



The impacts of Covid-19 on macroeconomic indicators and the performance of Islamic banks in Indonesia

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Abstract

Purpose – The purpose of this study was to determine the extent of the impact of Covid-19 on the macroeconomic indicators and financial performance of Islamic banks in Indonesia. The results of this study may serve as a reference for the Indonesian government and Islamic banks' stakeholders in formulating strategic decisions in creating innovative solutions during the Covid-19 pandemic.

Methodology – Quantitative research method with 2 approaches, namely Partial Least Square-Structural Equation Modeling (PLS-SEM) and Artificial Neural Networks (ANN) was selected for this study.

Findings – This study demonstrated that macroeconomic indicators were significantly affected by the Covid-19 pandemic. However, the results of the ANN and PLS-SEM models varied. The PLS-SEM model illustrated the impact of the Covid-19 pandemic affecting the performance of Islamic banking, while the ANN model did not.

Implication – This research has implications for stakeholders, especially the government to maintain macroeconomic stability, while for Islamic banking management to focus more on product innovation and service excellence so that it can be closer to the public, especially Muslims community.

Originality – Numerous studies examining macroeconomics and the financial performance of Islamic banking have been conducted. This study aimed to offer an alternative perspective by using two models, namely PLS-SEM and ANN.

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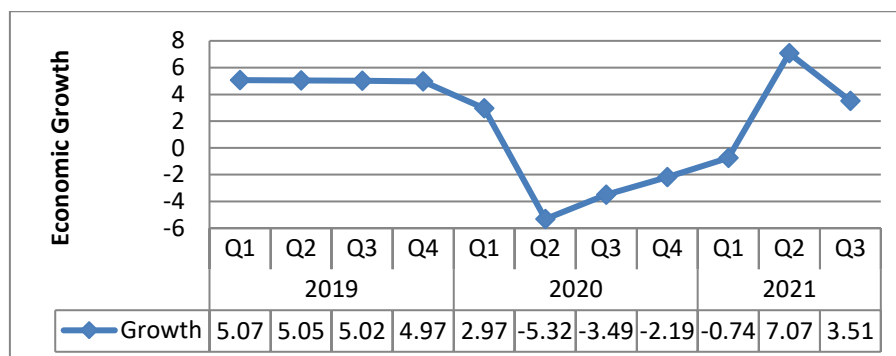
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Introduction

The Covid-19 outbreak has massively affected all aspects of life in Indonesia. According to the Central Statistics Agency (BPS) (2020), the impact of the Covid-19 pandemic in Indonesia could be observed from the decline in economic growth, from 2.97% in the 1st quarter of 2020, to -5.32% in the 2nd quarter. Fakhrunnas (2019) and Luwihono et al. (2021) stated that inflation, exchange rates, interest rates were strongly influenced by the spread of Covid-19 in Indonesia. The overview of Indonesia's economic growth is illustrated as seen in Figure 1.

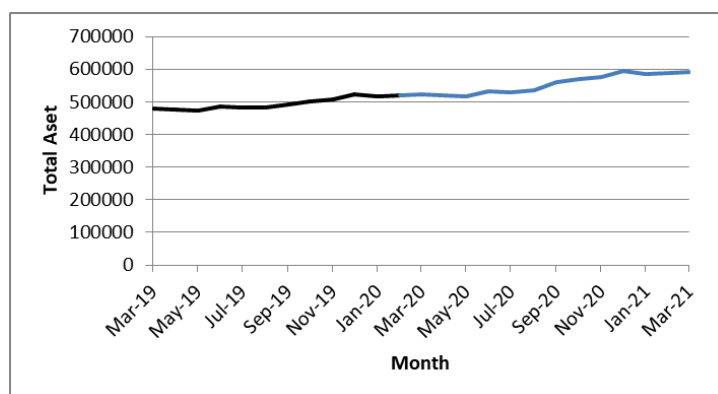
The Islamic banking assets during the period of March 2020 - March 2021 experienced the similar growth to the period of March 2019-February 2020 before the pandemic. Islamic banks also continued to experience growth in assets. When comparing the 2019 and 2021 results,

the assets grew 8.9% (yoy), while in the period from 2020 to 2021 a growth of 12.9% was recorded (Statistik Perbankan Syariah, 2021). During normal economic conditions, external factors, such as inflation, are very significant to the financial performance of BUKU 2 Islamic banks, while conventional banks are nearly not affected by external factors as indicated by the banking health report (Fakhri et al., 2020). The report also indicated that BUKU 2 Islamic banks were affected by internal factor of Net Operation Margin (NOM) while conventional banks were affected by Financing to Deposit Ratio (FDR) (Fakhri et al., 2019).



Source: Badan Pusat Statistik (BPS), 2020

Figure 1. Indonesian Economic Growth



Source: Statistik Perbankan Syariah (SPS), 2021

Figure 2. Total Assets of Indonesian Islamic Banking

Numerous studies indicated that Covid-19 has greatly affected the macroeconomic indicators (inflation, exchange rate, and BI rate) and the financial performance of Islamic banks. Wunder (2021) noted that the impact of Covid-19 has caused the macroeconomic indicators in a number of countries to worsen. In developing countries, inflation rate rose, resulting in a decline in the purchasing power (Dumitrescu et al., 2021). Likewise, the decline in exchange rates during the Covid-19 pandemic caused many industries to generate lower revenue (Iyke & Ho, 2021). As a result, Bank Indonesia has introduced changes in interest rates. Changes in interest rates may cause problems in banking performance, especially in net income margin (NIM) (Nurhuda, et al. 2020). Anwar et al (2020) stated that the Covid-19 pandemic has greatly affected the banking performance in Malaysia. Likewise for Islamic banks in Indonesia, the spread of Covid-19 impacted the performance of several Islamic banks, such as FDR, CAR, BOPO (Ichsan, 2021; Fakhri & Darmawan, 2021).

