

M&A Efficiency Islamic Bank Pre-Merger Analysis: Does Control Covid-19 Matter?

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Abstract

Analysis of pre-mergers is important to do as an effort for Islamic banks to increase competitiveness. This study aims to analyze the determinants of the efficiency of pre-merger Islamic banking in Indonesia. This study uses a quantitative research design through the two-stage banking data envelopment analysis (DEA) model. The input variables for the first stage are third party funds (DPK), operational costs (BIOP), total financing (TFIN), and the output variables are operating income (PENDOP), total assets (TASSET). Then in the second stage with multivariate tobit regression, using the dependent variable the efficiency score obtained through the results of the first stage and in the first model the independent variables are total assets, bank size, ROA, NPF, CAR and then measurements are made on additional Covid-19 controls for the second model. The results showed that total assets, bank size, ROA, and CAR significantly affected efficiency scores. NPF has no significant effect. The second model with the Covid-19 control variable produced a more substantial empirical model influence than non-control Covid-19. Overall, the performance of Islamic commercial banks increased until the fourth quarter of 2020, seen from the improving quality of financing, which was also marked by the decline in NPF and quite good intermediation. Limitations of this study include the limited update of the Covid-19 control data.

Keywords : Efficiency, Pre-merger, Islamic Bank, Two Stage Banking Data Envelopment Analysis (DEA) Model

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1. INTRODUCTION

The trend of the Islamic banking industry in Indonesia is increasing, based on the State of the Global Islamic Economy Report for 2019 – 2020 (GIER, 2020) Indonesia is in 5th position out of the Top 15 Global Islamic Economy Indicator Score Rank and in terms of Islamic Finance in Indicator Score Rank By Sector, Indonesia is in 6th place in the world, then based on The Islamic Finance Development Indicator (ICD, 2020) Indonesia is ranked 2nd Up from the previous rank at number 4 in 2019 with the criteria of Top IFDI Markets and Global Average IFDI Values For 2020.

Developmentally until 2021, the Islamic banking sector is according to the Islamic Banking Statistics Report for January 2021(OJK, 2021b) consists of 12 Islamic Commercial Banks, 20 Sharia Business Units,

163 Islamic People's Financing Banks with a market share as of December 2020 of 9.89% for the Islamic finance sector. Analysis on pre-mergers is important to do as an effort for Islamic banks in order to increase competitiveness, as well as assist in fulfilling the analysis and being included in the objectives of the Sharia Banking Development Roadmap released by the Financial Services Authority OJK (2021a) and the Indonesian Sharia Economic Masterplan for 2019 – 2024 Komite Nasional Keuangan Syariah (2018) which consists of three elements, namely strengthening sharia banking identity, sharia economic ecosystem synergy, strengthening licensing, regulation and supervision which aims to create sharia banking that is resilient, highly competitive and contributes significantly to the national economy and social development.

According to research by Sufian & Abd. Majid (2007), the banking sector in Singapore has seen globalization, deregulation, and liberalization comparable to those in industrialized nations such as the EU and the United States. These modifications are associated with the process of mergers and acquisitions (M&A). M&A increase the competitiveness and efficiency of banks. Singapore's banking industry is an important component of Asian financial activities that has not been the subject of extensive examination relative to other affluent nations. Since an efficient banking system contributes significantly to a nation's economic prosperity, policymakers, industry leaders, and many others who rely on the banking sector find these types of research quite useful.

A pre-merger examination of Islamic banking in Indonesia is an intriguing topic for discussion. Sinha & Gupta (2011) stated in their research on pre-merger and post-merger effects on financial institutions in India that there is a distinction between the pre and post-merger. Abbas et al. (2014) conducted a study comparing pre-merger and post-merger analyses of banks' financial performance in Pakistan, concluding that there was no significant difference between pre-merger and post-merger financial performance, so this study could serve as a reference for future research. The study of pre-merger and post-merger Islamic banking in Indonesia will continue.

Bod'a & Zimková (2021) discuss the use of data envelopment analysis (DEA) to measure financial intermediation by proposing a more complex and comprehensive DEA model, specifically a two stage DEA analysis in which the use of DEA deficiencies in non-parametric methods based on considerations issued in this case (traditional DEA) is only for studying the benefits of financial intermediation (size,

maturity and risk transformation of mediated funds, delegated monitoring). Existing models based on macroeconomic theory were used to show that the end effect is a moderation of transaction costs for unit surpluses and deficits. Xu & Zhou (2021) researched the assessment of banking efficiency as a recent intermediation chain. Taking the non-performing (NPF) process elements of commercial banks in China, they found that China's state-owned commercial banks performed better than joint-stock commercial banks and private commercial banks over five years.

Analysis of Islamic banking pre-merger is an essential determining factor. From this phenomenon, researchers try to uncover and see the determinants of analyzing the pre-merger efficiency of Islamic banking in Indonesia.

