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# Liquidity risk in economic uncertainty: Evidence from Indonesian Islamic banks

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## Abstract

**Purpose** – This paper aims to analyze the effect of economic uncertainty on liquidity risk of Islamic banks in Indonesia by observing the impact of economic uncertainty (World Uncertainty Index), macroeconomic factors (GDP Growth and Inflation Rate), and bank-specific factors (CAR and ROA) on liquidity risk.

**Methodology** – Using time-series quarterly data from OJK's Islamic Banking Statistics 2015-2021, this research applies Auto-Regressive Distributed Lag (ARDL) and Error Correction Term (ECT) to see the long-term impact and short-term response of economic uncertainty, inflation rate, GDP growth, ROA and CAR on liquidity risk of Islamic Bank.

**Findings** – This research finds that economic uncertainty has a positive and significant effect on liquidity risk in the short term and long term. It means the increase in uncertainty index caused by the crisis, war, or pandemic like nowadays will enhance the liquidity risk of Islamic banking. At the same time, the inflation rate has a significant negative effect on liquidity risk in the short-term and long term.

**Originality** – This research uses a combination of macroeconomic variables and bank-specific factors, and the economic uncertainty variable from the World Uncertainty Index. In this case, one of the reasons for liquidity problems apart from fund management failure is unfavorable economic conditions. In addition, this study also provides several recommendations in maintaining banking liquidity risk.

**Research limitations** – This study uses time-series data with a limited period (2015Q1-2021Q2). In addition, this uses cumulative data on Islamic banking in Indonesia; thus, it does not describe the conditions in each Islamic bank, although certainly there are some different conditions between each other. Therefore, it is hoped that studies will complement these limitations in the future.

## Introduction

A measurable level of liquidity is essential for banks since the liquidity ratio serves the ability of banks to meet their short-term mismatch and the ability of banks to optimize between prudential factors and the level of profit (Asytuti, 2015). In this case, as a financial institution, banks must be able to control their level of liquidity in order to absorb possible losses and strengthen their solvency level (Hugonnier & Morellec, 2017). Therefore, liquidity risk received significant attention from policymakers, researchers, and practitioners, especially after the economic and financial crisis (Hugonnier & Morellec, 2017) because the experience of banks in several

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countries which face liquidity pressures reveals the importance of managing liquidity risk effectively (Hugonnier & Morellec, 2017).

From a sharia point of view, liquidity risk applies to conventional and Islamic banking, but in managing liquidity, Islamic banking must make additional efforts. It is because liquidity problems in Islamic banks are due to liquidity coverage and related to acceptable, tradable, and flexible instruments to apply (Ben Jedidia, 2020). Therefore, as an Islamic financial institution that is trusted by the public to save their money, Islamic banks must manage their liquidity well to minimize the level of liquidity risk, especially with the increasing levels of global uncertainty, including in terms of the economy and finances, caused by various things, such as a crisis or a pandemic like nowadays.

Therefore, this study is designed to analyze the factors that can affect the liquidity risk of Islamic banking in Indonesia. Several previous studies have shown that, in general, two factors can influence liquidity risk, namely bank-specific factors and macroeconomic factors (Alzoubi, 2017; Chowdhury et al., 2019; Ghenimi et al., 2021; Iqbal, 2012; Kasri & Azzahra, 2020; Moussa, 2015; Sukmana & Suryaningtyas, 2016; Waemustafa & Sukri, 2016). Bank-specific factors exist within the Islamic bank itself, and macroeconomic factors are the macroeconomic indicators that can influence it. Hence, this study intends to examine factors such as capital adequacy ratio (CAR) and return on asset (ROA) from bank-specific factors, GDP growth, and inflation rate from macroeconomic factors.

Subsequently, considering that liquidity problems often occur because of failure in fund management and unfavorable economic conditions (Ismal, 2010), such as the current economic crisis, war, or health crisis, economic uncertainty tends to increase in these conditions, and it can also have significant negative consequences on economic performance, including banking risk management (Ahir et al., 2018; Bilgin et al., 2021). Therefore, in some studies, dummy variables indicate a financial crisis in a certain period. Nevertheless, in this study, the variable used to indicate this condition is the World Uncertainty Index. In this case, the world uncertainty index has more advantages than the dummy variable because it can continuously track economic uncertainty and capture its presence in regular and crisis times (Bilgin et al., 2021a).

This study on the Islamic banking industry in Indonesia was conducted using a quantitative approach. With time-series data analysis, this research used a combination of macroeconomic variables and bank-specific factors, as in other studies, and used the economic uncertainty variable from the World Uncertainty Index as the primary variable. In this case, it can be understood that the factors of liquidity problems apart from the fund management is due to unfavorable economic conditions. Thus, this study aims to explain these factors that can influence the liquidity risk of Islamic banking in Indonesia. In addition, this is expected to provide several recommendations to control banking liquidity risk.

## Literature Review

The author found that there had been many empirical studies that revealed several determinants affecting liquidity risk. For instance, according to Chouwdury et al. (2019), the research on liquidity risk using data from six Islamic banks in Bangladesh from 2012 to 2016 explained that ROA, ROE, CAR, and the investment ratio to deposits had a positive relationship with liquidity risk. On the other hand, bank size and NPL harmed liquidity risk. In line with that, according to Iqbal (2012), in his research on 22 conventional banks and 5 Islamic banks in Pakistan found that the capital adequacy ratio (CAR), return on assets (ROA), return on equity (ROE), and bank size had a positive effect on liquidity risk while the ratio of non-performing loans (NPL/NPF) harmed liquidity risk.

In contrast, Sukmana and Suryaningtyas (2016) found a significant and positive relationship between ROA and NPF with liquidity risk, while CAR was negative and significant in Indonesian conventional banks. Meanwhile, CAR was significantly positive with liquidity risk in Islamic banks, while ROA showed negative and significant results. Meanwhile, according to (Alzoubi, 2017) there was a negative relationship between liquidity risk and bank securities, bank size, bank equity, and cash ratio. In addition, there was a positive relationship between assets with high returns and poor financial provision to liquidity risk.

