Measuring the Efficiency Performance of Rural Banks in East Java during Covid-19: A Novel Approach using SuperDEA

Aisyah As-Salafiyah[1]
[1]Sharia Economic Applied Research and Training (SMART) Indonesia

This research aims to analyze the efficiency level, source of efficiency, the potential for improvement needed, and comparison of the efficiency of BPR (Rural Bank) and BPRS (Islamic Rural Bank) in East Java. This research also looks at the efficiency of BPR and BPRS during the Covid-19 pandemic. The research period used in this study is from 2016-2021, with a research sample of 8 BPR and 6 BPRS in East Java. The analytical method used is a non-parametric approach, namely Data Envelopment Analysis (DEA), with secondary data sources originating from BPR and BPRS financial reports on the official OJK website. The study results show that the efficiency of BPR and BPRS during 2016-2021 has fluctuated yearly. BPR has higher efficiency than BPRS. Then in the efficiency analysis during the pandemic, the efficiency of BPR is relatively stable, even though there has been a decline in 2021. Meanwhile, BPRS showed a significant decline in 2021. Furthermore, based on the potential improvement analysis, the most significant cause of BPR inefficiency comes from input variables, namely fixed assets, and at BPRS is the financing provided. This research also provides recommendations to banks, regulators, and academics.

Keywords: Rural Bank; BPR; BPRS; Efficiency; Covid-19; East Java

OPEN ACCESS

*Correspondence:
Aisyah As-Salafiyah
assalafiyahsmart@gmail.com

Received: 20 May 2023
Accepted: 28 May 2023
Published: 11 June 2023

Citation:
(2023) Measuring the Efficiency Performance of Rural Banks in East Java during Covid-19: A Novel Approach using SuperDEA Accounting and Sustainability 2.1.

INTRODUCTION

The banking industry is the leading institution that acts as an intermediary institution and funding source for developing countries, including Indonesia (Agustina et al., 2019). BPR (Rural Bank) and BPRS (Islamic Rural Bank) are part of the banking industry that has made a significant contribution to the economy (Hosen & Muhari, 2013). BPR and BPRS are also alternative financial providers for people who are not reached by the banking sector, bearing in mind that the specific objectives of the two microfinance institutions are to provide products and services for low-income people as well as micro, small, and medium enterprises (MSMEs) both in cities and in rural areas (Wasiaturrahma et al., 2020). This is because the financing schemes and services offered by Rural Banks are adapted to the conditions of the people who cannot be reached by the financing offered by Commercial Banks (Hasbi & Apriyana, 2021).

However, the Covid-19 pandemic in Indonesia has caused significant shocks in various sectors, including the economic and financial sectors, especially the banking sector, which was significantly affected (Nicola et al., 2020). As a result, the sustainability of the banking industry becomes unstable (Sholihah, 2021). The stability of the financial sector regulated by banks is crucial in ensuring good economic growth (Masrizal et al., 2022). In addition, as an intermediary institution for BPR in particular, they also experience obstacles in extending micro-credit to individuals and business entities due to the government's restrictive policy (Widiyaningtias & Dura, 2022). As a result, there was a decrease in demand for credit and financing and an increase in credit risk, so the BPR and BPRS industries became more selective in lending practices, and the perception of high credit risk led to a decrease in the amount of credit extended. According to economic report data from Bank Indonesia in 2022, East Java is the second most significant support for the national economy, with a share (14.46%).

Therefore, efficiency is a crucial aspect that needs to be carried out to assess how BPR and BPRS in East Java can operate efficiently and well and provide more significant benefits to the community. By conducting an efficiency assessment, the BPR and BPRS will clearly understand their performance to guide them in operational activities. Through efficiency measurements, it can also be seen how well the BPR and BPRS utilize all available resources to produce optimal output. For this reason, studies are needed to measure the efficiency of BPR and BPRS and determine the right strategy to fix efficiency problems (Khusnah et al., 2020). In addition, the urgency of measuring banking efficiency lies in banking competitiveness; through efficiency, bank management can benchmark bank performance and find the source of inefficiency for future improvements (Marsondang et al., 2019).

Research on the efficiency of BPR and BPRS in East Java is still limited. Among these studies are Widiyaningtyas & Wura (2022), analyzing the financial performance comparison of BPR and BPRS East Java before and during the Covid-19 pandemic; Miranti et al. (2022); Khusnas et al. (2022) and Khairunnisa & Laila (2018) discuss the efficiency level of BPRS in East Java; and Almas (2018) examined the comparison of the efficiency of conventional BPR and sharia BPRS in East Java using a non-parametric approach.

LITERATURE REVIEW

BPR first appeared in 1998 by the government with the release of the October 1998 Policy Package (PAKTO 1998) and Presidential Decree No. RI. 38. Rural Banks (BPR) are banks that carry out their business activities with conventional operational mechanisms or with Sharia principles. Conventional BPR and Sharia BPRS carry out similar functions, but the fundamental difference lies in the principles used. In line with other Islamic financial institutions, BPRS conducts its operations based on Islamic values that are free of interest (Wasiaturrahma et al., 2020). UU no. 7/1992 concerning Banking, amended by Law no. 10/1998, explains that BPR does not provide services in payment traffic and prohibits current account products, no foreign exchange, no insurance business, no equity participation, and no business activities. Conventional BPR and sharia BPRS are essential in the economy because they function as intermediaries between households and the economic or financial sector (Nashihin & Harahap, 2014) in the microdomain. Therefore, measuring efficiency is one of the efforts to see how far a BPR can efficiently carry out its intermediary function in the microdomain.

Efficiency is a financial concept that evaluates the extent to which inputs invested produce output (Belanes et al., 2015). Efficiency measurement was developed by Farrell (1957), who revealed that efficiency measurement consists of technical efficiency (TE) and allocative efficiency. The output-to-input ratio is referred to as TE Conversely, allocative efficiency refers to the ability of a business to maximize input according to its pricing system and production technology. Efficient businesses make producing more output per

input unit possible than competing businesses. Banks, like any business, must consistently improve their operational efficiency. Efficiency has been widely used as a measure of bank performance. There are various ways to increase efficiency, including increasing the concentration and profitability of microfinance institutions (Hartarska et al., 2013). In addition, increasing the number of loans will also increase efficiency (Bos & Millone, 2015). In addition, the efficiency of microfinance institutions is affected by the profit component or the amount of margin they use (Amran et al., 2014).

Several previous studies have examined the efficiency of banks, but few have examined the efficiency of microfinance institutions such as rural banks. So far, previous research that is relevant to the efficiency of BPR and BPRS, especially in East Java, among others, is by Widiyaningtyas & Wura (2022), analyzing the financial performance comparison of BPR and BPRS East Java before and during the Covid-19 pandemic.