2. METHODS

This study uses a quantitative research design. The quantitative approach used in this study includes two stages, the first stage is non-parametric meaning that it does not require special criteria in measurement Charnes et al. (1978) and the second stage with parametric according Henriques et al. (2020) to determine the effect of the efficiency score variable on Total Assets, Bank Size, ROA, NPF, CAR in Islamic banking in Indonesia. In this study table 1 includes the scope to analyze the factors that affect the performance efficiency of Islamic banking in Indonesia. In the first stage of measurement, there are input and output variables and in the second stage, namely an equation model consisting of more than one variable and equation so that it sees the relationship to each other (Gujarati and Porter, 2009). The variables of the two stages are:

Table 1. Research Variables

No.	Variable	Source
Output		
1	PENDOP (Pendapatan Operasional)	Quarterly Published Report (OJK)
2	TFIN (Total Pembiayaan)	Quarterly Published Report (OJK)
Input		
3	DPK (Dana Pihak Ketiga)	Quarterly Published Report (OJK)
4	BIOP (Biaya Operasional)	Quarterly Published Report (OJK)
5	Tasset (Total Asset)	Quarterly Published Report (OJK)
Two Stage Variable		
1	Tasset (Total Asset)	Quarterly Published Report (OJK)
2	Return On Assett-1	Quarterly Published Report (OJK)

3	Bank Size ($\frac{ASSET_t - ASSET_{t-1}}{ASSET_{t-1}} \times 100$)	Quarterly Published Report (OJK)
4	NPF (Non Performing Finance)	Quarterly Published Report (OJK)
5	CAR (Capital Adequacy Ratio)	Quarterly Published Report (OJK)
Control Covid-19		
6	New Case Covid-19 Indonesia	Johns Hopkins Coronavirus Resource Center
7	New Deaths Covid-19 Indonesia	Johns Hopkins Coronavirus Resource Center
8	Total Case Covid-19 Indonesia	Johns Hopkins Coronavirus Resource Center
9	Total Deaths Covid-19 Indonesia	Johns Hopkins Coronavirus Resource Center

Source: Author

The population used in this study is banking in Indonesia in Quarter (Q1) 2017 - Quarter (Q4) 2020. This study uses purposive sampling, with a sample of sharia commercial banks in Indonesia listed and supervised by the Financial Services Authority (OJK). OJK) in total, there are 14 sharia commercial banks analyzed consisting of:

Table 2. Research Sample

No.	Nama Bank Umum Syariah	Code
1	Bank Syariah Mandiri	(BSM)
2	Bank Rakyat Indonesia Syariah	(BRIS)
3	Bank Negara Indonesia Syariah	(BNIS)
4	Bank Central Asia Syariah	(BCAS)
5	Bank Muamalat Indonesia	(BMI)
6	Bank Panin Syariah	(BPS)
7	Bank Syariah Bukopin	(BSB)
8	Bank Mega Syariah	(BMS)
9	Bank Victoria Syariah	(BVS)
10	Bank Pembangunan Daerah Nusa Tenggara Barat Syariah	(BPD NTBS)
11	Bank Tabungan Pensiunan Nasional Syariah	(BTPNS)
12	Bank Aceh Syariah	(BAS)
13	Bank Pembangunan Daerah Jawa Barat dan Banten Syariah	(BJBS)
14	Maybank Syariah	(MS)

Source: OJK (2021b)

This study borrows the DEA equation from (Ahn & Le, 2014; Banker et al., 1984; Charnes et al., 1978; Himmawan & Firdausi, 2021; Prima Sakti & Mohamad, 2018) where the Data Envelopment Analysis (DEA) will calculate the efficiency value of the bank *s* (*hs*), *hs* is the number of multiplications of the output weight *i* by the number of output *i* in the Islamic banking period *s*. The following is the equation of the efficiency of several outputs and inputs based on their technical efficiency.

$$hs = \frac{\sum_{i=1}^m U_{is}Y_{is}}{\sum_{j=1}^n U_{js}Y_{js}} \quad i = 1, \dots, m, j = 1, \dots, n$$

With information, *hs* is the efficiency of bank *s* then *m* is the output of bank *s* observed if *i* and *j* reach = 1 then achieve efficiency, and then *n* is the input of bank *s* observed, and *Y_{is}* is the amount of output *i* produced by bank *s* and *Y_{js}* is the amount of input *j* used by bank *s* and lastly *U_{is}* is the weight of output *i* produced by bank *s* and *U_{js}* is the weight of input *j* given by bank *s* and *i* is calculated from 1 to *m* and *j* is calculated from 1 to *n*. To explain the determinants of the technical efficiency score derived from the DEA model. (Coelli, T. J., Rao, D.S.P., & Battese, 2005; Coelli et al., 1998) Suggest several ways “environmental variables” can be accommodated in a DEA analysis. The term “environmental variables” is usually used to describe factors that can affect the efficiency of a company (Sufian & Abd. Majid, 2007). In this case, these factors are not standard inputs and are assumed to be beyond the control of managers or stakeholders. Therefore, the two-stage method used in this study involves solving the DEA problem in the first stage of analysis, which mainly consists of standard outputs and inputs. In the second stage, the efficiency score obtained from the first stage analysis is regressed on bank characteristics and other environmental variables.