Furthermore, Mousa (2015) showed that GDP growth also affected banking liquidity. The changes in GDP growth had an inverse relationship with banking liquidity. During an expansionary economic policy, banks had an excellent opportunity to create more income, reducing their exposure to liquidity risk. It is different from the study of (Chen & Phuong, 2013) on liquidity risk in Euro countries which found that GDP growth had a positive impact on liquidity risk. Meanwhile, according to Ben Jedidia (2020), in his research on the impact of profit and loss sharing on Islamic bank liquidity in GCC member countries, he found that the real GDP growth rate had an insignificant positive relationship with Islamic bank liquidity in GCC countries. Then, Sukri and Waemustafa (2016) concluded that the inflation rate also affected liquidity risk. In this case, the inflation rate showed a positive and significant relationship to liquidity risk in Islamic banks, while in conventional banks, the effect was not significant. Nevertheless, Ghenimi et al. (2021) showed that the inflation rate had a significant adverse effect on the liquidity risk of conventional banks while not significant for Islamic banks.

Then, because certain conditions (such as war, crisis, or epidemic) can also affect liquidity risk (Ismal, 2010), this study will appoint this as one of the main variables. Furthermore, according to Ghenimi et al. (2021), the financial crisis could lead to an increase in toxic lending, which prompts most depositors to withdraw their funds and increases banks' liquidity risk. In this case, aggregate liquidity becomes tight when a financial crisis occurs. Hence, depositors and borrowers with outstanding loan commitments withdraw funds from banks to meet their liquidity and funding needs (Chen et al., 2021). In this case, when a crisis occurs, the economic uncertainty increases and affects economic performance. Furthermore, Bilgin et al. (2021) found that uncertainty increases leverage risk in conventional banks and hurts bank stability.

However, economic uncertainty exists during a crisis and in normal conditions. Thus, the measurement is needed to measure the level of uncertainty rather than using a dummy variable. Fortunately, some measurements are available in the literature to highlight it, such as macroeconomic uncertainty index, variance risk premium, stock market volatility indices (VIX), economic policy uncertainty index (EPU), and world uncertainty index (WUI) (Bilgin et al., 2021).

In this study, the World Uncertainty Index (WUI) is used to determine and analyze the factor and whether or not it has a significant effect on liquidity risk. This index was constructed by Ahir et al. (2018). It uses the frequency word of "uncertainty" and its variants in Economist Intelligence Unit (EIU) country report quarterly to capture uncertainty that related to economic and political developments, both regarding short-term and long-term concerns (Ahir et al., 2018).

The world uncertainty index is chosen because it has advantages over other economic uncertainty indices. For example, this index covers variously developed and developing countries, while other indexes only have limited coverage of countries, especially developed countries. Moreover, this index is considered more standardized than others because it uses a single source base, namely EIU country reports. In addition, this index can highlight global uncertainty occurs around significant events that generate uncertainty, such as the 9/11 attacks, the SARS outbreak, the Euro debt crisis, El Nino, Brexit, the US presidential election, and the COVID-19 outbreak like nowadays (Ahir et al., 2018, as cited in Bilgin et al., 2021).

Based on the studies mentioned above, the hypotheses in this study are:

$H_1$: The capital adequacy ratio (CAR) positively affects liquidity risk.

$H_2$: The profitability ratio (ROA) has a negative effect on liquidity risk.

$H_3$: GDP growth has a negative effect on liquidity risk.

$H_4$: The inflation rate has a positive effect on liquidity risk.

$H_5$: The world uncertainty index has a positive effect on liquidity risk.

## Research Methods

This study uses a quantitative approach and secondary data. The data type is quarterly time-series data from the 1st quarter of 2015 to the 2nd quarter of 2021 because the data of specific-bank factors from Islamic banks in the Sharia Banking Statistics on the OJK website in the period before 2015 was still mixed with data from the Sharia Business Unit (UUS). Meanwhile, the focus of this research was only on Islamic commercial banks (BUS). Further, to strengthen the validity

of the data, this study uses the data obtained from the official website of the institutions that manage them. The details are as follows:

**Table 1.** Summary of Operational Variables

| Type of Variable | Name | Variable Definition | Hypothesis (Expected Sign) | Source of Data |
|---|---|---|---|---|
| Dependent | Liquidity Risk | 1/liquid assets to total assets ratio (Ghenimi et al., 2021) | | Indonesia Financial Services Authority (OJK) |
| Independent | Bank Specific variables | | | |
| | Capital Adequacy Ratio | Minimum Capital Requirements (%) | CAR (+) | Indonesia Financial Services Authority (OJK) |
| | Return on Asset | Profit before tax/Average Total Asset (%) | ROA (+) | Indonesia Financial Services Authority (OJK) |
| | Macroeconomic variables | | | |
| | GDP Growth | GDP growth rate (%) | GROWTH (-) | Central Bureau of Statistic (BPS) |
| | Inflation rate | Inflation rate (%) | INF (-) | Indonesian Central Bank (BI) |
| | Uncertainty variable | | | |
| | World Uncertainty Index | Ln(Index of world uncertainty) | UNCERTAINTY (+) | World Uncertainty Index |

The dependent variable in this study is liquidity risk. In this case, bank liquidity is measured by the ratio of current assets to total assets. We adopted this proxy for liquidity because it is the most popular indicator of bank liquidity. Meanwhile, liquidity risk is the opposite of the liquidity ratio. Thus, it can be described as the inability of banks to pay their current liabilities when they fall due. In this case, the higher the liquidity ratio level, the lower the liquidity risk level, and vice versa. Therefore, this variable can be denoted as the 1/liquidity ratio (Ghenimi et al., 2021).