Miranti et al. (2022) discussed the level of efficiency of BPRS in East Java. The results of this study conclude that BPRS in East Java is classified as inefficient. Khairunnisa & Laila (2018) also explain the efficiency level of BPRS in East Java. The analysis found that the average BPRS in East Java showed inefficient efficiency during the study period. Almas (2018) compared the efficiency of conventional BPR and sharia BPRS in East Java using a non-parametric approach. The analysis results using the Data Envelopment Analysis (DEA) method show that out of 5 samples of efficient BPR, there are two BPR, while out of 5 samples of BPRS, there is no efficient BPRS. Khusnas et al. (2020) analyzed the efficiency of BPRS in East Java during the 2012-2018 period using DEA. The study results explain that there are still BPRS in East Java that are not efficient.

Other relevant research is Hasbi and Apriyana (2021) analyzing the efficiency level of BPR and BPRS in West Java during the Covid-19 pandemic. Yasin and Fisabilillah (2021) conducted a comparative analysis of BPR financial performance before and during the Covid-19 pandemic. Agustina et al. (2019) analyzed the efficiency level of BPRS in Indonesia during the 2011-2016 period. Based on Data Envelopment Analysis, Hadini and Wibowo (2021) analyze the comparative efficiency of conventional and Islamic banks in Indonesia. Sholihah (2021) analyzes the financial performance efficiency in banking during a pandemic. Jatmiko (2017) discusses the efficiency of BPR and BPRS using the Stochastic Frontier Analysis (SFA) method, which measures ownership structure variables on the efficiency of BPR and BPRS in Indonesia.

This research has the novelty of more recent data and comparisons between BPR and BPRS with a more significant number of samples. It combines efficiency calculations before the Covid-19 pandemic and during the Covid-19 pandemic. Therefore, it is hoped that this research can provide new, up-to-date, and more comprehensive knowledge about the level of efficiency of BPR and BPRS in East Java.

METHOD

This quantitative research uses a non-parametric approach, using the Data Envelopment Analysis (DEA) method to measure the efficiency of BPR and BPRS in East Java. The sample in this study consisted of 14 BPR and BPRS in East Java, which published financial reports for 2016-2021. Data obtained from the official OJK website is used as a data source in research.

Furthermore, this study uses an output-oriented approach in comparing the analysis results of the efficiency of BPR and BPRS in East Java. The inputs used in the DEA method are operational costs, third-party funds, and fixed assets, while the output variables used are financing provided and operating income. The DEA method is used in this study to evaluate the relative efficiency and managerial performance of a production unit or DMU.

Two DEA models are often used: the Charnes, Cooper, and Rhodes (CCR) model and the Banker, Charnes, and Cooper (BCC) model. The main difference is in the return-to-scale approach used. The CRS model uses the CCR approach, which means that when there is an addition of 1 input variable, the output will increase by 1. Meanwhile, the VRS approach in the BCC model produces Pure Technical Efficiency (PTE). The VRS approach assumes that when there is an additional input, the resulting additional output will not have the same ratio.

Efficiency in DEA is measured on a scale of 0 to 1 or 100%. A value of 100% indicates that the efficiency achieved has been maximized, while the smaller the efficiency value, the more inefficient the BPR and BPRS are. The VRS approach to the BCC model is more suitable for use in conditions of competition and financial constraints that can lead to inefficiencies in companies to provide more accurate results in measuring the efficiency of BPR and BPRS in East Java.

Data Envelopment Analysis is the most popular non-parametric method for measuring efficiency. In

addition, the DEA method is appropriate for measuring efficiency with insufficient data. Similar to this study, there are several philanthropic organizations for which input and output variable data are unavailable for a given year. The disadvantage of the DEA model is that it is difficult to determine the optimal ranking of DMUs when multiple DMU units are equal to 1. Then, Anderson and Petersen (1993) presented the notion of super efficiency. The fundamental concept of super-efficiency is permitting the observed DMU efficiency to exceed 1 or 100 percent. Super efficiency measures the power of efficient units used to rank DMUs that are the subject of observation. To verify the robustness of the test, we employed the super-efficiency DEA method, which was initially developed by Andersen and Petersen (1993) and denoted as follows:

$max\varphi_k$ - $\varepsilon[\sum_{i=1}^{m} S_i^- + \sum_{r=1}^{s} S_r^+]$ …….. (1)

Subject to: $x_{ik} \sum_{\substack{j=1 \\ j\neq k}}^{n} \lambda_j x_{ij} - S_i^- = 0$

$$\sum_{\substack{j=1 \\ j\neq k}}^{n} \lambda_j x_{ij} - S_r^+ = \varphi_k y_{rk}$$

$$\sum_{\substack{j=1 \\ j\neq k}}^{n} \lambda_j = 1$$

$$\lambda_j, S_{i,}^- S_r^+ \geq 0, j\neq k$$

i = 1, 2..., m, j = 1, 2..., n, r = 1,2,...,s
k = DMU under study

RESULT AND DISCUSSION

Descriptive Statistics of BPR and BPRS in East Java

Table 1 represents the input and output variables and input and output descriptive statistics for Rural Banks (BPR) and Sharia Rural Banks (BPRS) in East Java used in this study during the 2016-2021 period.

Table 1: Descriptive Statistics of BPR in East Java

Variable	Mean	Min	Max	Std.Dev
Inputs				
Fixed assets	Rp1.771.527,24	Rp10.687,00	Rp7.982.099,00	Rp1.998.266,86
Operating Expenses	Rp10.367.411,19	Rp699.348,00	Rp34.103.787,00	Rp8.448.528,34
Third-party funds	Rp65.540.237,57	Rp3.338.240,00	Rp324.146.687,00	Rp66.243.967,61
output				
Amount of Financing Provided	Rp56.891.642,20	Rp12.448,00	Rp178.707.085,00	Rp52.541.619,81
Operating Income	Rp14.589.124,46	Rp272.589,00	Rp44.044.004,00	Rp12.132.123,65

Summary of BPR and BPRS Efficiency Panel per Year

With the DEA method, the efficiency of BPR and BPRS in Indonesia has been checked annually and investigated using a common frontier. The table below shows the average Technical Efficiency (TE), Pure Technical Efficiency (PTE), and Scale Efficiency (SE) of BPR and BPRS from 2016 (Panel A), 2017 (Panel B), 2018 (Panel C), 2019 (Panel D), 2020 (Panel E), 2021 (Panel F) and the entire year (Panel G).