Tobit standard model developed by (Coelli, T. J., Rao, D.S.P., & Battese, 2005; Dutta et al., 2020; Henriques et al., 2020; Sufian & Abd. Majid, 2007) based on bank *i* observations a mathematical model was produced where:

$$y_i^* = \beta' \chi_i + \varepsilon_i$$

$$y_i = y_i^* \text{ if } y_i^* \geq 0$$

$$y_i = 0$$

$$\theta_i = \alpha + \sum_{j=1}^m \beta_j Z_{ij} + \varepsilon_i$$

$$\theta_{it} = \alpha + \beta_1 T_{ASSET_{it}} + \beta_2 SIZE_{it} + \beta_3 ROA_{it-1} + \beta_4 NPF_{it} + \beta_5 CAR_{it} + \varepsilon_{it}$$

In this study, an additional variable was used to control Covid-19 (Durmuş, 2021; Min et al., 2021), by adopting the covid-19 control measurement method

from Min et al. (2021) in order to assess the socio-economic impact of COVID control measures in the country of Indonesia, the authors modified according to the literature Min et al. (2021) by adding the Covid-19 control model to a series of Tobit regression analyses. Covid-19 control data was obtained through the Johns Hopkins Coronavirus Resource Center. Covid-19 control data is in the form of datasets still in the exploration and development stage, showing that much data still needs to be updated, especially at the start of cases of Covid-19 entering Indonesia, including the number of vaccines and mortality tests. So that an additional mathematical model is obtained referring to Min et al. (2021):

$$y_i^* = \beta' \gamma_i + \varepsilon_i \text{ and } \varepsilon_i \sim N(0, \sigma^2), i = 1, \dots, n$$

$$\theta_{it} = \alpha + \beta_1 \text{TASSET}_{it} + \beta_2 \text{SIZE}_{it} + \beta_3 \text{ROA}_{it-1} + \beta_4 \text{NPF}_{it} + \beta_5 \text{CAR}_{it} + \beta_6 \text{NEWCASE}_{it} + \beta_7 \text{NEWDEATHS}_{it} + \beta_8 \text{TOTALCASE}_{it} + \beta_9 \text{TOTALDEATHS}_{it} \varepsilon_{it}$$

where y_i^* is the dependent variable, x_i and β additional vector control covid-19, ε_i is the error term of the constant variance σ^2

3. RESULT AND DISCUSSION

3.1. Result

Table 3 shows the average efficiency score for each Islamic banking in Indonesia based on the research results. The results show that the highest CRS efficiency is owned by BTPNS of 0.86. The lowest CRS efficiency score is owned by BAS of 0.58. Thus, it shows that BTPNS can produce output with an efficiency comparable to the available input. The analysis of the VRS model by analyzing output orientation through existing variables. VRS will assess input based on available variables in output-oriented specifications to maximise the available output. The results of the VRS efficiency score show the highest at BSM of 0.96 and the lowest at BVS of 0.64.

Table 3. Analysis of CRS and VRS Efficiency Results

Unit Name	CRS	VRS
	Mean	Mean
BSM	0.64	0.96
BRIS	0.64	0.79
BNIS	0.62	0.80
BCAS	0.69	0.77
BMI	0.70	0.84
BPS	0.79	0.83
BSB	0.75	0.79
BMS	0.67	0.75
BVS	0.61	0.64
BPD NTBS	0.79	0.86
BTPNS	0.86	0.92
BAS	0.58	0.69
BJBS	0.69	0.74
MS	0.79	0.86
AVERAGE	0.70	0.80

Source: Data Processing Results MaxDEA 8

Criteria Test for Non-Control Covid-19 and Control Covid-19 Models

Then enter the second stage of testing, the use of efficiency scores used in the dependent variable testing is based on output-oriented before testing is carried out first test the model criteria to determine the level of bias and robustness in the data, which can be seen in table 4 which includes redundant likelihood tests variable test, wald test. Refers to Prahutama et al. (2019) To perform multiple modelling in Tobit regression, all independent variables are simultaneously modeled based on significant individual modelling. Simultaneous testing will be performed on the parameter estimation findings from these numerous models. On the likelihood redundant variable test, in books, Bellini (2019) mentions that multinomial regression, like the Tobit regression, uses the likelihood estimation method, it is assumed that because the equation is used for large sample size and better reflects the level of bias in the data.