Further, the independent variables in this study consist of bank-specific factors, macroeconomic factors, and economic uncertainty. In this case, the bank-specific factors used are CAR as an indicator of bank capitalization and ROA as bank profitability. These two items were chosen because they could explain banking conditions. At the same time, the macroeconomic factors used in this case are the rate of economic growth and inflation, which are essential variables in viewing macroeconomic conditions. The uncertainty variable used in this research is data from the World Uncertainty Index. This index was chosen because it has several advantages that the author has conveyed in the literature review above.

Then, the data was analyzed using Auto Regressive Distributed Lag (ARDL) model, linear time-series model used to test the relationship between one variable and others, which allows differences in stationarity of the variables used at the level I(0) and first different I(1) (Pesaran et al., 2001). The ARDL model can be constructed as follows:

$$\Delta LIKUID_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i}\, LIKUID_{t-i} + \sum_{i=1}^{n} \alpha_{2i}\, GROWTH_{t-i} + \sum_{i=1}^{n} \alpha_{3i}\, ROA_{t-i} + \sum_{i=1}^{n} \alpha_{4i}\, UNCETAINTY_{t-i} + \sum_{i=1}^{n} \alpha_{5i}\, CAR_{t-i} + \sum_{i=1}^{n} \alpha_{6i}\, INF_{t-i} + \beta_1 LIKUID_{t-i} + \beta_1 GROWTH_{t-i} + \beta_2 ROA_{t-i} + \beta_3 UNCERTAINTY_{t-i} + \beta_4 CAR_{t-i} + \beta_5 INF_{t-i} + e_t$$

In the equation above, $n$ stands for the lag length of the model, $\alpha_0$ is the constant coefficient, and $\alpha_{1i-6i}\, \beta_{1-5}$ is the estimator's co-efficient. LIKUID is the liquidity risk of Islamic banks, CAR is the capital adequacy ratio of Islamic banking, and ROA is the return on asset of

Islamic banking. GROWTH is GDP Growth that represents the economic growth in Indonesia, INF stands for the inflation rate in Indonesia, and UNCERTAINTY is the world uncertainty index representing economic uncertainty. Then $_{it}$ is the error correction or disturbance term.

Then, the model was tested by a series of analytical techniques. They are as follows:

**Stationarity test**

In time-series data, stationarity is one of the critical requirements. A data set is said to be stationary if the mean and variance of the data are constant or do not change systematically over time. One of the formal procedures for testing stationarity is the unit root test. This test was developed by David Dickey and Wayne Fuller, which was then named the Augmented Dickey-Fuller (ADF) Test. Supposed a time series data is not stationary at the level. In that case, the stationarity of the data can be found through the following order, namely first-order or I (1) (first difference) or second-order (second different). The hypotheses for this test are:
$H_0$: There is a unit root (not stationary)
$H_1$: No unit root (stationary)

**Bond-testing cointegration test**

Cointegration bound-testing test is a test to find cointegration between variables in the model. The F-statistical test is used in bound-testing on the best model. The best model will be obtained by looking at Akaike's Information Criteria (AIC) value. The AIC value is used for the optimal lag indicator because AIC is a model that chooses the maximum lag length.

The AIC value is used as an indicator in choosing the optimal lag. Based on the AIC test, the best model will be chosen with the most extended lag. Then, the model is tested by the bound-testing, in which if the F-count value is greater than the upper critical bound, it means a cointegration between the variables. If the lower critical bound is greater than the F-count value, it means no cointegration. Furthermore, if the F-count value is between the upper critical value and the lower critical value, it means the decision of whether there is cointegration or not is inconclusive.

**ARDL-ECT model test**

This study uses the ARDL method. Aside from differences in the level of stationarity in each variable, it is also due to the authors' limitations in obtaining samples in this study. In this case, the ARDL method does not concern with the small number of samples (Gujarati & Porter, 2012). Hence, it can be used on data with limited samples because this model does not require a large number of samples.

In determining the regression equation, each variable will be estimated by including the long-term and short-term lags until the best model of ARDL is found. In addition, the Error Correction Term (ECT) is used to determine the speed of adjustment and shows how quickly the variable will return to its equilibrium in the long run. The ECT must have a significant coefficient and negative value in this case. The ARDL model estimation is done using the Akaike Information Criterion (AIC) model on the best model with the most optimal lag length that has been previously selected.

**Classic assumption test**

The model must meet several classical assumption tests to become a good and unbiased estimator or commonly referred to as BLUE (Best Linear Unbiased Estimator). The classical assumption test required in this study is the normality test, autocorrelation test, and heteroscedasticity test. The normality test was conducted to determine whether the residuals were normally distributed or not. The Jarque-Bera test carried out the normality test. At the same time, the autocorrelation test is used to detect autocorrelation problems in the residuals. In this case, the autocorrelation test was performed using the Bruesch- Godfrey method. Then, the classical assumption test used in this model is the heteroscedasticity test using Bruesch- Pagan-Godfrey method to determine whether

there is an inequality of residual variance from one observation to another. Furthermore, if all the classical assumption tests are met, the model can be the Best Linear Unbias Estimator (BLUE).

### Stability test

After the classic assumption tests, the model must be tested for its stability. It can be done through stability tests such as the Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ). The stability test is required to prevent long-term and short-term stability parameters. The significant CUSUM graph at the 5% confidence level indicates the stability parameter.