Table 2: Statistical Summary of Efficiency Score (TE, PTE, and SE) of BPR and BPRS in East Java per year

Years/Type of Efficiency	Mean		Min		Max		Std.Dev	
	BPR	BPRS	BPR	BPRS	BPR	BPRS	BPR	BPRS
Panel A (2016)								
TE	0,766	0,795	0,513	0,567	1,000	1,000	0,144	0,135
PTE	0,878	0,840	0,643	0,572	1,000	1,000	0,118	0,135
SE	0,884	0,948	0,513	0,826	1,000	1,000	0,164	0,062
Panel B (2017)								
TE	0,844	0,800	0,653	0,502	1,000	1,000	0,116	0,184
PTE	0,911	0,866	0,734	0,525	1,000	1,000	0,089	0,175
SE	0,930	0,928	0,653	0,691	1,000	1,000	0,112	0,109
Panel C (2018)								
TE	0,848	0,783	0,736	0,489	1,000	0,993	0,091	0,189
PTE	0,898	0,810	0,775	0,516	1,000	1,000	0,078	0,171
SE	0,944	0,961	0,833	0,854	1,000	0,998	0,054	0,051
Panel D (2019)								
TE	0,809	0,867	0,637	0,607	0,946	1,000	0,114	0,147
PTE	0,905	0,896	0,686	0,620	1,000	1,000	0,097	0,140
SE	0,894	0,968	0,761	0,842	0,983	1,000	0,073	0,057
Panel E (2020)								
TE	0,869	0,814	0,721	0,511	1,000	1,000	0,113	0,156
PTE	0,963	0,887	0,865	0,534	1,000	1,000	0,056	0,175
SE	0,902	0,923	0,747	0,804	1,000	1,000	0,096	0,069
Panel F (2021)								
TE	0,832	0,726	0,702	0,198	1,000	1,000	0,116	0,257
PTE	0,938	0,756	0,841	0,199	1,000	1,000	0,064	0,272
SE	0,889	0,966	0,702	0,904	1,000	1,000	0,111	0,043
Panel G (All Years)								
TE	0,828	0,828	0,513	0,513	1,000	1,000	0,121	0,121
PTE	0,915	0,915	0,643	0,643	1,000	1,000	0,091	0,091
SE	0,907	0,907	0,513	0,513	1,000	1,000	0,109	0,109

From the table above, it can be seen that the lowest average Technical Efficiency (TE) score for BPR was in 2016 (0.766) and for BPRS in 2021 (0.726). Then for the highest TE average score in BPR in 2020 (0.869) and BPRS in 2019 (0.867). Then, on the Pure Technical Efficiency (PTE) average, it is known that the highest BPR PTE was in 2020 (0.963), and the lowest was in 2016 (0.878). As for BPRS, the highest PTE is in 2019 (0.896), and the lowest is in 2021 (0.756). Furthermore, the lowest Scale Efficiency (SE) for BPR was in 2016 (0.884), and BPRS was in 2017 (0.928). For the highest score, BPR in 2019 (0.944) and BPRS in 2021 (0.966). Based on this, it can be concluded that the efficiency level of BPR and BPRS in Indonesia tends to fluctuate from year to year, and no BPR or BPRS has yet achieved maximum efficiency.

BPR and BPRS Efficiency Scores in East Java

Table 3: Average BPR and BPRS Efficiency Scores in East Jawa

DMU	CRS	VRS	SE
BPR Artha Mlatiindah Sleman	0,812	0,873	0,930
BPR Bank Daerah Kabupaten Madiun	0,741	0,911	0,817
BPR Bank Tulungagung (Perseroda)	0,810	0,966	0,837
BPR Dana Raya Jawa Timur Sidoarjo	0,858	0,948	0,906
BPR Guna Yatra	0,836	0,976	0,857
BPR Harta Swadiri Pasuruan	0,836	0,876	0,954
BPR Mitra Jaya Mandiri Jember	0,897	0,922	0,975
BPR Nusumma Jombang Jatim	0,836	0,852	0,980
Average	**0,828**	**0,915**	**0,907**
BPRS Al Mabrur Babadan Ponorogo	0,547	0,579	0,953
BPRS Baktimakmur Indah Sidoarjo	0,999	1,000	0,999
BPRS Karya Mugi Sentosa Surabaya	0,692	0,733	0,954
BPRS Lantabur Tebuireng	0,854	0,874	0,976
BPRS Mitra Harmoni Kota Malang	0,934	0,952	0,981
BPRS Tanmiya Artha Kota Kediri	0,758	0,915	0,829
Average	**0,797**	**0,842**	**0,949**

From Table 3, it can be seen that based on the CRS and VRS assumptions, there are no BPR in East Java that have achieved optimal efficiency (1,000). However, when viewed from the highest score, BPR Mira Jaya Mandiri Jember is the BPR with the highest score (0.897) based on the CRS assumption. Meanwhile, based on the VRS assumption, BPR Guna Yatra has the highest score (0.976). Then, based on the CRS assumption, BPRS has not yet achieved optimal efficiency (1,000). Based on the VRS assumption, it is known that the Baktimakmur Indah Sidoarjo BPRS is the only BPRS that achieves optimal efficiency (1,000). When viewed from the highest and lowest scores, BPRS Baktimakmur Indah Sidoarjo with a value of (0.999) on the CRS assumption and BPRS Al Mabrur Babadan Ponorogo with a value of (0.547) on the CRS assumption and with a value of (0.579) on the VRS assumption is BPRS with the highest and lowest scores. Furthermore, if we look at the average BPR and BPRS, it can be concluded that based on both the CRS and VRS assumptions, BPR has a higher efficiency level than BPRS. Where on the assumption of CRS and VRS, BPR has an average efficiency of (0.828) and (0.915). Meanwhile, BPRS has an efficient average of (0.797) and (0.842).