This study aimed to determine the extent of the impact of Covid-19 pandemic on the macroeconomic indicators and the financial performance of Islamic banks. The results of this study may serve as an early warning system for the Indonesian government and especially for Islamic banks' stakeholders so that they may innovate in the face of the Covid-19 pandemic. This study utilized 2 models, namely PLS-SEM and ANN with reference to Abbasi et al. (2021) who used ANN and PLS-SEM to predict behavioral intentions in adopting cryptocurrencies. A study

conducted by Hsu et al. (2006) employed the similar model with the aim of understanding the level of customer satisfaction that affects profitability and market value. The use of these 2 approaches is hoped to strengthen the analysis of the findings. This study may provide inputs to Islamic banks' stakeholders to introduce innovative products and technology during the uncertain period of the Covid-19 pandemic. This research encourages community participation in assisting Islamic banks in particular to overcome the financial crisis, mirroring Islamic banking customers' support and loyalty during the economic crisis of 1998 (Amah & Hendriana, 2017).

Literature Review

Covid-19 Pandemic

The World Health Organization (WHO) (2020) stated that Covid-19 is an infectious disease caused by the newly discovered coronavirus and has declared the disease a pandemic. Bank Indonesia (2020) stated that the Covid-19 outbreak has caused extraordinary impacts to the society in various aspects of life. Olivia et al. (2020) revealed that the impacts of the Covid-19 pandemic in Indonesia was visible in the slow economic growth, the decline of people's welfare and the increase of poverty. In the economic field, the spread of Covid-19 influenced the macroeconomic indicators and the performance of Islamic banks.

Macroeconomics and Covid-19 Pandemic

General equilibrium theory attempts to provide an understanding of the whole economy using a bottom-up approach (Dorman, 2014; Taylor, 2021). Indicators related to macroeconomics include inflation, labor welfare, and financial stability (Dorman, 2014), whereas Fontana et al. (2010) include bank interest as part of the macroeconomic indicators. Ohyama (2016) stated that exchange rate also plays a role in macroeconomic growth.

Covid-19 has affected macroeconomic indicators in numerous countries. Walmsley et al. (2020) research demonstrated that Covid-19 pandemic resulted in the decline in GDP and employment in the United States. Likewise in China, Zhang et al., (2020) stated that the pandemic caused a drastic decline in GDP and increase in unemployment. In addition, Covid-19 also brought a positive effect on inflation (Jelilov, Iorember, Usman, & Yua, 2020) and a negative effect on the exchange rate (Syahri, & Robiyanto, 2020). Sugandi (2020) explained that Covid-19 had a negative effect on inflation, BI Rate and Exchange Rate. Poverty level of a country affected by Covid-19 pandemic would therefore increase due to the macroeconomic impacts. Based on these arguments, the following hypothesis was proposed:

H₁: Covid-19 pandemic has negative impacts on macroeconomic indicators.

Financial Performance of Islamic Banks and Covid-19 Pandemic

Financial performance of Islamic banks is influenced by several external and internal factors (Setyawati, et al., 2017). Internal factors affecting the performance of Islamic banks include capital adequacy (CAR), financing to deposit ratio (FDR), non performing financing (NPF), return on assets (ROA), and net operation margin (NOM) (Fakhri and Darmawan, 2021; Murad, et al., 2021; Rahman and Santoso, 2019).

The financial performance of Islamic banks is extremely vulnerable to external conditions (Fakhri, et al., 2019 and Yunita, 2020) and Covid-19 outbreak has brought a shock to Islamic banks. Yunita (2020) indicated that the current crisis significantly influenced the profitability of Islamic banks. In addition, a study by Ichsan et al. (2021) highlighted that during the Covid-19 pandemic, Capital Adequacy Ratio (CAR), Operating Costs to Operating Income (BOPO), Financing to Deposit Ratio (FDR) introduced a positive and significant effect on profitability, while Non Performing Financing (NPF) brought a negative and insignificant effect. The results of this study indicated that customer participation in installment plans was not affected by the Covid-19 pandemic. Based on these arguments, the following hypothesis was proposed:

H₂: Covid-19 pandemic has a negative impact on financial performance.

Previous Research

Previous studies discussing the effects of Covid-19 on macroeconomic indicators and the financial performance of Islamic banks simultaneously are limited. Jelilov et al. (2020) stated in their study that Covid-19 pandemic caused a positive effect on inflation, while Sugandi (2020) highlighted that it had a negative effect on inflation, BI rate and exchange rates.

Numerous studies examining the effect of Covid-19 on the financial performance indicators of Islamic banks have been conducted. Fakhri and Darmawan (2021) employed the ANN model and reported that Covid-19 greatly affected financial performance indicators, especially the FDR variable. Ichsan et al. (2021) utilized the Multiple Linear Regression Testing model and the model linearity testing using the Ramsey test and indicated that during the Covid-19 pandemic, Capital Adequacy Ratio (CAR), Operating Costs to Operating Income (BOPO), Financing to Deposit Ratio (FDR) had a positive and significant effect on profitability, whereas Non-Performing Financing (NPF) had a negative and insignificant effect on profitability. The results of this study confirmed that customer participation in installment plans was not affected by the Covid-19 pandemic.

This study is in line with the research of Fakhri and Darmawan (2021). However, this study place additional emphasis on the macroeconomic indicators. In addition to using the ANN model, this study also utilized PLS-SEM to obtain better analysis out of the results.

Research Framework

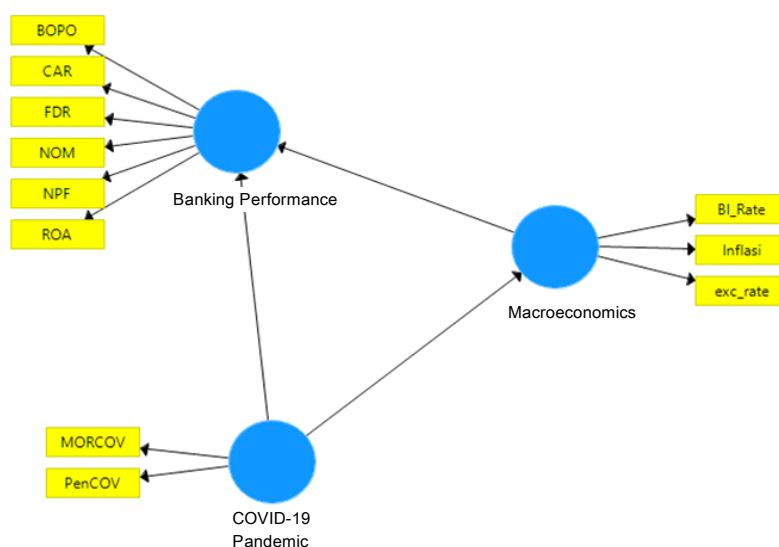


Figure 3. Conceptual Framework

Research Methods

Data

This study utilized secondary data with details as follows:

1. Covid-19 pandemic data, consisting of spread level and mortality rates (Bairoliya, & Imrohroglu, 2020), which were obtained through www.covid19.go.id.
2. Macroeconomic data, consisting of inflation rate, BI rate, and exchange rates (Fakhri et al. 2019, and Yunita 2020), which were obtained through www.bi.go.id.
3. Indonesian banking financial performance data, consisting of CAR (Capital Adequacy Ratio), NIM (Net Interest Margin), FDR (Financing for Deposit Ratio), ROA (Return on Assets), BOPO (Operating Costs to Operating Income), and NPF (Net Performing Financing) (Ichsan, et al., 2021 and Yusuf & Ichsan, 2021), which were obtained through www.ojk.go.id.
4. Time series of the secondary data is January-April 2021, where January 2020 indicated the beginning of Covid-19 pandemic in Indonesia (Riono, 2020).

Methods

Structural Equation Modeling (SEM)

Based on the study by Al-Emran et al., (2018), two stages are involved in utilizing the SEM-PLS approach, namely:

1. Path Model and Variables Research

The first stage is to determine the PLS SEM Structural Model, which includes determining the path analysis, direct influence and indirect influence. The Path model presented in the Figure 4 below is the model used in the research.

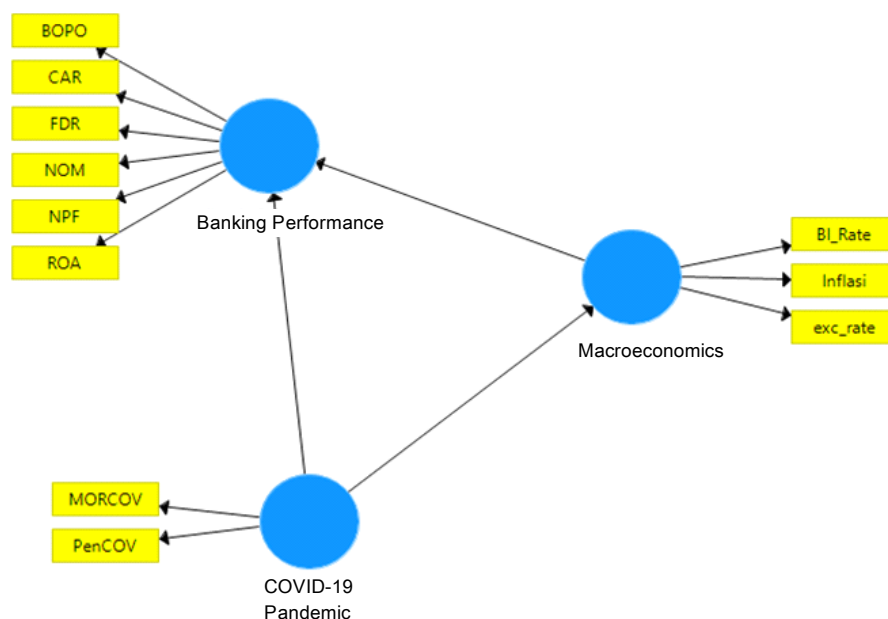


Figure 4. Path Chart

From the above chart, it could be determined that the Covid-19 pandemic is an exogenous latent variable with indicators, namely mortality due to the Covid-19 pandemic and the rate of spread of Covid-19. Meanwhile, macroeconomic indicators are mediator variables between the Covid-19 pandemic and the financial performance of Islamic banks, including the BI rate, inflation rate, and exchange rates. Financial performance is an endogenous variable with indicators, such as BOPO, CAR, FDR, NOM, NPF, and ROA.

2. Data Analysis

The data analysis in PLS-SEM consist of five stages, namely:

a. Model Identification

Model identification could be determined after the path model results are generated. Subsequently, by using the maximum literacy standard of 300, Convergent Validity and Discriminant Validity would be obtained.

b. Convergent Validity

Convergent validity is the degree to which the measurement results of a concept indicate a positive correlation with the measurement results of other concepts which theoretically must be positively correlated (Prasetyo, 2005). Meanwhile, according to Yamin and Kurniawan (2011), Convergent Validity measures the magnitude of the correlation between the construct and the latent variable. Evaluating the Convergent Validity of individual item reliability checks can be observed from the standardized loading factor value. A loading factor value of higher than 0.7 is considered to be ideal, indicating that the indicator is valid to measure the construct. A standardized loading factor value of higher than 0.5 is acceptable, while a value below 0.5 is excluded from the model.

c. Discriminant Validity

The discriminant validity of the reflective model is evaluated through cross loading, followed by a comparison between the AVE value with the square of the correlation value between constructs (or compares the AVE root with the correlation between constructs). The cross loading measurement is comparing the correlation of the indicator with its construct and the construct of other blocks. If an indicator with a construct is higher in value than the correlation with other blocks, it indicates that the construct predicts the size of their block better than the other blocks. Another measure of Discriminant Validity is that the AVE root must be higher than the correlation between constructs and other constructs or the AVE value is higher than the square of the correlation between constructs (Yamin and Kurniawan, 2011).

d. Composite Reliability

According to Sholihin, and Ratmono (2021), Composite Reliability is obtained by examining the coefficients of the latent variables. From this output, two items would be generated, namely composite reliability and Cronbach's alpha. Both must be have a value of higher than 0.70 as a condition of reliability. If a construct has met these two criteria, the construct is considered reliable.

e. Structural Model Evaluation (Inner Model)

The evaluation of the structural model (inner model) includes a model fit test (model fit), path coefficient, and R2. This model fit test is used to determine whether a model matches with the data. In the model fit test, there are 3 test indices, namely average path coefficient (APC), average R-squared (ARS) and average variance factor (AVIF). The p value for APC and ARS must be lower than 0.05 or significant. In addition, AFIV as an indicator of multicollinearity must be lower than 5 (Sholihin, and Ratmono, 2021).