## Results and Discussion

### Descriptive Analysis

The descriptive statistics of all variables are shown in Table 2 as below:

**Table 2.** Descriptive Analysis

| Variables | Mean | Median | Maximum | Minimum | Std. Dev. |
|---|---|---|---|---|---|
| LIKUID | 0.037808 | 0.036500 | 0,051000 | 0,022000 | 0,007419 |
| CAR | 18,48436 | 19.01500 | 24,45000 | 14,09000 | 3,060734 |
| ROA | 1,177692 | 1,255000 | 2,060000 | 0,490000 | 0,480993 |
| GROWTH | 0,997692 | -0,230000 | 5,505000 | -4,190000 | 2.698025 |
| INF | 3,393846 | 3,205000 | 7,260000 | 1,330000 | 1,514371 |
| UNCERTAINTY | 10,14962 | 10,20000 | 10,93000 | 9,380000 | 0,372982 |

According to table 2, the descriptive analysis shows the results of all variables. The results showed that liquidity risk had a mean value of 0,037808, a median value of 0,036500, and a standard deviation value of 0,007419. As an indicator of bank capitalization, CAR had a mean value of 18,48436, a median value of 19,01500, and a standard deviation value of 3,060734. As an indicator of bank profitability, ROA had a mean value of 1,177692, the median value of 1,255000, and the standard deviation value of 0,480993. At the same time, the economic growth and inflation as an indicator of macroeconomic condition had the mean values of 0,997692 and 3,393846, the median values of (-0,230000) and 3,205000, and the standard deviation values of 2,698025 and 1,514371. In addition, the economic uncertainty had a mean value of 10,14962, a median value of 10,20000, and a standard deviation value of 0,372982. According to those results, it can be concluded that the liquidity risk of Islamic banking is relatively stable. At the same time, the variable of uncertainty is relatively volatile than the liquidity risk throughout the observation period. As for the other variables such as CAR, ROA, economic growth, and inflation, it can be seen that they show more fluctuation statistics.

### Pre-estimation Procedure

### Stationarity test

In this study, the Augmented Dickey-Fuller unit root test was carried out with the Schwarz Info Criterion on LIQUID, CAR, ROA, GROWTH, INF, and UNCERTAINTY variables showing the following results as in Table 3.

The stationarity test results presented in table 3 reveal that the CAR, ROA, INF, and UNCERTAINTY contain unit root at the level. It is an indication that the variables are non-stationary at the level. However, after making the first difference, the variables became stationary so that the variables were integrated at the first difference I (1). On the other hand, the null hypothesis was rejected on LIQUID and GROWTH for having a unit root at the level. It indicates that these variables are stationary at level I (0). Therefore, the results showed mixture stationarity of level I (0) and the first difference I (1). Thus, ARDL can be applied if there are such cases. It justifies the selection of the ARDL framework to test for cointegration. Different

from other approaches, the ARDL model does not impose a constraining assumption that all variables must be integrated in the same order. Therefore, ARDL is applied regardless of whether the variables have different stationarity or are mutually cointegrated (Pesaran et al., 2001).

**Table 3.** Augmented Dickey-Fuller Test

| Variables | Level I(0) | | First Difference I(1) | | Stationary at |
|---|---|---|---|---|---|
| | Unit Root | Prob. | Unit Root | Prob. | |
| LIKUID | -2,996558 | 0,0490 | -6,815939 | 0,0000 | I (0) |
| CAR | -0,117293 | 0,9376 | -4,766564 | 0,0000 | I (I) |
| ROA | -0,875559 | 0,7765 | -7,428664 | 0,0000 | I (I) |
| GROWTH | -7,069196 | 0,0000 | -7,332846 | 0,0000 | I (0) |
| INF | -1,947936 | 0,3064 | -6,468780 | 0,0000 | I (1) |
| UNCERTAINT | -2,714623 | 0,0856 | -6,453810 | 0,0000 | I (1) |

**Bond-testing cointegration test**

Previously in this study, it was mentioned that the bound-test approach would be used to cointegration test. The results can be shown in Table 4 as follows:

**Table 4.** F-Bounds Test

| Test Statistic | Value | Significant | Lower Critical Value | Upper Critical Value |
|---|---|---|---|---|
| F-Statistic | 6,185067 | 10 % | 2,08 | 3 |
| | | 5 % | 2,39 | 3,38 |
| | | 2,5 % | 2,7 | 3,73 |
| | | 1 % | 3,06 | 4,15 |

The results in Table 4 reveal that the calculated F-statistic value for the model is 6,185067, which is greater than the upper critical limit value (3,38 at the 5% significance level). Therefore, it shows solid statistical evidence for the existence of a long-term relationship between the investigated variables. It provides evidence that the bank-specific factors (CAR and ROA), macroeconomic factors (economic growth and inflation rate), and economic uncertainty have a long-term equilibrium relationship with the liquidity risk of Islamic banking in Indonesia. Thus, it can be concluded that there is cointegration between variables so that the model can be continued.

**Classic assumption test**

The classical assumption test required in this study is the normality test to determine whether the residuals were normally distributed or not, and autocorrelation test to detect autocorrelation problems in the residuals, and then, heteroscedasticity test to find out whether there was an inequality of residual variance from one observation to another. The results of those tests are as follow:

**Table 5.** Classic Assumption Test

| Test Statistic | Value | | Probability | Result |
|---|---|---|---|---|
| Normality Test | Jarque-Bera | 4,959463 | 0,083766 | Normally distributed |
| Autocorrelation LM Test | F-statistic | 0,219984 | 0,5066 | No Autocorrelation |
| Heteroskedasticity Test | F-statistic | 0,579007 | 0,9981 | No Heteroskedasticity |

Table. 5 shows that the normality test using the Jarque-Bera test obtained a Jarque-Bera value of 0.642 with a probability of 0.08376. Thus, it can be concluded that the residuals in this study were typically distributed, and the model passed the normality test. Using the Jarque-Bera test, the normality test obtained a Jarque-Bera value of 0.642 with a probability of 0.08376. It can be concluded that the residuals in this study were usually distributed.

Then, the results of the autocorrelation test, based on the Breusch-Godfrey test, obtained an F-statistic value of 0.219984 and a probability value (p-value) of 0.5066, which is greater than the significance value used in this study, which is 0.05. It indicates that the residuals in this study are free from autocorrelation problems. Meanwhile, from the results of the heteroscedasticity test, the F-statistic result is 0.579007 with a probability value of 0.9981, which is higher than the significance level used in this study, which is 0.05. It means that there is no heteroscedasticity in the residuals. Thus, the proposed model has passed all the required classical assumption tests, and it can be concluded that the model meets the Best Linear Unbias Estimator (BLUE).