Comparison of BPR and BPRS Efficiency Trends in East Java

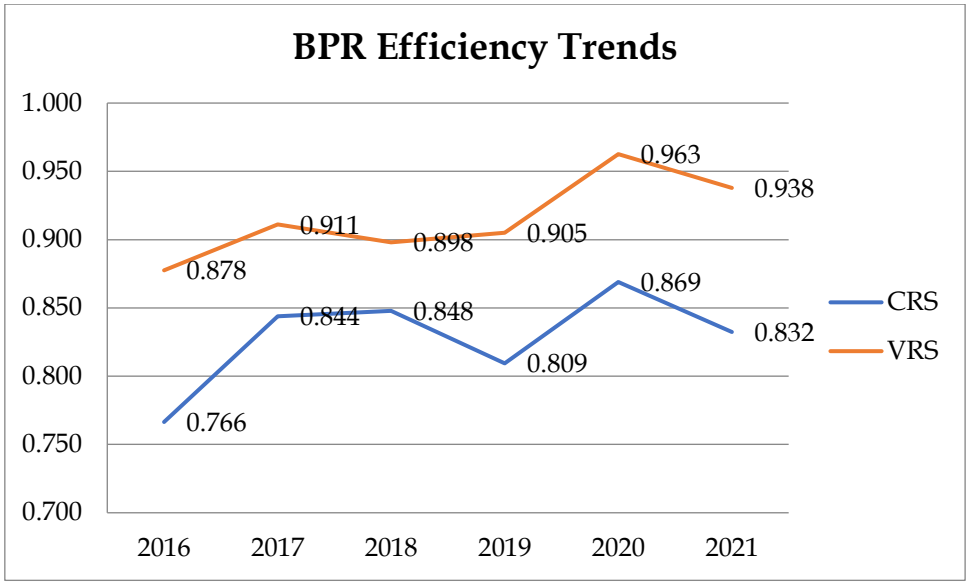

Figure 1: BPR Efficiency Trends in East Java

Figure 1 represents the trend of BPR efficiency in East Java during the 2016-2021 observation period. It can be concluded that the efficiency of BPR in East Java has fluctuated from year to year. In 2017 the efficiency of BPR in East Java based on the CRS and VRS assumptions showed a significant increase in efficiency. In the following period, on the CRS assumption, the efficiency level tends to increase steadily, but there is a significant decrease in 2019. Meanwhile, on the VRS assumption 2018, the efficiency level will decrease and increase again in 2019. Until 2020, the CRS assumption is reasonable, and VRS, the efficiency level again increased significantly and was the highest efficiency during the observation period. At the end of the observation period, namely 2021, the efficiency level of BPR, both seen from the CRS and VRS assumptions, show a decline. From the figure, there are exciting findings, namely, an almost similar pattern between the CRS and VRS assumptions.

Then, the trend of BPRS efficiency in East Java based on the CRS and VRS assumptions can be seen in the figure below.

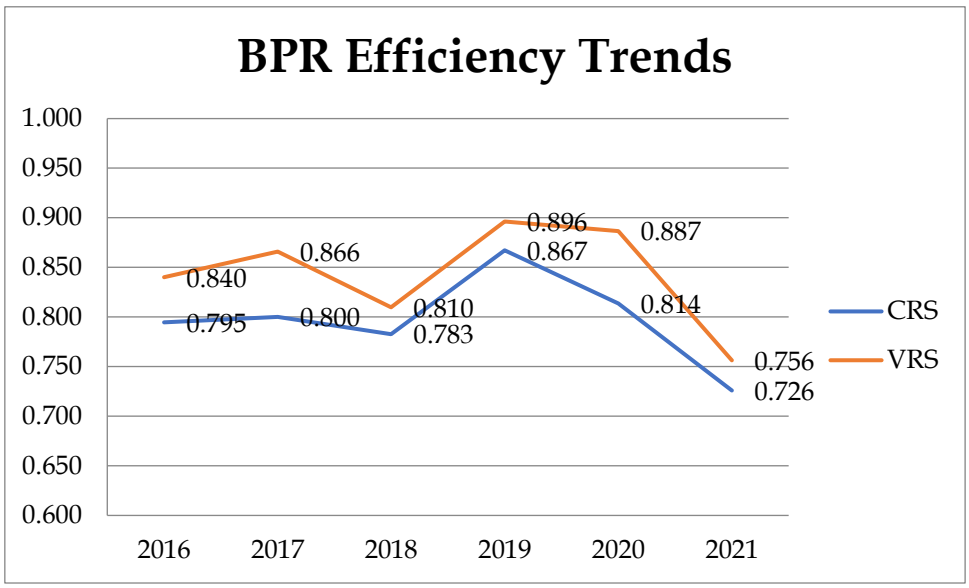

Figure 2: BPR Efficiency Trends in East Java

Figure 2 explains the trend of BPRS efficiency in East Java during the 2016-2021 observation period. It is known that the efficiency of BPRS in East Java has fluctuated from year to year. In 2017 the efficiency of BPRS in East Java based on the CRS and VRS assumptions both showed an increase, which then experienced a decrease in efficiency in 2018. The efficiency of BPRS increased significantly again in 2019 until it continued to decline sustainably from 2020 to 2021. As is well known, at the end of 2019, the Covid-19 pandemic began to spread massively in Indonesia. The figure has exciting findings: a similar pattern exists between the CRS and VRS assumptions.

Next is a comparative analysis of the efficiency of BPR and BPRS in East Java. This comparison uses the VRS efficiency score for six research periods. The results are as follows:

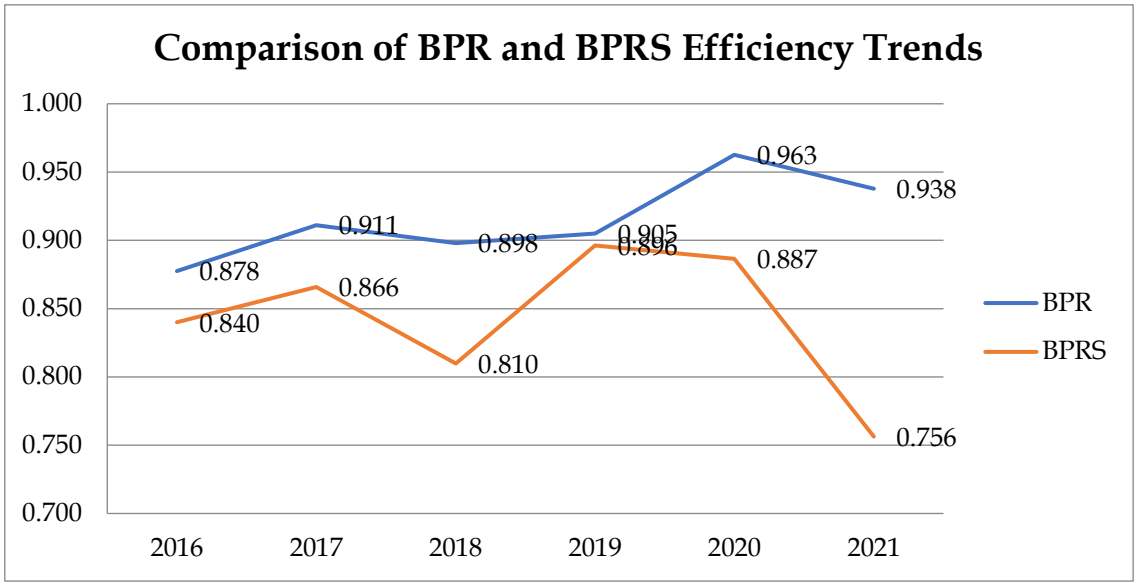

Figure 3: Comparison of BPR and BPRS Efficiency Trends in East Java

Based on Figure 3, it is known that the efficiency level of BPR in East Java is higher when compared to the efficiency level of BPRS. In 2018, the efficiency of BPRS in East Java decreased significantly, while in the same period, the efficiency of BPR in East Java can still be stable until it increases significantly in the 2020 period. Furthermore, significant efficiency increases in BPRS occurred in 2019 and continue to decline continuously to the lowest efficiency level throughout the research period 2021. Similar to BPRS, BPR in East Java also declined in 2021. However, the decrease is not significant.