Tabel 4. Criteria for the Non Control Covid-19 and Control Covid-19 Models

	Non Control Covid-19					Control Covid-19				
	Coefficient	Std.Error	Z-Statistic	Value	Probability	Coefficient	Std. Error	Z-Statistic	Value	Probability
Like Lihood Redundant Variable Test	0.802501	0.009815	81.76131	197.4653	0.0000	0.802501	0.009815	81.76131	212.7659	0.0000

	Non Control Covid-19				Control Covid-19			
	T-statistic	F-Statistic	Chi-Square	Probability	T-Statistic	F-Statistic	Chi-Square	Probability
Wald Test	5.750427	33.06742	33.06742	0.0000	4.269402	18.22780	18.22780	0.0000

Source: Data Processing Results E-Views 9.0

Then test the additional model criteria, namely the Breusch-Pagan LM variable influence factor (VIF), because the researcher wants to see whether there is multicollinearity in the panel data, which consists of a cross-section dependence test (Gujarati, 2004), the results show that the model test has a significance level of each in the estimation test of $0.0000 < 0.05$. This means that the model meets the criteria to continue testing the multivariate tobit regression model because it already reflects the robust data criteria mentioned (He et al., 2020) in testing the

criteria stage in the multivariate Tobit regression criterion test.

Wasiaturrahma et al. (2020) mention that Tobit does not use the normality test due to the use of the dependent variable efficiency with levels 0 and 1. When testing using ordinal least squares (OLS), regression does not answer the model because there is a classical assumption in the model. In the second stage, the best model is used for measurement, Tobit regression.

Test Result

Table 5. Model Non Control Covid-19

Variabel	Coefficient	Std. Error	z-Statistic	Probability
Konstanta	0.419763	0.072997	5.750427	0.0000
X1_TASSET	2.64925	4.0293	6.57481	0.0000***
X2_ROAt-1	0.01071	0.0022	4.71902	0.0000***
X3_BANKSIZE	0.02936	0.0084	3.46833	0.0009***
X4_NPF	-0.00196	0.0047	0.41240	0.7201
X5_CAR	0.00062	0.000189	3.31129	0.0000***
Pseudo R-Squared	0.485062			
Adjusted R-Squared	0.473251			
Wald Chi-Square	33.06742			
Prob.>Chi-Square	0.000000			

Source: Data Processing Results E-Views 9.0

Then the second phase of the model test is carried out, shown in table 5. Like other types of regression analysis, Tobit regression analysis has value in determining how much variance in the data can be explained by the model. According to (Jeryana et al., 2014; Veall & Zimmermann, 1996; Yu & Ramanathan, 2008), the Pseudo-R-Squared value is used to assess the goodness of fit in the Tobit regression, which has a value between 0 and 1, as in the Tobit regression. The model test results in table 4.5 show that the Pseudo R-Squared value is 0.485062 or 49.1%, meaning that the model formed can explain the effect of 49.1% simultaneously. At the partial probability level, the constant, in this case, is the efficiency score in the model, indicating a significance level < 0.05 , where total assets influence the efficiency score, return on assets (ROA), bank size (BankSize),

and capital adequacy ratio (CAR) while on non-performing finance (NPF) variables, and not significant to the dependent variable, namely efficiency score. With the partial mathematical results of the model, namely $Y_{Efficiency} = 0.419763 + 2.64925X1_TASSET + 0.01071X2_ROAt-1 + 0.02936X3_BANKSIZE - 0.00196X4_NPF + 0.00062X5_CAR$. From the mathematical results, a coefficient of 0.419 is obtained, and if there is an increase in total assets, it will increase efficiency by 2.649. Then, if there is an increase in ROA, it will increase efficiency by 0.01. An increase in bank size will reduce efficiency by 0.02, and an increase in NPF will increase efficiency by 0.001. Finally, an increase in CAR will increase efficiency by 0.0006.

Table 6. Model Control Covid-19

Variabel	Coefficient	Std. Error	z-Statistic	Probability
Konstanta	0.32305	0.075703	4.268402	0.0000
X1_TASSET	3.00827	4.035771	7.454030	0.0000***
X2_ROAT-1	0.00700	0.002520	2.781866	0.0152**
X3_BANKSIZE	0.03387	0.008374	4.045446	0.0001***
X4_NPF	-0.00510	0.004958	1.028704	0.5540
X5_CAR	0.00070	0.000191	3.668999	0.0000***
NEW_CASE_PERMILLION	-0.0018	0.007603	-0.24297	0.9694
NEW_DEATHS_SMOOTHED	-0.0006	0.000838	-0.79948	0.2269
TOTAL_CASE_PERMILLION	-0.0009	0.000287	-3.14355	0.0004***
TOTAL_DEATHS PER MILLION	0.02739	0.009356	2.927737	0.0012***
Pseudo R-Squared	0.520232			
Adjusted R-Squared	0.500055			
Wald Chi-Square	18.36531			
Prob.>Chi-Square	0.000000			