**Stability test**

The stability test is required to prevent long-term and short-term stability parameters. The stability test in this study was determined from the position of the CUSUM line, which is between the two 5% significance lines. In this case, if the CUSUM line crosses the significant line, the model is considered unstable. In contrast, if the CUSUM line remains between the significance lines, it indicates the model is stable. Likewise, in the CUSUMQ test, if the model remains between the two significant lines, the model is considered stable.

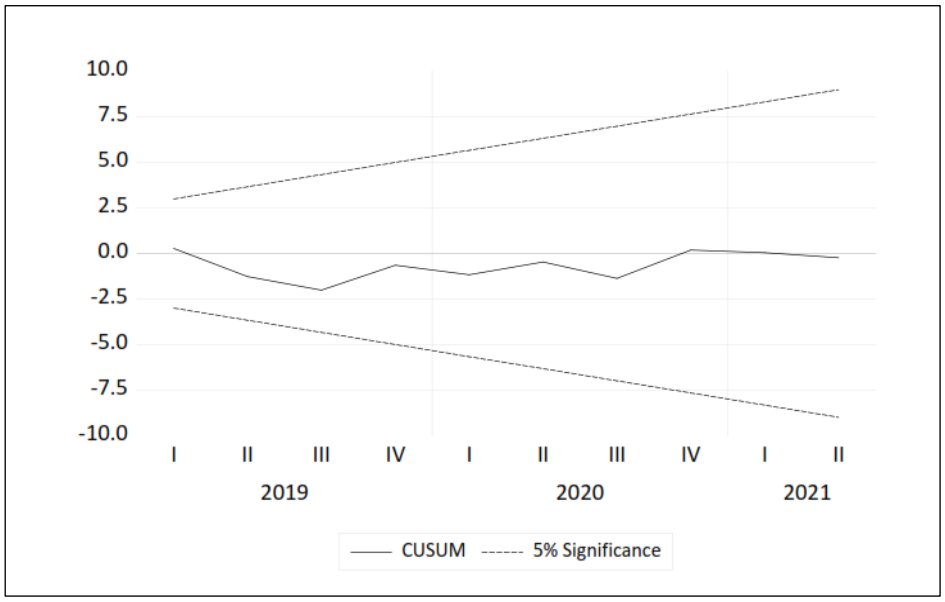


**Figure 1.** Cumulative Sum of Recursive Residuals (CUSUM) Test

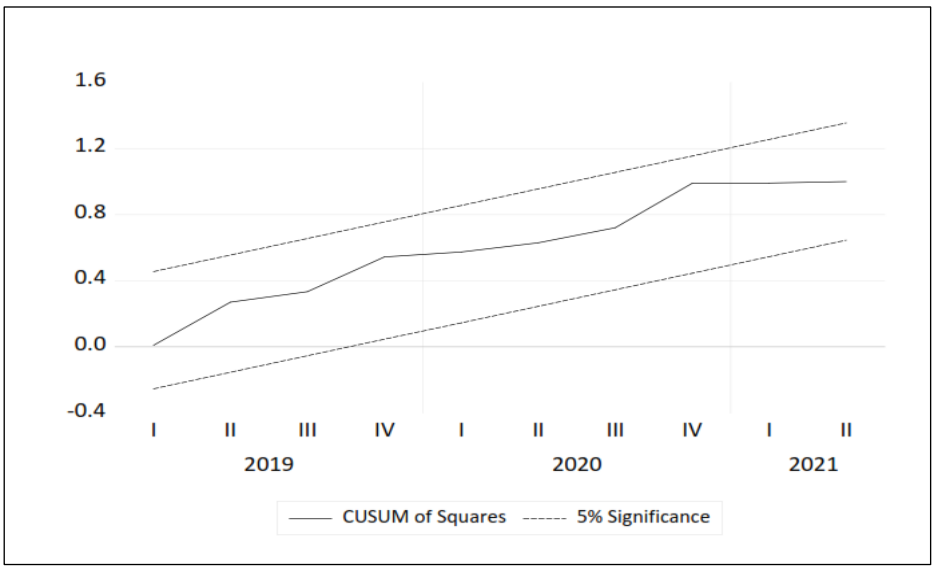


**Figure 2.** Cumulative Sum of Square Recursive Residuals (CUSUMQ) Test

The CUSUM and CUSUMQ graphs above indicate that the model was stable at the 5% significance level.

## Estimation Results

### ARDL model estimation and long-run relationship

In determining the regression equation, each variable is estimated by including the long-term and short-term lags until the best model of ARDL is found. ARDL model estimation is done using the Akaike Information Criterion (AIC) on the best model with the most optimal lag length. In this case, the best model was selected using the AIC value, and the best model with optimal lag was found in the ARDL (2,0,1,2,1,2) model with the smallest AIC value of -8.24. Therefore, the general form of the ARDL (2,0,1,2,1,2) model to be estimated is as follows:

$$\begin{aligned}\Delta LIKUID_t = {} & \alpha_0 + \sum_{i=1}^{n} \alpha_{1i}\, LIKUID_{t-1} + \sum_{i=1}^{n} \alpha_{1i}\, LIKUID_{t-2} + \sum_{i=1}^{n} \alpha_{2i}\, GROWTH_t + \sum_{i=1}^{n} \alpha_{3i}\, ROA_t \\ & + \sum_{i=1}^{n} \alpha_{3i}\, ROA_{t-1} + \sum_{i=1}^{n} \alpha_{4i}\, UNCERTAINTY_t + \sum_{i=1}^{n} \alpha_{4i}\, UNCERTAINTY_{t-1} \\ & + \sum_{i=1}^{n} \alpha_{4i}\, UNCERTAINTY_{t-2} + \sum_{i=1}^{n} \alpha_{5i}\, CAR_{t-1} + \sum_{i=1}^{n} \alpha_{6i}\, INF_t + \sum_{i=1}^{n} \alpha_{6i}\, INF_{t-1} \\ & + \sum_{i=1}^{n} \alpha_{6i}\, INF_{t-2} + \beta_1 LIKUID_{t-1} + \beta_1 LIKUID_{t-2} + \beta_1 GROWTH_t + \beta_2 ROA_t \\ & + \beta_2 ROA_{t-1} + \beta_2 UNCERTAINTY_t + \beta_2 UNCERTAINTY_{t-1} \\ & + \beta_3 UNCERTAINTY_{t-2} + \beta_4 CAR_t + \beta_4 CAR_{t-1} + \beta_4 INF_t + \beta_5 INF_{t-1} + \beta_5 INF_{t-2} \\ & + e_t\end{aligned}$$