Comparison of BPR and BPRS Efficiency Levels in East Java During the Covid-19 Pandemic

The emergence of the Covid-19 pandemic at the end of 2019 and starting to spread massively in 2020 in Indonesia also impacted the national economy, including the banking industry. The figure below explains the effect of Covid-19 on BPR and BPRS in East Java using the CRS and VRS assumptions and comparing the two types of banks.

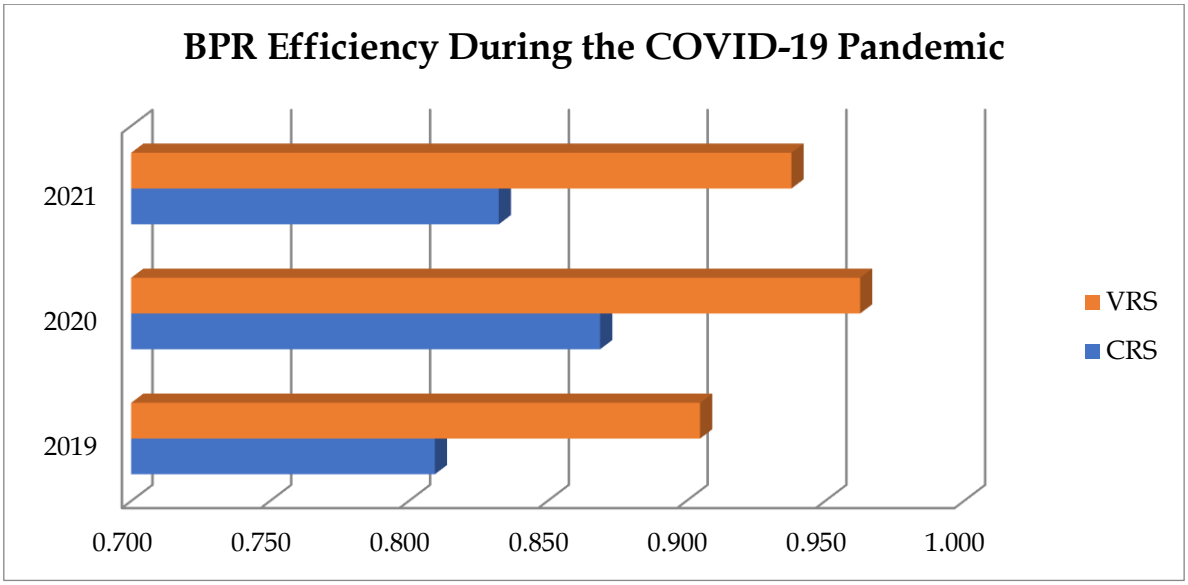

Figure 4: BPR Efficiency in East Java During the Covid-19 Pandemic

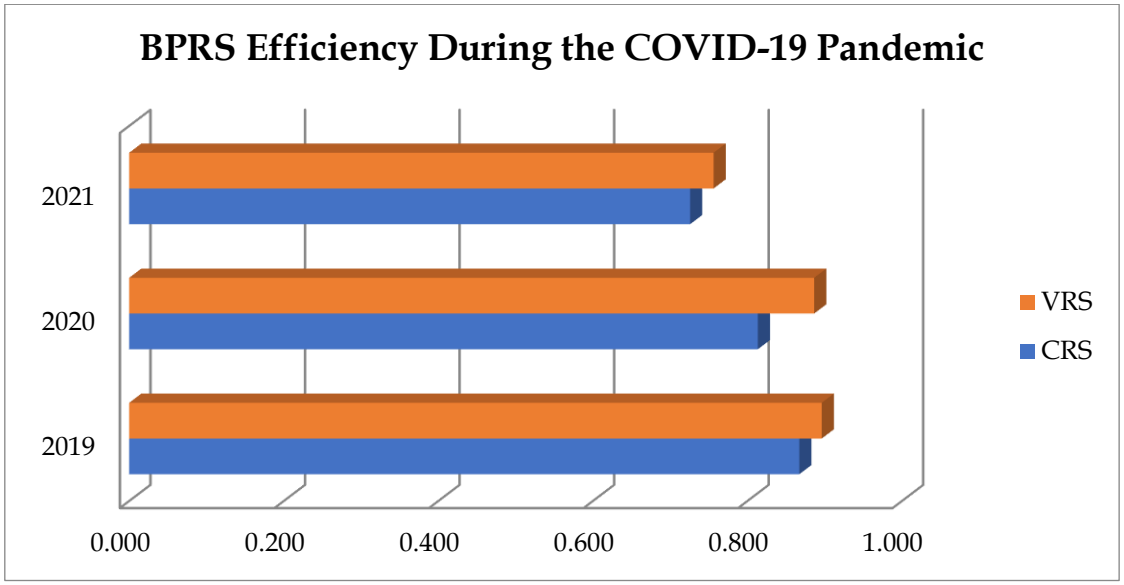

Figure 5: BPRS Efficiency in East Java During the Covid-19 Pandemic

Figures 4 and 5 above show the CRS and VRS analysis on the efficiency of BPR and BPRS in East Java during the pandemic. Figure 4 shows that the efficiency level of BPR has increased from 2019 to 2020 and will decrease in 2021, based on both CRS and VRS analysis. It can be said that the decline that occurred in BPR at the end of the study period was relatively small compared to the efficiency level in the 2019 period. Meanwhile, in Figure 5, it can be seen that the efficiency level of BPRS has decreased continuously, and 2021 will be the year with the lowest efficiency level in BPRS in East Java. This indicates the influence of the Covid-19 pandemic on the efficiency of BPRS in East Java. In contrast to BPR in East Java, which have experienced an increase in efficiency, even though in 2021, there is a decrease in efficiency.

Potential Improvement

The DEA method can produce potential improvements to obtain values that must be corrected to achieve optimal efficiency levels. Through this potential improvement, we will get any variables that must be improved to achieve optimal efficiency. Potential improvement analysis, using the last year of research, namely 2021, is then analyzed separately from previous years to get an overview of the values that must be achieved. Below are the results of potential improvement measurements.