Artificial Neural Network (ANN)

Three stages are involved in the application of ANN model to predict the bankruptcy of Islamic banks using the Alyuda's software, namely:

1. Data input
2. Data processing through 2 stages, namely training stage and testing stage.
3. Output generation in the form of the predicted output of the variable.

Calculation of technical data in the ANN model is conducted using the following mathematical equation (Vochozka et al., 2019):

$$Y = f \left[v_0 + \sum_{j=1}^m h(\lambda_j + \sum_{i=1}^n x_i w_{ij}) v_j \right]$$

Where:

Y = network output

f = Activity Function of the Output Layer

v0 = Output bias

h = Activity Function of hidden layer

λ_j = hidden unit biases ($j = 1, \dots, m$)

The calculation produces a logarithm used in the learning process aimed at: (1) all neurons choosing a logistic function; (2) output error is minimized by selecting the sum of squares error; (3) the logistics activation function uses between 0 and 1 to set the network output.

Artificial Neural Networks were utilized using special conditions to obtain the level of significance of each variable using reverse propagation for logarithmic learning. The learning speed and momentum were determined at 0.1, and the process was maximized at a mean square of less than 0.000001 or with the model completing 20,000 iterations. Thus, the information provided in this process is a significant variable that affects profitability.

Results and Discussion

The Impacts of Covid-19 on Macroeconomic Indicators and Islamic Banks' Financial Performance using PLS SEM

Data validation process using PLS SEM approach involved the results of the outer model stages, composite reliability and discriminant validity, and the good fit model.

Outer Model

The outer model stage produced a valid data classification with the value of >70%, while data producing values of <70% would be deleted (Hair et al, 2018). The result of the outer model stage is presented in the following figure.

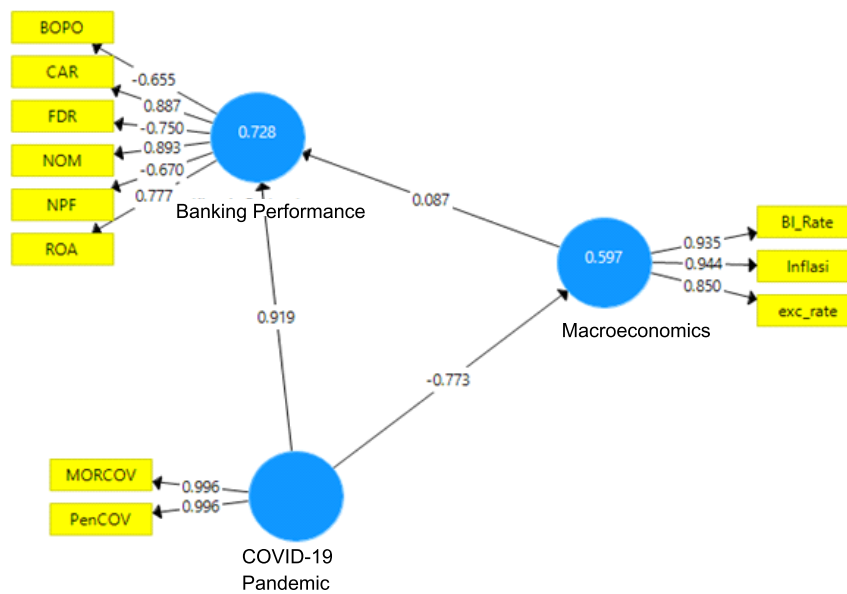


Figure 5. Results of Outer Model

The above results indicate that the BOPO variable/indicator with a value of (-0.655), FDR with a value of (-0.750), and NPF with a value of (-0.670) could not be utilized since they produced negative values. Variables with other than the above 3 values produced results of 0.7 or higher and therefore could be processed (Hulland, 1999). The path diagram is presented in figure 6.

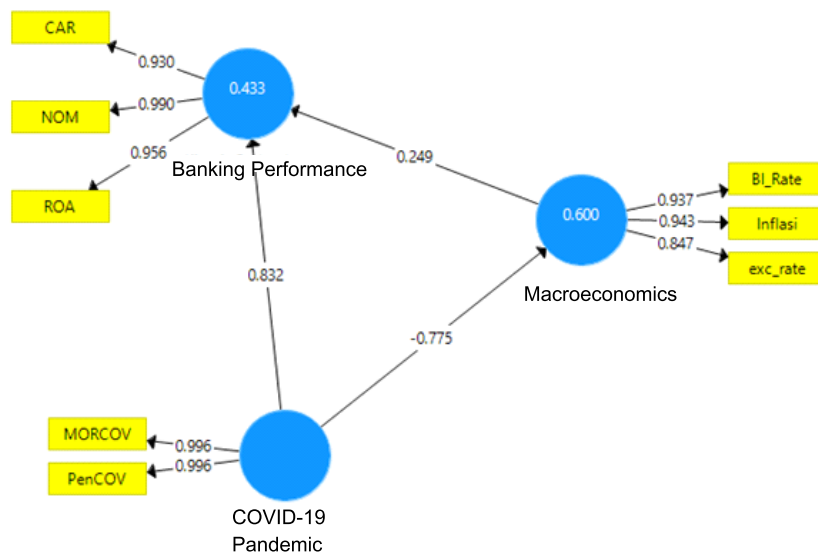


Figure 6. Path Diagram of Results

Composite Reliability and Discriminant Validity

Composite reliability and average variance extracted (AVE) determine the validity of the data and the acceptance of data in further observations. This study indicated composite reliability results of higher than 0.7, namely 0.972 for the performance of Islamic banks, 0.935 for macroeconomic indicators, and 0.996 for the Covid-19 pandemic. In addition, the study indicated AVE results of higher than 0.5, namely 0.92 for banking performance, 0.828 macro conditions, and 0.992 for the Covid-19 pandemic. Therefore, the data is valid and admissible in subsequent observations. The graph of Composite reliability and average variance extracted (AVE) is presented below.