Source: Data Processing Results E-Views 9.0

In testing the model with the covid-19 control with the covid-19 control variables listed in table 6 consisting of NEW_CASE_PERMILLION, NEW_DEATHS_SMOOTHED, TOTAL_CASE_PERMILLION, TOTAL_DEATHS_PER_MILLION shows that the proxies of the effect of TOTAL_CASE_PERMILLION, TOTAL_DEATHS_PER_MILLION are significant to the efficiency score in the model formed. Surprisingly, the Pseudo R-Squared value increases by 0.520232 or 52%, meaning that the model formed can explain the effect of 52% simultaneously. The influence of the Covid-19 control model is stronger and can explain the factors that affect efficiency scores in Islamic banking in Indonesia compared to the Covid-19 non-control model. Furthermore, with a significant probability, NPF remains an insignificant variable on the efficiency score, followed by the covid-19 control variable, which consists of NEW_CASE_PERMILLION, and NEW_DEATHS_SMOOTHED. With a partial model that is $Y_{\text{Efficiency}} = 0.3294 + 2.994X1_{\text{TASSET}} + 0.0048X2_{\text{ROAT-1}} + 0.0338X3_{\text{BANKSIZE}} + 0.0028X4_{\text{NPF}} + 0.0008X5_{\text{CAR}} + 0.0002\text{NEW_CASE_PERMILLION} - 0.0009\text{NEW_DEATHS_SMOOTHED} - 0.0009\text{TOTAL_CASE_PERMILLION} + 0.0298\text{TOTAL_DEATHS_PER_MILLION}$

3.2. Discussion

In this discussion, total assets are an important influence on the efficiency of Islamic banking, where large banks have more total assets than small banks in general. This result shows that efficiency is related to total assets (Khalifaturafi'ah, 2018). On the other hand, banks with low efficiency will increase non-performing loans, reducing banking performance in terms of total assets. According to the banking industry profile report for the fourth quarter of 2020 by OJK (2020), the performance of Islamic commercial banks is reflected in an increase in total assets of 13.23% in December 2020 compared to December 2019 of only 9.90%. Islamic commercial banks can maintain total assets. This study shows that total assets significantly influence efficiency in Islamic banking in Indonesia. The empirical results in this study are corroborated by research from Mursyid et al. (2021), which stated that judging from its financial performance, Islamic Commercial Banking in Indonesia showed positive growth. Return on assets (ROA) has a significant positive effect on efficiency scores. Thus, banks that can generate high levels of profit or profitability with each input variable can be considered efficient. Some researchers like (Chaluvadi et al., 2018; Firdaus & Hosen, 2014) link the effect of return on assets (ROA) to efficiency scores because, during the development of banking technology, they can use digital-based services so that they can maximize profits and cut operational costs,

this is the basis for making studies on efficiency seen from profitability.

In this study, bank size significantly positively affects efficiency scores. This study provides novelty to research Boulanouar et al. (2021) conducted by comparison between Islamic banking and conventional commercial banks in the regional Gulf Cooperation Council (GCC) states that the tendency of Islamic banking to have a higher default rate than conventional commercial banks because the bank size is smaller so that the mitigation tools are limited. Regulators in Islamic banking must develop sharia-compliant risk mitigation tools to improve risk management practices in sharia banking. Furthermore, the non-performing finance variable (NPF) is the amount of problem financing handled by Islamic banks, and this shows the risks associated with credit exposure. Banks with high levels of non-performing financing are often considered inefficient, which shows that the amount of NPF is inversely proportional to the degree of efficiency of the bank. The findings corroborate the research (Muljawan et al., 2014; Pantas, 2021; Setiawan et al., 2017). The NPF variable has no significant effect on the efficiency score. Islamic banking is tightening the provision of financing due to the COVID-19 pandemic, thereby increasing efficiency slightly, although not significantly. Research conducted by (Abidin et al., 2021; Hafsal et al., 2020) revealed that a bank could have good efficiency with a high risk of bad credit, provided that banks can increase their efficiency by managing the level of non-performing assets (NPA), because a high NPF will lead to a high NPA so that banks have to bear the costs due to efficiency losses and incur more costs.