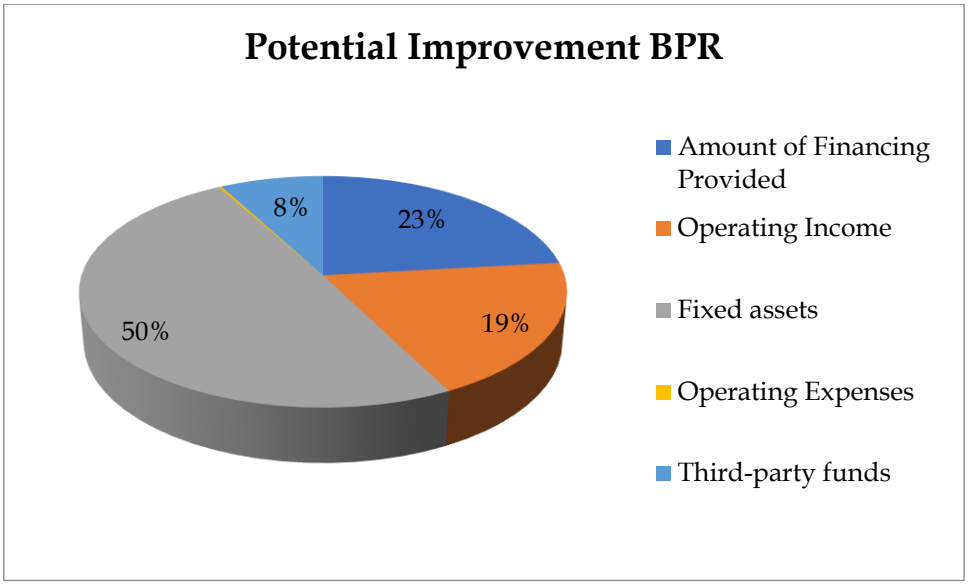

Figure 6: Potential Improvement of BPR in East Java

The figure shows that general information is related to input and output variables that cause inefficiency in BPR in East Java. The input variables that cause inefficiency are fixed assets and third-party funds. As for the output, the variables are the financing provided and operating income. In the potential improvement analysis from Figure 6, it is known that if the BPR wants to achieve an optimal efficiency level, then the output variables, namely financing provided and operating income, need to be increased by 23% and 19%. As for the input variables, fixed assets were reduced by 50%, and third-party funds were reduced by 8%. It can be concluded that the most significant cause of inefficiency in BPR in East Java comes from the input variable, namely Fixed Assets.

The following analysis is related to the potential improvement of BPRS in East Java, which is as follows.

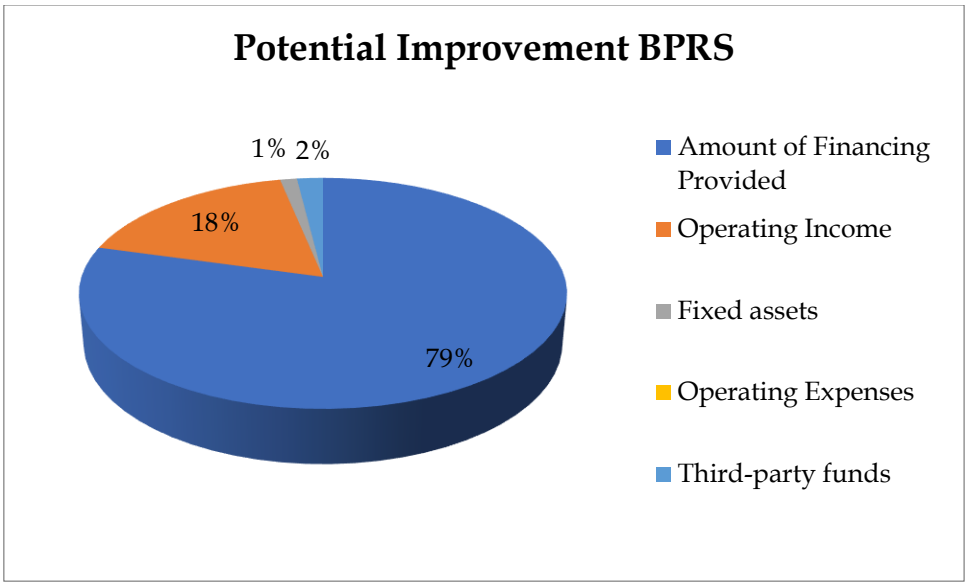

Figure 7: Potential Improvement of BPRS in East Java

Similar to BPR, in the potential improvement of BPRS in East Java, it is known that if BPRS wants to achieve optimal efficiency, the financing provided needs to be increased by 79%, and operating income increased by 18%. The input variables that cause inefficiency, namely fixed assets and third-party funds, must be reduced by 1% and 2%. It can be concluded that the most significant cause of inefficiency in BPRS in East Java comes from the output variable, namely the amount of financing provided.

Benchmarking of BPR and BPRS in East Java

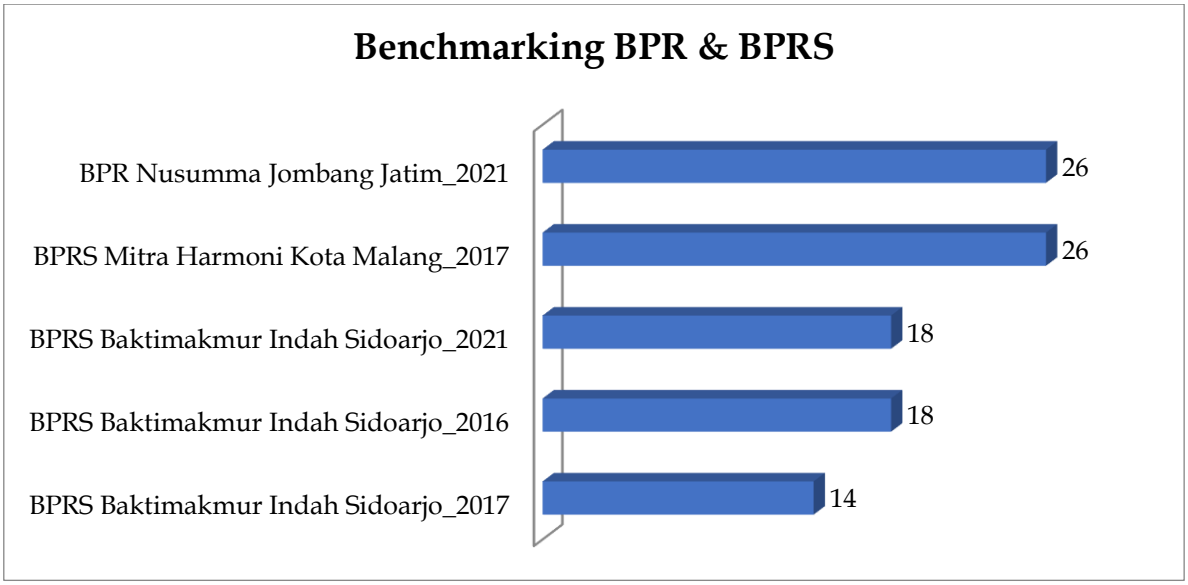

Figure 8: Benchmarking of BPR and BPRS in East Java

Figure 8 explains benchmarking, namely BPR or BPRS in East Java, a reference for other BPR and BPRS, especially for banks that have not yet reached an optimal efficiency level. Based on the frontier analysis, it was found that BPR Nusumma Jombang 2021 and BPRS Mitra Harmoni Malang City 2017 had 26 reference banks for each, both BPR and BPRS. Then, BPRS Baktimakmur Indah Sidoarjo in 2016, 2017, and 2021 with a total referral of 50 banks.