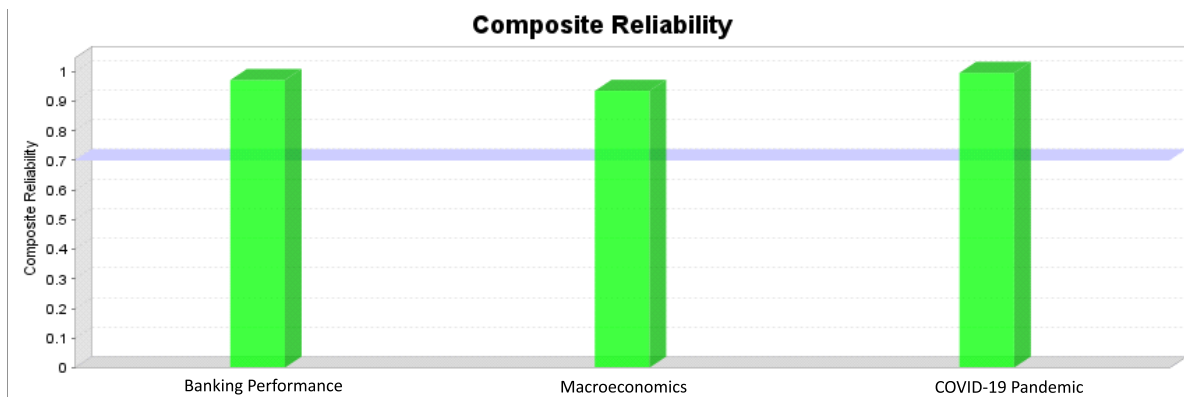


Figure 7. Composite Reliability

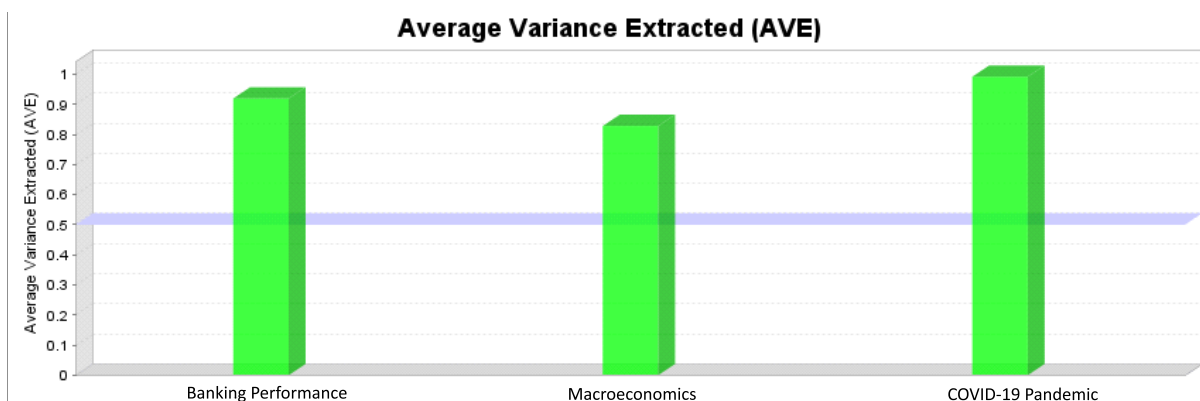


Figure 8. Average Variance Extracted (AVE)

Goodness of Fit Model

Analysis of Variant (R²) was conducted to determine the influence of independent variables on dependent variables as well as the value of the coefficient of determination. The results of R Square test is presented below:

Tabel 1. R Square Value

Variables	R-Square
Banking Performance	0.433
Macroeconomics	0.6

Source: PLS-SEM

The above table presents R-Square value of 0.433 for banking performance, indicating that a large percentage of financial performance (43%) is attributed to the Covid-19 pandemic. The table also presents R-Square value of 0.6 for macroeconomic indicators, indicating that a large percentage of macroeconomic indicators (60%) is attributed to the Covid-19 pandemic.

The Q-Square value was subsequently obtained to determine the goodness of fit of the model. The calculation of the Q-Square value is presented as follows:

$$\begin{aligned}
 \text{Q-Square} &= 1 - ((1 - R12) * (1 - R22)) \\
 &= 1 - 0.52 \\
 &= 0.48
 \end{aligned}$$

The calculation demonstrated that the model of this study has an acceptable goodness of fit value. Therefore, the data used could be observed further.

Partial Least Squares Structural Equation Modeling (PLS-SEM) Results

The purpose of this study was to determine the correlations between the Covid-19 pandemic and the macroeconomic indicators and financial performance of Islamic banks in Indonesia. The results of this study are illustrated in the table below.

Tabel 2. Path Coefficients

	Std Deviation (STDEV)	Tstas(STDEV)	P Value
Pandemic Covid-19 → Macroeconomics	0.071	10.885	0.0001
Pandemic Covid-19 → Banking Performance	0.432	1.926	0.055
Macroeconomics → Banking Performance	0.552	0.477	0.634

The above table indicates that the relationship of Covid-19 pandemic and macroeconomic indicators has a P-Value of 0.0001, which is lower than a maximum α of 10%. Therefore, the Covid-19 pandemic had a significant impact on macroeconomic conditions in Indonesia. Meanwhile, the relationship between the Covid-19 pandemic and the performance of Islamic banks resulted in a value of 0.055, indicating that the Covid-19 pandemic affected the performance of Islamic banks. Lastly, the value of macroeconomic indicators on Islamic banks' performance is at 0.634, which is higher than 10%, and therefore indicates that macroeconomic conditions had no effects on the performance of Islamic banks in Indonesia. A path diagram of the PLS-SEM results is presented below.

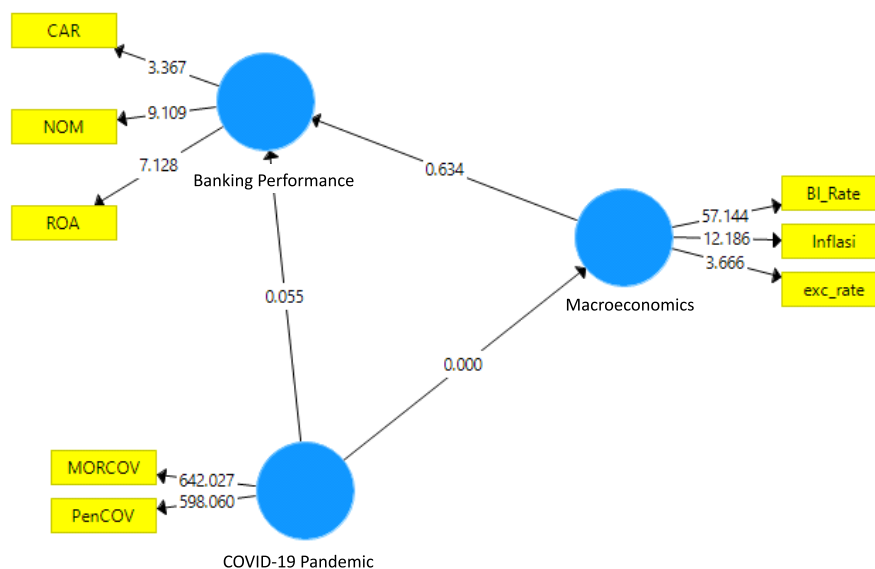


Figure 9. Research Result

The Impacts of Covid-19 on Macroeconomic Indicators and Islamic Banks' Financial Performance using ANN

Data validation process using ANN approach involved best logarithm results and validation parameters.