The findings in this study showed that the CAR variable has a significant effect on the efficiency score. This finding was confirmed by Khalifaturafi'ah (2018) states that cost efficiency and CAR have a significant influence with the dependent variable total assets. This means that CAR is a vital ratio affecting total assets and efficiency. The higher the CAR, the more efficient it will be because banks must maintain their capital adequacy level (Saif-Alyousfi & Saha, 2021), efficiency impact due to the lowest positive significance of CAR compared to other variables. This study has two testing models: the Covid-19 non-control model and the Covid-19 control model. The reason for testing these two models is that in the first quarter of 2020, there was a COVID-19 pandemic

(WHO, 2020). Until the fourth quarter of 2020 there were 743,198 total cases due to Covid-19 in Indonesia, and reaching 8,000 new cases at the end of 2020, Covid-19 also caused a contracting export contribution of -7.21% (yoy) and third party funds (DPK) of conventional commercial banks (BUK) in terms of foreign currency credit contracted by -3.71% (yoy) where the depreciation of the exchange rate caused this, and productive credit at BUK also contracted -3.25% (yoy), which was much lower compared to the previous year which grew by 6.07% (yoy). Meanwhile, from the perspective of Islamic commercial banks (BUS), there was a slowdown in Islamic bank DPK which grew by 11.86% (yoy), slightly slowing compared to the previous year which grew 12.03% (yoy) (OJK, 2020).

The findings on the Pseudo R-Squared value test increase by 0.520232 or 52%, meaning that the model formed can explain the effect of 52% simultaneously. This shows that the influence on the Covid-19 control model is higher and is able to explain the factors that affect efficiency scores in Islamic banking in Indonesia compared to the Covid-19 non-control model. Findings on Min et al. (2021) the use of the covid-19 control variable in terms of tracking, from a practical point of view these findings provide an overview related to the institutional practices of an entity in dealing with the COVID-19 outbreak and in terms of the dimensions of risk that occur in the entity.

4. CONCLUSION

The conclusion of this study shows that overall the variable total assets, ROA^{-1} , bank size, and capital adequacy ratio have a significant effect on the efficiency score, except non-performing finance variables do not have a significant effect on the efficiency score. This study is a research development from Boulanouar et al. (2021) conducted by comparison between Islamic banking and conventional commercial banks in the regional Gulf Cooperation Council (GCC) states that the tendency of Islamic banking to have a higher default rate than conventional commercial banks because the bank size is smaller so that the mitigation tools are more limited. Regulators in Islamic banking must develop sharia-compliant risk mitigation tools to improve risk management practices in sharia banking. This study also strengthens the research Mursyid et al. (2021), which stated that Islamic Commercial Banking in Indonesia showed positive growth based on its

financial performance. Return on assets (ROA) has a significant positive effect on efficiency scores. Thus, banks that can generate high levels of profit or profitability with each input variable can be considered efficient. Some researchers like (Chaluvadi et al., 2018; Firdaus & Hosen, 2014) link the effect of return on assets (ROA) to efficiency scores because, during the development of banking technology, they can use digital-based services so that they can maximize profits and cut operational costs, this is the basis for making studies on efficiency seen from profitability.

This research is a reference for model development in that the Covid-19 control variable produces a higher level of empirical model influence compared to models with non-control Covid-19. For stakeholders in Islamic banking management, it is necessary to pay attention to the level of efficiency of Islamic banking in Indonesia by influencing related factors so that this model can answer challenges and increase performance in terms of efficiency in Islamic banking in Indonesia in the future. Practitioners and researchers can develop further related models which are not accommodated in this study so that they can enrich efficiency studies on Islamic banking in Indonesia, then they can also consider adding the Covid-19 control variable in the model so that it better responds to the challenges of Islamic banking in the future and its performance in through the Covid-19 pandemic.

Suggestions for further research, this study examines the determinants of pre-merger efficiency of Islamic banking in Indonesia from the operational aspect. It is hoped that in future research, there will be limited updating of Covid-19 control data so that many data has not been fulfilled for testing, such as data on the first vaccine, data tracking the Covid-19 test, and data on the mortality rate. In order to provide more thorough answers within the context of the covid-19 control model.