Table 4: CRS vs VRS vs Super-Efficiency Scores

DMU	CRS	VRS	SuperDEA
BPR Artha Mlatiindah Sleman	0,812	0,873	0.98
BPR Bank Daerah Kabupaten Madiun	0,741	0,911	0.853
BPR Bank Tulungagung (Perseroda)	0,810	0,966	0.877
BPR Dana Raya Jawa Timur Sidoarjo	0,858	0,948	0.936
BPR Guna Yatra	0,836	0,976	0.897
BPR Harta Swadiri Pasuruan	0,836	0,876	1.040
BPR Mitra Jaya Mandiri Jember	0,897	0,922	1.051
BPR Nusumma Jombang Jatim	0,836	0,852	1.140
Average	**0,828**	**0,915**	**0,971**
BPRS Al Mabrur Babadan Ponorogo	0,547	0,579	0.963
BPRS Baktimakmur Indah Sidoarjo	0,999	1,000	1.211
BPRS Karya Mugi Sentosa Surabaya	0,692	0,733	0.994
BPRS Lantabur Tebuireng	0,854	0,874	1.061
BPRS Mitra Harmoni Kota Malang	0,934	0,952	1.181
BPRS Tanmiya Artha Kota Kediri	0,758	0,915	0.877
Average	**0,797**	**0,842**	**1,047**

This research applies the Super-efficiency DEA method developed by Andersen & Petersen (1993) for the robustness test (Rusydiana et al., 2022). The results show that the average value of SuperDEA is not much different from the efficiency value of the CRS and VRS models. Table 4 shows that BPR and BPRS, which have high-efficiency scores, are also relatively higher than the others in the SuperDEA assessment. Likewise, BPR and

BPRS that score low on the efficiency of the CRS and VRS models tend to get low scores on the SuperDEA assessment.

FINDINGS

Based on the analysis results, there are several exciting findings; namely, the efficiency level of BPR and BPRS in East Java has fluctuated yearly. No BPR has achieved optimal efficiency at BPR, while at BPRS, one bank has achieved optimal efficiency. Then when compared, the efficiency level of BPR is higher than BPRS in East Java. On the CRS and VRS assumptions, BPR has an average efficiency of (0.828) and (0.915). Meanwhile, BPRS has an efficient average of (0.797) and (0.842). The results of this study support research from Almas (2018), which explains that the efficiency of BPR in East Java is higher than the efficiency of BPRS in East Java. This can be seen from the average BPR efficiency reaching 99.63%. In comparison, BPRS only reaches 98.57%, with research from Hadini and Wibowo (2021) stating that the efficiency of conventional banks is higher than Islamic commercial banks.

From the experience side, BPR or conventional banks have more experience than Islamic banks. In addition, Islamic banking is more inclusive and socially meaningful, involving customer funds to finance productive and approving projects for the environment. Meanwhile, conventional banks focus more on minimizing operational costs, ensuring higher shareholder returns, and increasing liquidity through lending and risky investments. This allows BPR or conventional banks to be more efficient in increasing revenue than Islamic banks. Therefore, BPRS needs to increase Fee Based Income to get additional income. That way, the number of transactions will increase and, in turn, can increase bank efficiency because there are improvements from the financing or credit side.

Further findings, during the Covid-19 pandemic, immensely affected the efficiency of BPR and BPRS. At BPR and BPRS, there was a decrease in the efficiency level in the 2021 period, even though at BPR, the decline that occurred was relatively small, while at BPRS, the decrease in efficiency was very significant. The results of this study are relevant to research from Yasin & Fisabilillah (2021) that the performance of BPR and BPRS shows inefficiency during a pandemic caused by the number of costs or expenses incurred by banks being more significant than their income. The same thing was also expressed by Mardhiyaturrositaingsih and Mahfuz (2020) that during the pandemic, almost all banks in Indonesia experienced a decline in collecting and distributing financing or credit, which ultimately directly affected the banks' efficiency. Setyono et al. (2021) explain that during the Covid-19 pandemic, the efficiency level of Islamic banks has decreased, due to turbulent economic conditions, requiring banks to make more efforts to achieve their targets, especially in musyarakah and mudharabah financing.

In analyzing the potential improvement of BPR and BPRS in East Java in the 2021 dataset, the potential improvement graph represents that if the BPR wants to achieve optimal efficiency, then the output variables, namely financing provided and operating income, need to be increased by 23% and 19%. As for the input variables, fixed assets were reduced by 50%, and third-party funds were reduced by 8%. Furthermore, for BPRS, the financing provided needs to be increased by 79%, and for operating income, it is increased by 18%. As for the input variables, namely fixed assets and third-party funds, it is necessary to reduce them by 1% and 2%. The most significant cause of inefficiency in BPR is fixed assets, while in BPRS is the financing provided. Yasin & Fisabilillah (2021) and Ningsih & Mahfuz (2020) explain that there has been a decline in fundraising and lending, resulting in less-than-optimal profits and will ultimately affect bank efficiency.

Furthermore, in BPR, where the cause of inefficiency comes from fixed asset input variables, it can lead to inefficiency for several reasons, including adding assets manually takes time. It increases the risk of errors, leading to missed deadlines for closing the end of the period, weak controls that can cause material weaknesses and audit risks, and inaccurate fixed asset inventory tracking. If an inventory is not tracked accurately, it can lead to over or under-usage of assets, leading to inefficiencies and increased costs. In addition, an outdated fixed asset management system can also lead to inefficiencies because it may not be able to keep up with changing business needs and requirements (Bloomberg Tax, 2022).

Furthermore, for benchmarking, it was found that BPR Nusumma Jombang 2021, BPRS Mitra Harmoni Malang City 2017, and BPRS Baktimakmur Indah Sidoarjo in 2016, 2017, and 2021 were the banks most referred to by other banks. The results of this analysis explain that the condition of BPR and BPRS efficiency in East Java varies or fluctuates yearly. It is a challenge for BPR and BPRS to operate professionally and accountably in managing their resources, particularly in input and output variables. In managing bank resources, bank management must be professional and accountable. Ilhamsyah (2018) explains that

professionalism positively and significantly affects the quality of banking internal audits. That means banks can produce quality audits or banking financial reports with high professionalism to increase customer trust and transparency, affecting bank efficiency.

The robustness test used in this study is the super-efficiency DEA model devised by Andersen and Petersen (1993), providing a rating of efficient DMUs relative to the reference technology spread by all other units. Several previous studies have extended this model to deal with problems that are impossible in the efficiency model (Chiu et al., 2008). Super-efficiency was introduced in DEA's two-stage network model to better rank and compare banks and further differentiate banks with an efficiency score of one (Rusydiana & Firmansyah, 2022; Rusydiana & Hasib, 2020).

