018**	0.0017	-0.0083***	0.0023***	0.0024***	-0.0091***
	(2.5240)	(1.3528)	(-2.7939)	(3.6267)	(2.6413)	(-2.8152)
CTI	0.0001	0.0002	-0.0004	0.0001	0.0002	-0.0005
	(1.1921)	(1.5055)	(-1.3040)	(1.1255)	(1.3237)	(-1.3223)
NIM	-0.0088*	-0.0174***	-0.0374	-0.0089	-0.0189***	-0.0398
	(-1.6580)	(-6.1430)	(-1.1165)	(-1.6400)	(-7.4639)	(-1.1103)
FGR	-0.0006***	-0.0007***	-0.0012*	-0.0005***	-0.0006***	-0.0012*
	(-3.5668)	(-2.8059)	(-1.8761)	(-2.8659)	(-3.2835)	(-1.7842)
Obs.	3492	1743	1749	3492	1743	1749
Banks	442	442	440	442	442	440
2SH. Stat.	11.14	9.17	93.15	13.37	8.01	100.5
2SH. Pval	0.00	0.01	0.00	0.00	0.01	0.00
KP Stat.	155.98	62.21	30.44	155.98	62.21	30.44
KP Pval.	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
H. Stat.	0.622	1.086	1.698	2.960	1.327	1.167
H. Pval.	(0.586)	(0.208)	(0.189)	(0.134)	(0.175)	(0.195)

This table contains second-stage regression. Standard errors are clustered within bank. t-statistic in parentheses. *, **, and *** are significant at 10%, 5%, and, 1% respectively.

Source: Author Analysis (2022)

DISCUSSION

Table 4 tabulates the coefficients and t-statistics in parentheses. Columns (1) to (3) present the regression result information for the CATFAT as the dependent variable. Column 1 shows the regression results for the entire sample. The CAR is negative (-0.2372) and significant at 1%. The higher the capital adequacy is, the lower the liquidity banks create. This result is in line with the first hypothesis that capital adequacy has a negative effect on liquidity creation. The theory of financial fragility crowding out explains that banks tend to rely on funding through equity rather than deposits because deposits are vulnerable to

withdrawals of large amounts of funds in a short time (the bank run). So that the increasing capital adequacy will reduce the performance of financial intermediation. This conclusion is the same as the regression in column (4).

The difference between the CAR coefficients pre and during the pandemic can be shown in columns (2) and (3). The CAR coefficient before the pandemic is -0.2083 and statistically significant while during the pandemic it is -0.9584 and statistically significant. The effect of capital adequacy on liquidity creation strengthens during the pandemic. This result is in line with the second hypothesis that the negative relationship between capital adequacy and liquidity creation strengthens during the crisis period of the COVID-19 pandemic. When increasing capital adequacy, banks will accumulate capital adequacy by reducing their portfolio of high-risk assets during crisis periods. Therefore, the capital owned by the bank is sufficient to absorb potential losses from loans.

CONCLUSION

Liquidity creation indicates the performance of banking intermediation by collecting short-term funds and distributing long-term loans. Intermediation performance is influenced by bank policies related to capital adequacy. Hence, the first objective of this article is to examine the effect of capital adequacy on liquidity creation The covid-19 crisis has affected the economy and impacted the financial services industry, including banking subsequently. On the one hand, capital is an important aspect to absorb potential losses in turmoil periods. On the other hand, banks will adjust their capital adequacy by limiting the credit volume. Therefore, the pandemic crisis may affect the relationship between capital adequacy and liquidity creation. Thus, the second objective of this article is to examine the role of the pandemic crisis in explaining the relationship between capital adequacy and liquidity creation.

The sample used is Rural Banks in Indonesia from the first quarter of 2019 to the first quarter of 2021. The results of the two-stage least square regression analysis prove the theory of financial-fragility crowding out that capital adequacy is a substitute for liquidity creation performance. In addition, the negative effect of capital adequacy and the creation of liquidity is even greater during the pandemic crisis.

Theoretically, the results of this study provide an overview of the intermediation performance of Rural Banks, considering that previous research has focused on commercial banks. In practical terms, capital adequacy empirically is related to the intermediation function of rural banks. Regulations are needed to provide flexibility for rural banks in managing credit risk so that their intermediation performance is not too disrupted during crises.

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