ANN's Best Logarithms and Parameters

Logarithms were generated from the Covid-19 pandemic data (confirmed numbers of monthly development) as independent data and macroeconomic data (BI Rate, Inflation, and Exchange Rate) as dependent data, as well as Islamic banks' financial performance data (CAR, NOM, NPF, FDR), and BOPO) an additional dependent data, namely N8-1-1 logarithm. The logarithm generated from the ANN calculations using Alyuda software is presented below. In the logarithm below, 8 neurons or variables, 1 weight between neurons, and 1 output were involved.

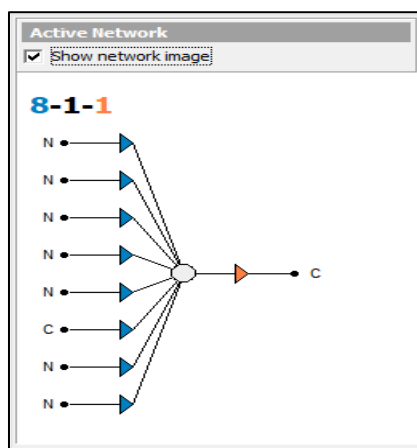


Figure 10. ANN Logarithms

The above logarithm produced data validation parameters from the variables. The results of the logarithm description in data validation are presented below.

Table 3. Parameters and Validation

Parameters	Training	Validation
CCR %	77.77778	100
Network Error	0.499	0
Error Improvement		0.000301
Iteration		501
Training Speed, iter/sec		2504.99
Architecture		[8-1-1]
Training Logarithm	Bacth Back Propagation	
Training Stop Reason	All iteration completed	

This study was analyzed using Batch Back Propagation logarithm training as the basis of research since it was able to provide maximum results with limited data (Zhang, Wu, & Yao, 2012). From this analysis, a CCR (Correct Classification Rate) of 77.89% was obtained, indicating that the processed data were valid.

ANN Analysis Results

The above calculations produced Network Statistics which explain the relationship between variables and the Covid-19 pandemic. Table 4 is presented statistical relationships between research variables. The table demonstrates that under the Covid-19 pandemic, performance did not have a significant effect, and if added up, the results of network statistics on banks' performance only produce a cumulative value of 47.7%. The largest result is attributed to FDR at 21.18%. A study by Fakhri and Darmawan (2021) stated that the policy of banking companies in disbursing funds (decreasing FDR) with extra caution caused a decline in the financial

performance of Islamic banks due to the impact of the Covid-19 pandemic and the declining wealth of the public.

Table 4. ANN Analysis Results

Network Statistic		
Variables	Importance %	Rank
CAR	11.491138	4
NPF	0.560493	7
FDR	21.18976	2
BOPO	2.730421	6
NOM	11.416069	5
BI Rate	36.795537	1
Inflation	0.393511	8
Exc_Rate	15.423073	3

In addition, the table indicates BI Rate value of 36.8%. This is in line with the policy of reducing interest rates at the lowest value, namely to 3.5% (Bank Indonesia, 2020). All macroeconomics results add up to a value of 52.3%, indicating the effect of macroeconomic indicators on the performance of Islamic banks.

Comparison between PLS-SEM and ANN Results

A comparison between the results of the PLS-SEM analysis with ANN analysis related to the impacts of the Covid-19 pandemic on macroeconomic indicators and financial performance of Islamic banks is presented below.

Table 5. Comparison of Results between PLS-SEM and ANN

Result	PLS-SEM	ANN
Validation	Q-Square = 0.48	CCR = 77.78%
Pandemic Covid-19 → Macroeconomics	P-Value = 0.0001 (Significant effect)	Net Stas = 52.3% (Significant effect)
Pandemic Covid-19 → Banking Performance	P-Value = 0.055 (Effect)	Net Stas = 47.7% (No effect)

The above table illustrates the similarities between the PLS-SEM model and the ANN approach. PLS-SEM produced a data validation value of 0.48%, while ANN produced a data validation value of 77.78%, indicating that the data used could be used even though it was not optimal due to their limitations. The equation could also be observed in the effects of the Covid-19 pandemic on macroeconomic conditions, where macroeconomic indicators were significantly affected by the Covid-19 pandemic in the PLS-SEM model with a P-Value value of 0.0001. Meanwhile, in the ANN Network Statistics model, a value of 52.3% was obtained, indicating that the macroeconomic indicators were influenced by the Covid-19 pandemic.

The above table demonstrates that the effect of the Covid-19 pandemic on banking performance with the PLS-SEM model has a P-Value of 0.055 with maximum $\alpha = 10\%$. These results indicate that Covid-19 affects the financial performance of Islamic banks. Meanwhile, the results of the ANN model indicated a value of Network Statistics on all banking performances at 47.7%. These results suggest that the Covid-19 pandemic did not affect the financial performance of Islamic banks in Indonesia. Therefore, the results of the two models, both ANN and PLS-SEM, are not in line with the performance of Islamic banks and macroeconomic conditions in Indonesia.

The Financial Services Authority (OJK) recorded a growth of Islamic Banking Third Party Funds (DPK) by 11.94 percent (yoy) to Rp425.29 trillion throughout 2019. This is an illustration that during the pandemic, Islamic banking still gained trust from the public in its fundraising activities. In Sharia SOEs, for example, there was an increase of 11.73% yoy to Rp.