Then the model was estimated and obtained an ARDL estimation as follows:

**Tabel 6.** ARDL Model Estimation

| ARDL Estimation | | | | |
|---|---|---|---|---|
| Variable | Coefficient | Std Error | t. Statistic | Prob |
| LIKUID (-1) | 0,113469 | 0,192775 | 0,588608 | 0,5706 |
| LIKUID (-2) | 0,196988 | 0,160816 | 1,224928 | 0,2517 |
| GROWTH | 0.000413 | 0,000345 | 1,198278 | 0,2614 |
| ROA | -0,005578 | 0,003546 | -1,573183 | 0,1501 |
| ROA (-1) | -0,006721 | 0,003912 | -1,717038 | 0,1199 |
| UNCERTAINTY | 0,006319 | 0,002495 | 2,532303 | 0,0321 |
| UNCERTAINTY (-1) | 0,006233 | 0,002690 | 2,317020 | 0,0457 |
| UNCERTAINTY (-2) | 0,004997 | 0,002775 | 1,800801 | 0,1053 |
| CAR | 0,001565 | 0,000921 | 1,699256 | 0,1235 |
| CAR (-1) | 0,001752 | 0,001017 | 1,722807 | 0,1190 |
| INF | -0,004937 | 0,001156 | -4,270104 | 0,0021 |
| INF (-1) | -0,004288 | 0,001411 | -3,038256 | 0,0141 |
| INF (-2) | -0,004520 | 0,001134 | -3,984424 | 0,0032 |
| C | 0,021422 | 0,005512 | 3,889906 | 0,0037 |
| Prob. (F. Statistik) | 0,004494 | | R-Squared | 0,901513 |

After the ARDL estimation was obtained, the estimation was tested in the Long-run and Bound tests to see the existence of long-term cointegration and obtain the Long-run Coefficients results. From the long-run estimation, data is obtained as shown in Table 7 below:

**Tabel 7.** Lung-run Estimation

| Long-run Estimation | | | | |
|---|---|---|---|---|
| Variable | Coefficient | Std Error | t. Statistic | Prob |
| GROWTH | 0,000599 | 0,000503 | 1,190873 | 0,2640 |
| ROA | -0,017836 | 0,010293 | -1,732818 | 0,1172 |
| UNCERTAINTY | 0,025450 | 0,008397 | 3,030732 | 0,0142 |
| CAR | 0,044810 | 0,002534 | 1,898155 | 0,0902 |
| INF | -0,019933 | 0,004001 | -4,982208 | 0,0008 |
| C | 0,031096 | 0,001876 | 16,57562 | 0,0000 |

From the estimation results in table 7 above, it can be analyzed that in the long term, this study found the significant relationships between the variables of economic uncertainty and inflation rate on the liquidity risk of Islamic banking in Indonesia, while other variables had no significant effect. In this case, the economic uncertainty measured by World Uncertainty Index had a positive and significant effect on liquidity risk. It means the increase in economic uncertainty will increase the liquidity risk of Islamic banking. It is in line with Ghenimi et al. (2021) opinion that crisis conditions can lead to an increase in toxic lending, which prompts most depositors to withdraw their funds and results in an increase in banks' liquidity risk. Moreover, according to Chen et al. (2021), aggregate liquidity becomes tight when a financial crisis occurs. Hence, depositors and borrowers with outstanding loan commitments withdraw funds from banks to meet their liquidity and funding needs. In this case, when a crisis occurs, the economic uncertainty increases and affects economic performance.

More clearly, this can be seen in Figure 3 and Figure 4. These figures show that when the level of uncertainty increases, the liquidity ratio of Islamic banks tends to decrease, and vice versa. In this case, a decrease in the liquidity ratio means an increase in liquidity risk (Ghenimi et al., 2021).

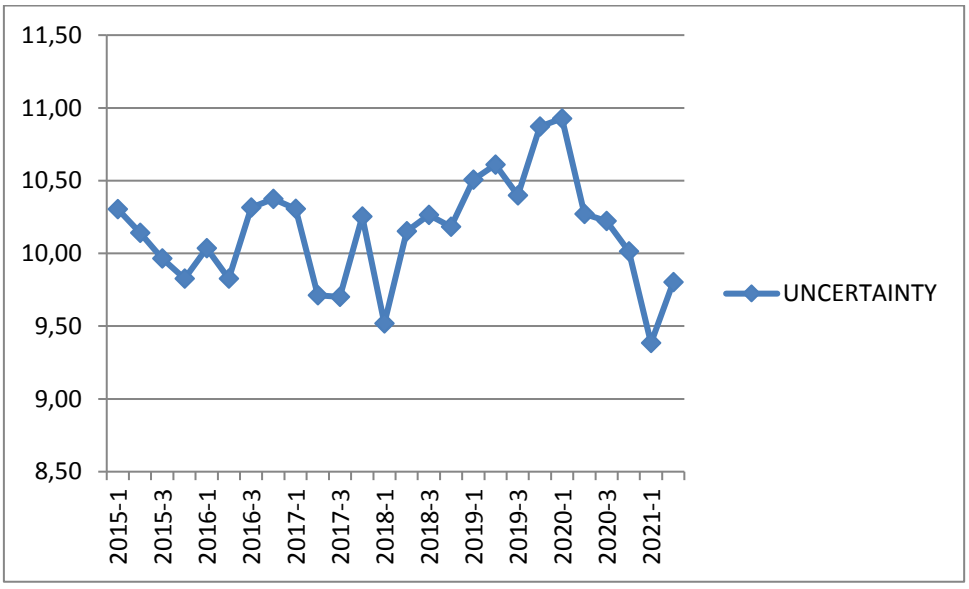


**Figure 3.** Uncertainty Chart

On the other hand, the inflation rate has a significant negative effect on liquidity risk. It is different from Sukri and Waemustafa's (2016) research, wherein his research concluded that the inflation rate positively affects the liquidity risk of Islamic banking. Meanwhile, according to Ghenimi et al. (2021), the inflation rate has a significant negative effect on liquidity risk in conventional banks. It does not have a significant effect on Islamic banking liquidity. In this case, in terms of the research locus, Sukri and Waemustafa (2016) took the case in Malaysia, and Ghenimi et al. (2021) took the case in the Middle East country while this study took the case in Indonesia. Besides that, in the long term, when the inflation increase, it will be responded by