5. REFERENCE

- Abbas, Q., Hunjra, A. I., Saeed, R., Hassan, E. U., & Ijaz, M. S. (2014). Analysis of Pre and Post Merger and Acquisition Financial Performance of Banks in Pakistan. *Information Management and Business Review*, 6(4), 177–190. <https://doi.org/10.22610/imbr.v6i4.1113>
- Abidin, Z., Prabantarikso, R. M., Wardhani, R. A., & Endri, E. (2021). Analysis of Bank Efficiency Between Conventional Banks and Regional Development Banks in Indonesia. *Journal of Asian Finance, Economics and Business*, 8(1), 741–750. <https://doi.org/10.13106/jafeb.2021.vol8.no1.741>
- Ahn, H., & Le, M. H. (2014). An insight into the specification of the input-output set for DEA-based bank efficiency measurement. In *Journal fur Betriebswirtschaft* (Vol. 64, Issue 1). <https://doi.org/10.1007/s11301-013-0098-9>
- Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. *Management Science*, 30(9), 1078–1092. <https://doi.org/10.1287/mnsc.30.9.1078>
- Bellini, T. (2019). Prepayments, Competing Risks and EAD Modelling. In *IFRS 9 and CECL Credit Risk Modelling and Validation*. Elsevier. <https://doi.org/10.1016/b978-0-12-814940-9.00013-x>
- Bod'a, M., & Zimková, E. (2021). A DEA model for measuring financial intermediation. In *Economic Change and Restructuring* (Vol. 54, Issue 2). Springer US. <https://doi.org/10.1007/s10644-020-09281-w>
- Boulanouar, Z., Alqahtani, F., & Hamdi, B. (2021). Bank ownership, institutional quality and financial stability: evidence from the GCC region. *Pacific Basin Finance Journal*, 66(December 2020), 101510. <https://doi.org/10.1016/j.pacfin.2021.101510>
- Chaluvadi, S., Raut, R., & Gardas, B. B. (2018). Measuring the performance efficiency of banks in a developing economy: The case study of Indian public sector vs private sector. *Benchmarking*, 25(2), 575–606. <https://doi.org/10.1108/BIJ-10-2016-0157>
- Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research*, 2(6), 429–444. [https://doi.org/10.1016/0377-2217\(78\)90138-8](https://doi.org/10.1016/0377-2217(78)90138-8)
- Coelli, T. J., Rao, D.S.P., & Battese, G. E. (2005). *An Introduction to Efficiency Analysis*. <http://dl.icdst.org/pdfs/files/3a67240be4e2274e4c95655ec16931de.pdf>
- Coelli, T., Rao, D. S. P., & Battese, G. E. (1998). An Introduction to Efficiency and Productivity Analysis. In *An Introduction to Efficiency and Productivity Analysis*. Springer US. https://doi.org/10.1007/978-1-4615-5493-6_2

- Durmuş, V. (2021). Is the country-level income an important factor to consider for COVID-19 control? An analysis of selected 100 countries. *International Journal of Health Governance*, 26(2), 100–113. <https://doi.org/10.1108/IJHG-10-2020-0121>
- Dutta, P., Jain, A., & Gupta, A. (2020). Performance analysis of non-banking finance companies using two-stage data envelopment analysis. *Annals of Operations Research*, 295(1), 91–116. <https://doi.org/10.1007/s10479-020-03705-6>
- Firdaus, M. faza, & Hosen, M. N. (2014). Efisiensi Bank Umum Syariah Menggunakan Pendekatan Two-Stage Data Envelopment Analysis. *Buletin Ekonomi Moneter Dan Perbankan*, 16(2), 167–188. <https://doi.org/10.21098/bemp.v16i2.31>
- Gujarati and Porter. (2009). *Dasar-Dasar Ekonometrika*. Salemba Empat.
- Gujarati, D. N. (2004). *Basic Econometrics*. Tata McGraw-Hill Education.
- Hafsal, K., Suvvari, A., & Durai, S. R. S. (2020). Efficiency of Indian banks with non-performing assets: evidence from two-stage network DEA. *Future Business Journal*, 6(1). <https://doi.org/10.1186/s43093-020-00030-z>
- He, H., Tang, W., Kelly, T., Li, S., & He, J. (2020). Statistical tests for latent class in censored data due to detection limit. *Statistical Methods in Medical Research*, 29(8), 2179–2197. <https://doi.org/10.1177/0962280219885985>
- Henriques, I. C., Sobreiro, V. A., Kimura, H., & Mariano, E. B. (2020). Two-stage DEA in banks: Terminological controversies and future directions. *Expert Systems with Applications*, 161, 113632. <https://doi.org/10.1016/j.eswa.2020.113632>
- Himmawan, M. F., & Firdausi, N. A. (2021). Projection of Indonesian Islamic commercial banks efficiency and stability in the Covid-19 period using DEA and panel ARDL. *Jurnal Ekonomi & Keuangan Islam*, 7(1), 17–30. <https://doi.org/10.20885/jeki.vol7.iss1.art2>
- ICD. (2020). *Islamic Finance Development Report 2020: Progressing Through Development*. 1–54.
- Jeryana, I. P., Kencana, I. P. E. N., & Gandhadi, G. K. (2014). MODEL REGRESI TOBIT KONSUMSI SUSU CAIR PABRIK (Studi Kasus Rumah Tangga di Provinsi Bali). *E-Jurnal Matematika*, 3(2), 75. <https://doi.org/10.24843/mtk.2014.v03.i02.p068>
- Khalifaturafi'ah, S. O. (2018). Cost Efficiency, Total Assets, and Profitability: Evidence from Islamic Bank. *Jurnal Keuangan Dan Perbankan*, 22(4), 769–778. <https://doi.org/10.26905/jkdp.v22i4.2218>
- Komite Nasional Keuangan Syariah. (2018). Masterplan Ekonomi Syariah Indonesia 2019–2024. In *Kementerian Perencanaan Pembangunan Nasional/ Badan Perencanaan Pembangunan Nasional*. https://knks.go.id/storage/upload/1573459280-MasterplanEksyar_Preview.pdf
- Min, H., Lee, C. C., & Joo, S. J. (2021). Assessing the efficiency of the Covid-19 control measures and public health policy in OECD countries from cultural perspectives. *Benchmarking*, 80. <https://doi.org/10.1108/BIJ-05-2021-0241>
- Muljawan, D., Hafidz, J., Astuti, R. I., & Oktapiani, R. (2014). Faktor-Faktor Penentu Efisiensi Perbankan Indonesia serta Dampaknya terhadap Perhitungan Suku Bunga Kredit. *Working Paper Bank Indonesia*, WP/2/2014, 1–77.
- Mursyid, M., Kusuma, H., Tohirin, A., & Sriyana, J. (2021). Performance Analysis of Islamic Banks in Indonesia: The Maqashid Syariah Approach. *Journal of Asian Finance, Economics and Business*, 8(3), 307–318. <https://doi.org/10.13106/jafeb.2021.vol8.no3.0307>
- OJK. (2020). *Laporan Profil Industri Perbankan Triwulan IV 2020*.
- OJK. (2021a). *Roadmap Pengembangan Perbankan Syariah*.
- OJK. (2021b). *Statistik Perbankan Syariah*.
- Pantas, P. (2021). Islamic Banking Efficiency in Indonesia and Malaysia: Two Stages Data Envelopment Window Analysis Cointegration of Stock Market and Exchange Rate in Indonesia View project. *Al-Uqud: Journal of Islamic Economics*, 5(2), 234–249. <https://doi.org/10.26740/al-uqud.v5n2.p234-249>
- Prahutama, A., Rusgiyono, A., Sudarno, Mukid, M. A., & Widiharih, T. (2019). Analysis of Household Expenditures on Education in Semarang City, Indonesia Using Tobit Regression Model. *E3S Web of Conferences*, 125(2019), 7–10. <https://doi.org/10.1051/e3sconf/201912509016>
- Prima Sakti, M. R., & Mohamad, A. (2018). Efficiency, stability and asset quality of Islamic vis-à-vis conventional banks: Evidence from Indonesia. *Journal of Islamic Accounting and Business Research*, 9(3), 378–400. <https://doi.org/10.1108/JIABR-07-2015-0031>
- Saif-Alyousfi, A. Y. H., & Saha, A. (2021). Determinants of banks' risk-taking behavior, stability and profitability: evidence from GCC countries. In *International Journal of Islamic and Middle Eastern Finance and Management: Vol. ahead-of-p* (Issue ahead-of-print). <https://doi.org/10.1108/imefm-03-2019-0129>