161.5 trillion as of June 2021. As for TPF, it recorded a growth of 16.03% to the level of Rp. 216.4 trillion compared to the same period last year, which was Rp. 186.5 trillion.

Conclusion

The Covid-19 pandemic has an extraordinary impact on various aspects of life and the global economic slowdown has an impact on the Indonesian economy. In contrast, the performance of Islamic banks indicated an increase in the performance at the global level. By using the PLS-SEM and ANN methods, this study aimed to highlight the effects of the Covid-19 pandemic on the macroeconomic indicators and financial performance of Islamic banks.

The results of this study demonstrated that the Covid-19 pandemic had a significant effect on the macroeconomic indicators. However, the results on the financial performance of Islamic banks differed. The PLS-SEM method indicated that the financial performance of Islamic banks was significantly affected by Covid-19, while ANN indicated that it was not.

Author Contributions

Conceptualization: Ulumuddin Nurul Fakhri

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Formal analysis: Ulumuddin Nurul Fakhri

Investigation: Aminah Nuriyah

Methodology: Ulumuddin Nurul Fakhri

Project administration: Aminah Nuriyah

Supervision: Aminah Nuriyah

Validation: Aminah Nuriyah

Visualization: Ulumuddin Nurul Fakhri

Writing – original draft: Ulumuddin Nurul Fakhri

Writing – review & editing: Aminah Nuriyah, Ulumuddin Nurul Fakhri

References

- Abbasi GA, Tiew LY, Tang J, Goh Y-N, & Thurasamy R. (2021). The adoption of cryptocurrency as a disruptive force: Deep learning-based dual stage structural equation modelling and artificial neural network analysis. *PLoS ONE*, 16(3). <https://doi.org/10.1371/journal.pone.0247582>.
- Al-Emran, M., Mezhyuev, V., & Kamaludin, A. (2018). PLS-SEM in information systems research: A comprehensive methodological reference. *Advanced Intelligent Systems and Informatics*, 644-653. https://doi.org/10.1007/978-3-319-99010-1_59
- Amah, N., & Hendriana, S. (2017). Determinan loyalitas nasabah (studi pada bank syariah di Kota Madiun). *Assets: Jurnal Akuntansi dan Pendidikan*, 5(2), 161-172. <http://doi.org/10.25273/jap.v5i2.1196>.
- Badan Pusat Statistik. (2020). *Pertumbuhan ekonomi Indonesia triwulan IV-2020*. No. 13/02/Th. Badan Pusat Statistik XXIV. www.bps.go.id.
- Bairoliya, N., & Imrohorglu, A. (2020). Covid-19: Mitigation measures and the aftershock in an overlapping generations model. *SSRN Electronic Journal*. <http://dx.doi.org/10.2139/ssrn.3737173>
- Bank Indonesia. (2020). *Laporan tahunan 2020*. Bank Indonesia. <https://www.bi.go.id/id/publikasi/laporan/Documents/Laporan-Akuntabilitas-Bank-Indonesia-2020.pdf>
- Dumitrescu, B. A., Kagitci, M., & Cepoi, C. O. (2021). Nonlinear effects of public debt on inflation. Does the size of the shadow economy matter?. *Finance Research Letters*. <https://doi.org/10.1016/j.frl.2021.102255>.

- Dorman, P. (2014). *Microeconomics*. Springer-Verlag Berlin Heidelberg.
- Fakhri, U. N., & Darmawan, A. (2021). Comparison of Islamic and conventional banking financial performance during the covid-19 period. *International Journal of Islamic Economics and Finance (IJIEF)*, 4(SI), 19-40. <https://doi.org/10.18196/ijief.v4i0.10080>.
- Fakhri, U. N., Anwar, S., & Ismal, R. (2020). Comparison of sharia and conventional banking bankruptcy rates in Indonesia. *Tazkia Islamic Finance and Business Review*, 13 (2), 125-141. DOI: <https://doi.org/10.30993/tifbr.v13i2.193>.
- Fakhri, U. N., Anwar, S., Ismal, R., & Ascarya, A. (2019). Comparison and predicting financial performance of Islamic and conventional banks in Indonesia to achieve growth sustainability. *al-Uqud: Journal of Islamic Economics*, 3(2), 174-187. <https://doi.org/10.26740/al-uqud.v3n2.p174-187>.
- Fakhrunnas, F. (2019). The effect of macroeconomic and bank-specific variables to risk-taking of Islamic bank in Indonesia. *International Journal of Islamic Economics and Finance (IJIEF)*, 1(2), 165-186. <https://doi.org/10.18196/ijief.129>.
- Fontana, G., McCombie, J., & Sawyer, M. (2010). *Macroeconomics, finance and money: Essays in honour of Philip Arestis*. Springer.
- Hair, J.F., M. Sarstedt, C.M. Ringle., & S.P. Gudergan. (2018). *Advanced issues in partial least squares structural equation modeling (PLS-SEM)*. Sage Publications.
- Hulland, J. (1999). Use of partial least squares (PLS) in strategic management research: A review of four recent studies. *Strategic Management Journal*, 20(2), 195–204. [https://doi.org/10.1002/\(SICI\)1097-0266\(199902\)20:2<195::AID-SMJ13>3.0.CO;2-7](https://doi.org/10.1002/(SICI)1097-0266(199902)20:2<195::AID-SMJ13>3.0.CO;2-7).
- Hsu, S. H., Chen, W. H., & Hsieh, M. J. (2006). Robustness testing of PLS, LISREL, EQS and ANN-based SEM for measuring customer satisfaction. *Total Quality Management & Business Excellence*, 17(3), 355-372. <https://doi.org/10.1080/14783360500451465>.
- Ichsan, R. N., Suparmin, S., Yusuf, M., Ismal, R., & Sitompul, S. (2021). Determinant of sharia bank's financial performance during the Covid-19 pandemic. *Budapest International Research and Critics Institute (BIRCI-Journal): Humanities and Social Sciences*, 4(1), 298-309. <https://doi.org/10.33258/birci.v4i1.1594>.
- Iyke, B. N., & Ho, S. Y. (2021). Exchange rate exposure in the South African stock market before and during the Covid-19 pandemic. *Finance Research Letters*, 102000. 1-9.: <https://doi.org/10.1016/j.frl.2021.102000>.
- Jelilov, G., Iorember, P. T., Usman, O., & Yua, P. M. (2020). Testing the nexus between stock market returns and inflation in Nigeria: Does the effect of Covid-19 pandemic matter?. *Journal of Public Affairs*, 1-9. <https://doi.org/10.1002/pa.2289>.
- Luwihono, A., Suherman, B., Sembiring, D., Rasyid, S., Kalbuana, N., Saputro, R., Prasetyo, B., Taryana, T., Suprihartini, Y., Asih, P., Mahfud, Z & Rusdiyanto, R. (2021). Macroeconomic effect on stock price: Evidence from Indonesia. *Accounting*, 7(5), 1189-1202. <https://doi.org/10.5267/j.ac.2021.2.019>
- Murad, H., Ali, S. B., Baig, U., Raza, A., Ali, S., & Abdullah, A. (2021). Comparative study: conventional and Islamic banking performance in Pakistan. *International Journal of Management (IJM)*, 12(3). 448-459. <https://doi.org/10.34218/IJM.12.3.2021.042>.
- Nurhuda, M. R., Rozali, M., Rakhmatillah, L., & Adinugraha, H. H. (2020). Does the pruning on the reference interest rate by bank Indonesia influence interest rate sensitivity towards banking net interest margin during early period in facing Covid-19 in Indonesia?. *Annals of the University of Craiova for Journalism, Communication and Management*, 6(1), 13-30. <https://aucjcm.ro/wp-content/uploads/2020/12/aucjcm-vol6-13-30.pdf>