Bank Indonesia to issue some contractionary policies such as increasing the interest rate and SBIS yields which will suppress credit absorption and encourage the purchase of SBIS which has a lower risk. Thus, it will reduce liquidity risk in Islamic banking.

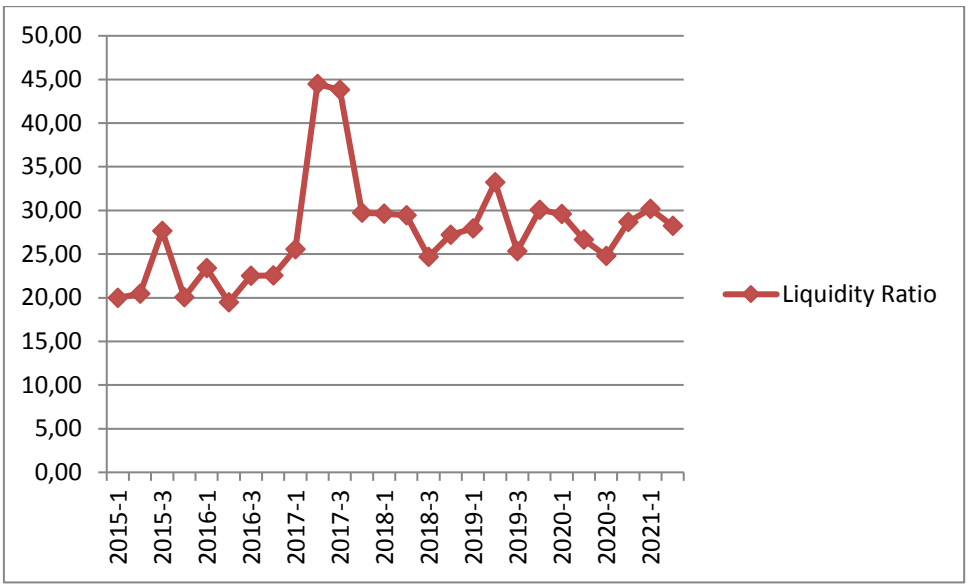


**Figure 4.** Liquidity Ratio Chart

Meanwhile, the other variables (GROWTH, CAR, and ROA) do not significantly influence the liquidity risk of Islamic banking in Indonesia. These results are different from the study by Kasri and Azzahra (2020), which concluded that Islamic banks' stability was more influenced by the bank's specific factors than macroeconomic factors. It may be caused by cumulative data of Islamic Banks used in this research so that it does not describe the conditions in each Islamic bank.

### Error correction term and short-run relationship

In the ARDL approach, estimations are carried out in both the short and long term. Then, the Error Correction Term (ECT) is used to determine the speed of adjustment and shows how quickly the variable will return to its equilibrium in the short run. The ECT must have a significant coefficient and negative value. In this case, the ECT test results are obtained as in the Table 8.

**Tabel 8.** Error Correction Term (ECT)

| ECM Regression | | | | |
|---|---|---|---|---|
| Variable | Coefficient | Std Error | t. Statistic | Prob |
| D(LIKUID(-1)) | -0,196988 | 0,101699 | -1,936966 | 0,0847 |
| D(ROA,2) | -0,005578 | 0,001744 | -3,198196 | 0,0109 |
| D(UNCERTAINTY,2) | 0,006319 | 0,001473 | 4,289283 | 0,0020 |
| D(UNCERTAINTY(-1),2) | -0,004997 | 0,001757 | -2,843233 | 0,0193 |
| D(CAR,2) | 0,001565 | 0,000463 | 3,376749 | 0,0082 |
| D(INF,2) | -0,004937 | 0,000617 | -7,996682 | 0,0000 |
| D(INF(-1),2) | 0,004520 | 0,000836 | 5,408848 | 0,0004 |
| CointEq (-1)* | -0,689543 | 0,081174 | -8,494652 | 0,0000 |

The ECT test results in Table 8 show the value of CointEq(-1) =-0.689543 and is significant at the 5% level, which means that there is a short-term cointegration in this model. The Cintiq coefficient will then be used to measure the speed of adjustment, which is in response to changes. The value of ECT or CointEq is valid if it is negative with a significant probability at the 5% level. In this study, the ARDL model (2,0,1,2,1,2) meets the validity requirements because

CointEq is negative, and the probability is significant at the 5% level. Therefore, it can be said that the short-run model will return to long-term equilibrium at a rate of 68.95% per period.