- Setiawan, C., Hasan, T., Hassan, K., & Mohamad, S. (2017). Non-performing loans and bank efficiency of conventional and Islamic banks in the Organization of Islamic Cooperation (OIC) countries. *Journal of Islamic Economics, Banking and Finance*, 13(4), 19–44. <https://doi.org/10.12816/0051000>
- Sinha, P., & Gupta, S. (2011). Mergers and Acquisitions: A pre-post analysis for the Indian financial services sector. *Munich Personal RePEc Archive*, 74203, 37.
- State of the Global Islamic Economy Report. (2020). State of the Global Islamic Economy Report 2019/20. In *Dubai International Financial Centre*. <https://cdn.salaamgateway.com/special-coverage/sgie19-20/full-report.pdf>
- Sufian, F., & Abd. Majid, M.-Z. (2007). Bank Mergers Performance and the Determinants of Singaporean Banks' Efficiency: An Application of Two-Stage Banking Models. *Gadjah Mada International Journal of Business*, 9(1), 19. <https://doi.org/10.22146/gamaijb.5602>
- Veall, M. R., & Zimmermann, K. F. (1996). Pseudo-R² measures for some common limited dependent variable models. *Journal of Economic Surveys*, 10(3), 241–259. <https://doi.org/10.1111/j.1467-6419.1996.tb00013.x>
- Wasiaturrahma, Sukmana, R., Ajija, S. R., Salama, S. C. U., & Hudaifah, A. (2020). Financial performance of rural banks in Indonesia: A two-stage DEA approach. *Heliyon*, 6(7), e04390. <https://doi.org/10.1016/j.heliyon.2020.e04390>
- Xu, G., & Zhou, Z. (2021). Assessing the efficiency of financial supply chain for Chinese commercial banks: a two-stage AR-DEA model. *Industrial Management and Data Systems*, 121(4), 894–920. <https://doi.org/10.1108/IMDS-01-2020-0022>
- Yu, W., & Ramanathan, R. (2008). An assessment of operational efficiencies in the UK retail sector. *International Journal of Retail & Distribution Management*, 36(11), 861–882. <https://doi.org/10.1108/09590550810911656>