- Ochozka, M., Horák, J., & Šuleř, P. (2019). Equalizing seasonal time series using artificial neural networks in predicting the Euro–Yuan exchange rate. *Journal of Risk and Financial Management*, 12(2), 76. <https://doi.org/10.3390/jrfm12020076>.
- Ohyama, M. (2016). *Macroeconomics, Trade, and Social Welfare*. Springer Japan.
- Olivia, S., Gibson, J., & Nasrudin, R. A. (2020). Indonesia in the time of Covid-19. *Bulletin of Indonesian Economic Studies*, 56(2), 143-174. <https://doi.org/10.1080/00074918.2020.1798581>.
- Prasetyo, B. (2006). *Metode penelitian kuantitatif teori dan aplikasi*. Raja Grafindo Persada.
- Rahman, T., & Santoso, A. (2019). Determinants of Islamic banking performance: An empirical study in Indonesia. *Muqtasid: Jurnal Ekonomi dan Perbankan Syariah*, 10(2), 139-154. <https://doi.org/10.18326/muqtasid.v10i2.139-154>.
- Riono, P. (2020). *UI ungkap kronologi negara abai virus corona masuk RI Januari*. CNN <https://www.cnnindonesia.com/teknologi/20200420160222-199-495344/ui-ungkap-kronologi-negara-abai-virus-corona-masuk-ri-januari>
- Sholihin, M., & Ratmono, D. (2021). *Analisis SEM-PLS dengan WarpPLS 7.0 untuk Hubungan Nonlinier dalam Penelitian Sosial dan Bisnis*. Andi Offset
- Setyawati, I., Suroso, S., Suryanto, T., & Nurjannah, D. S. (2017). Does financial performance of Islamic banking is better? Panel data estimation. *European Research Studies Journal* 20(2A), https://www.ersj.eu/repec/ers/papers/17_2_A_p36.pdf
- Sugandi, E. A. (2020). Indonesia's financial markets and monetary policy dynamics amid the Covid-19 pandemic. *ADB Working Paper*. 1198. <http://dx.doi.org/10.2139/ssrn.3712774>.
- Syahri, A., & Robiyanto, R. (2020). The correlation of gold, exchange rate, and stock market on Covid-19 pandemic period. *Jurnal Keuangan dan Perbankan*, 24(3), 350-362. <https://doi.org/10.26905/jkdp.v24i3.4621>.
- Taylor, L. (2021). *Reconstructing macroeconomics*. Harvard University Press.
- Vochozka, M., Horak, J., & Suler, P. (2019). Equalizing seasonal time series using artificial neural networks in predicting the Euro-Yuan exchange rate. *Journal of Risk and Financial Management*, 12(2), 1-17. <https://doi.org/10.3390/jrfm12020076>
- Walmsley, T. L., Rose, A., & Wei, D. (2020). Impacts on the US macroeconomy of mandatory business closures in response to the Covid-19 Pandemic. *Applied Economics Letters*, 1-8. <https://doi.org/10.1080/13504851.2020.1809626>.
- World Health Organization. (2020). *Coronavirus Disease*. World Health Organization <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>
- Wunder, S., Kaimowitz, D., Jensen, S., & Feder, S. (2021). Coronavirus, macroeconomy, and forests: What likely impacts?. *Forest Policy and Economics*, 131, 102536. <https://doi.org/10.1016/j.forpol.2021.102536>.
- Yamin, S., & Kurniawan, H. (2011). *Generasi baru mengolah data penelitian dengan partial least square path modeling*. Salemba Infotek.
- Yunita, P. (2020). The future of Indonesia Islamic banking industry: Bankruptcy analyzing the second wave of global financial crisis. *International Journal of Islamic Economics and Finance (IJIEF)*, 3(2), 199-226. <https://doi.org/10.18196/ijief.3227>.
- Yusuf, M., & Ichsan, R. N. (2021). Analysis of banking performance in the aftermath of the merger of bank syariah Indonesia in Covid 19. *International Journal of Science, Technology & Management*, 2(2), 472-478. <https://doi.org/10.46729/ijstm.v2i2.182>.

- Zhang, Y., Diao, X., Chen, K.Z., Robinson, S. & Fan, S. (2020). Impact of Covid-19 on China's macroeconomy and agri-food system – an economy-wide multiplier model analysis. *China Agricultural Economic Review*, 12(3), 387-407. <https://doi.org/10.1108/CAER-04-2020-0063>.
- Zhang, H., Wu, W., & Yao, M. (2012). Boundedness and convergence of batch back-propagation algorithm with penalty for feedforward neural networks. *Neurocomputing*, 89, 141-146. <https://doi.org/10.1016/j.neucom.2012.02.029>.