Meanwhile, the results of the short-run estimation of this model are as follows:

**Tabel 9.** Short-run Estimation

| Short-run Estimation | | | | |
|---|---|---|---|---|
| Variable | Coefficient | Std Error | t. Statistic | Prob |
| D(LIKUID(-1)) | -0,196988 | 0,160816 | -1,224928 | 0,2517 |
| GROWTH | 0.000413 | 0,000345 | 1,198278 | 0,2614 |
| D(ROA(-1)) | -0,012298 | 0,006134 | -2,005000 | 0,0759 |
| D(ROA,2) | -0,005578 | 0,003546 | -1,573183 | 0,1501 |
| D(UNCERTAINTY(-1)) | 0,017549 | 0,005546 | 3,164186 | 0,0115 |
| D(UNCERTAINTY,2) | 0,006319 | 0,002495 | 2,532303 | 0,0321 |
| D(UNCERTAINTY(-1),2) | -0,004997 | 0,002775 | -1,800801 | 0,1053 |
| D(CAR,(-1)) | 0,003317 | 0,001476 | 2,246687 | 0,0513 |
| D(CAR,2) | 0,001565 | 0,000921 | 1,699256 | 0,1235 |
| D(INF(-1)) | -0,013475 | 0,002447 | -5,617443 | 0,0003 |
| D(INF,2) | -0,004937 | 0,001156 | -4,270104 | 0,0021 |
| D(INF(-1),2) | -0,004520 | 0,001134 | -3,984424 | 0,0032 |
| C | 0,021422 | 0,005512 | 3,889906 | 0,0037 |

From the estimation results in Table 9, it can be analyzed that in the short term, several exogenous variables have a significant effect on endogenous variables, namely UNCERTAINTY and INF. Meanwhile, other variables, namely GROWTH, CAR, and ROA, do not have a significant relationship. In this case, the variable of economic uncertainty has a positive and significant effect on liquidity risk in the previous one and two periods. It indicates that the changes or fluctuations in the world uncertainty index will impact liquidity risk in the same direction in the short term.

When the value of uncertainty increases, it will be followed by an increase in liquidity risk, while when the level of economic uncertainty decreases, liquidity risk will tend to increase. It indicates that changes or fluctuations in the world uncertainty index will impact liquidity risk in the same direction in the short term. In other words, when the value of uncertainty increases, it will be followed by an increase in liquidity risk. When economic uncertainty decreases, liquidity risk will tend to increase.

It is different from the study by Muhammad and Triharyono (2019) that found that the liquidity of Islamic banks in Asia had no difference before, during, and after the global financial crisis. Nevertheless, according to Ahir et al. (2018) and Bilgin et al. (2021), the occurrence of economic crises, wars, or health crises tended to increase the risk level and could have negative consequences on economic performance, including banking risk management. Hence, when economic conditions face increased uncertainty, either due to a crisis or a pandemic like nowadays, it would affect the increase in liquidity risk in banking, including Islamic banking in Indonesia.

In addition, as in the long term, the inflation rate also has a significant negative effect in the short term. In this case, the changes in the inflation rate and second previous periods have a negative and significant effect on the liquidity risk of Islamic banking in Indonesia. It differs from the previous research (Ghenimi et al., 2021; Kasri & Azzahra, 2020; Waemustafa & Sukri, 2016). In this case, when the inflation rate is seen to rise, the public will respond by holding back the consumption levels and diverting the fund into savings, investment, or time deposits, especially when considering that the expected rate of return or the reference interest rate at the time of inflation tends to rise. Therefore, it can increase the liquidity ratio and reduce liquidity risk in banks.

Although, in principle and practice, Islamic banks do not use the interest system in their business activities, technically, the profit-sharing or fees system used in Islamic banks tends to consider or refer to the reference interest rate of Bank Indonesia. Therefore, the inflation rate can

significantly affect the liquidity of Islamic banking. Especially considering *murabahah* (cost-plus financing) contracts still dominate the financing activities in the Islamic banking industry.

Meanwhile, in the short-term, other variables, namely GDP growth, CAR, and ROA, have no significant effect on liquidity risk. It is different from the study of Cucineli (2013), which found that GDP growth had a positive impact on liquidity risk, and the research of Iqbal (2012) and Sukmana and Suryaningtyas (2016), which found a significant relationship between CAR and ROA on the liquidity risk of Islamic banking in Indonesia. In Sukmana and Suryaningtyas's (2016) research conducted on a panel basis on 13 Islamic and conventional banks, this study was carried out cumulatively on the Islamic banks in Indonesia from Islamic banking statistical data. Because of the cumulative calculation, the ROA and CAR levels in this study are aggregates from the Islamic banking in Indonesia to generate different results.

## Conclusion

Based on the results of the tests and previous discussions, it can be concluded that in this study, the variables of economic uncertainty and inflation rate affect the liquidity risk of Islamic banking in Indonesia both in the long-term and short term. In this case, the economic uncertainty positively affects liquidity risk, and the inflation rate harms it. Thus, an increase in economic uncertainty will affect the liquidity risk of Islamic banking rise, and an increase in the inflation rate will decrease the liquidity risk of Islamic banking.

It can be explained that the increasing economic uncertainty as a result of a crisis, war, or pandemic like nowadays will affect increasing the liquidity risk of Islamic banking. When the level of uncertainty increases, it will have implications for an increase in non-performing financing. It can cause concern for depositors to withdraw their funds from banks. Consequently, it can encourage the liquidity risk of banking increases, including in Islamic banking. It can certainly suggest that the policymaker always pays attention to the liquidity issues in determining the policies, especially when the economic uncertainty tends to increase, such as at the beginning of the covid-19 pandemic some times ago. Therefore, nowadays, to recover the post-pandemic economy, for example, by loosening regulations to maximize credit distribution, it must be ensured that it does not result in a significant increase in banking liquidity risk because it can harm the economic recovery.

As for the inflation rate, although it is inversely related to liquidity risk, this is not necessarily good news. In this case, the inflation rate can threaten liquidity risk when the inflation rate grows out of control and causes a financial crisis in Indonesia in 1998. Vice versa, when the inflation rate is low or even deflates, the central bank will respond to it by issuing expansionary policies to spur economic growth, one of which is by optimizing lending or financing activities. In this case, Islamic banks must also pay attention to banking liquidity to control banking liquidity risk.

In addition, banking-specific variables (ROA and CAR) and economic growth have no significant effect on the liquidity risk of Islamic banking. This finding is different from previous studies, which generally have a significant positive or negative effect on both variables. This happens because of the limitations of this study. Therefore, these factors cannot be ruled out to control the liquidity risk of Islamic banking in Indonesia since, in many ways, these factors are indicators of banking and economic performance.

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