The basic concept of super efficiency is to allow for observed DMU efficiencies greater than 1 or 100%. Super efficiency measures the power of efficient units used to rank the DMU units that are the object of observation. In this research, BPR and BPRS in Indonesia are used as the object of study. Super efficiency only affects units considered equally efficient with the constraints removed. Meanwhile, inefficient units are not affected because efficiency is less than 1. Super efficiency measures the strength of efficient units used to rank DMU units that are objects of observation (Li et al., 2022).

This study first compared the efficiency scores of CRS and VRS. Then to verify whether the efficiency index results are different, a robustness test is performed with SuperDEA. The results showed that most of the results of the efficiency indices of BPR and BPRS, which CRS and VRS modeled, did not differ significantly in the DEA super efficiency scores. There is no significant difference between the models. Thus, the results obtained are quite relevant.

CONCLUSION AND RECOMMENDATION

This study aims to analyze and measure the efficiency of Rural Credit Banks (BPR) and Islamic Rural Banks (BPRS) in East Java, as well as compare the level of efficiency of the two types of banks during the 2016-2021 period using Data Envelopment Analysis (DEA). Based on the research results, there are several findings. BPR efficiency level is higher than BPRS in East Java. BPR has an average efficiency of (0.828) and (0.915). Meanwhile, BPRS has an efficient average of (0.797) and (0.842). During the Covid-19 pandemic, BPR and BPRS experienced a decrease in their efficiency level in the 2021 period, wherein BPRS's reduction in efficiency levels was more significant than that of BPR. Rural banks can achieve optimal efficiency if the variable financing provided and operating income are increased by 23% and 19%, and fixed assets and third-party funds are reduced by 50% and 8%. As for BPRS, the financing provided needs to be increased by 79%, operating income increased by 18%, and fixed assets and third-party funds need to be reduced by 1% and 2%. Furthermore, BPR Nusumma Jombang 2021, BPRS Mitra Harmoni Malang City 2017, and BPRS Baktimakmur Indah Sidoarjo in 2016, 2017, and 2021 are the banks most referred to by other banks. The results of the robustness test using Super-efficiency DEA show that the results of the BPR and BPRS assessments were found to be not much different from the results of the CRS and VRS assessments, where BPRs and BPRS with high-efficiency scores also had high scores on SuperDEA, and vice versa.

It is expected that the bank will pay more attention to the level of efficiency by making improvements to the source of inefficiency. In addition, banks can also improve the quality of their human resources, conduct market research related to public-interest products, and innovate in bank digitization products. Specifically, for the regulators to further support the development of BPR and BPRS in East Java in increasing their professionalism and customer trust and paying attention to the quality of human resources owned by BPR and BPRS. This study has limitations, including the small number of samples used, which makes it possible to be less representative of the distribution of BPR and BPRS in East Java, the research year is still limited until 2021, and this research does not delve deeply into the causes of inefficiency or those that affect inefficiency in banks. So that further research can further develop this research, especially on aspects that affect tire inefficiency. Further research can also use the DEA Two-Stage method to get more in-depth results.

REFERENCES

Agustina, D., Sholihin, M., & Fithria, A. (2019). The Efficiency of Indonesian Islamic Rural Banks: A Stochastic Frontier Analysis. *International Journal of Islamic Economics and Finance (IJIEF)*, *1*(2), 229–248. https://doi.org/10.18196/ijief.1212

Almas, B. (2018). Perbandingan Efisiensi BPR Konvensional Dan BPR Syariah Provinsi Jawa Timur Dengan Pendekatan Non-Parametrik. *IQTISHADIA Jurnal Ekonomi & Perbankan Syariah*, *5*(2), 188-206.

Amran, A.M., Rahman, R.A., Yusof, S.N.S., Mohamed, L.S. (2014) The Current Practice of Islamic Microfinance Institutions' Accounting Information System via The Implementation of Mobile Banking. *Procedia Social and Behavioral Sciences*, *145*, 81-87

Andersen, P., & Petersen, N. C. (1993). A procedure for ranking efficient units in data envelopment analysis. *Management Science*, *39*(10), 1261-1264.

Belanès, A., Ftiti, Z., & Regaïeg, R. (2015). What can we learn about Islamic banks efficiency under the subprime crisis? Evidence from GCC Region. *Pacific-Basin Finance Journal*, *33*, 81–92. https://doi.org/https://doi.org/10.1016/j.pacfin.2015.02.012

Bloomberg Tax. (2022, 8 23). *The Top 10 Fixed Assets Challenges*. Retrieved from https://pro.bloombergtax.com: https://pro.bloombergtax.com/brief/top-fixed-assets-challenges/

Bos, J.W.B., Millone, M. (2015). Practice What You Preach: Microfinance Business Models and Operational Efficiency, 70. *World Development*, 28-42.

Chiu, Y. H., Jan, C., Shen, D. B., & Wang, P. C. (2008). Efficiency and capital adequacy in Taiwan banking: BCC and super-DEA estimation. *Service Industries Journal*, *28*(4), 479–496. https://doi.org/10.1080/02642060801917604

Farell, MJ (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society*, *120*(3), 253-290.

Hadini, M. L., & Wibowo, D. (2021). Komparasi Efisiensi Bank Konvensional Dan Bank Syariah Di Indonesia Berdasarkan Data Envelopment Analysis (Dea). *Jurnal Ilmu Dan Riset*. http://jurnalmahasiswa.stiesia.ac.id/index.php/jira/article/view/3723

Hartarska, V., Shen, X., & Mersland, R. (2013). Scale economies and input price elasticities in microfinance institutions. *Journal of Banking & Finance*, *37*(1), 118-131. https://doi.org/10.1016/j.jbankfin.2012.08.004

Hasbi, S., & Apriyana, M. (2021). Efficiency Level of BPR and BPRS in West Java During The Covid-19 Pandemic. *Jurnal Nisbah*, *7*(1), 1–7. https://doi.org/10.30997/jn.v7i1.4287

Hosen, M. N., & Muhari, S. (2013). Efficiency of the Sharia Rural Bank in Indonesia Lead to Modified Camel. *International Journal of Academic Research in Economics and Management*, *2*(5). https://doi.org/10.6007/IJAREMS/v2-i5/298

Jatmiko, W. (2017). EFFICIENCY AND OWNERSHIP STRUCTURE: EVIDENCE FROM RURAL BANKS IN INDONESIA Wahyu. *International Journal of Economics, Management, and Accounting*, *25*(2), 355–380. https://journals.iium.edu.my/enmjournal/index.php/enmj/article/view/523

Khairunnisa, A. H., & Laila, N. (2018). EFISIENSI PEMBIAYAAN BANK PEMBIAYAAN RAKYAT SYARIAH (BPRS) DI JAWA TIMUR PERIODE 2014-2017. ANALISIS DENGAN METODE DEA (CRS, VRS, dan Skala). *AFEBI Islamic Finance and Economic Review*, *3*(01), 15-27.

Khusnah, N., Zaki, I., & Rani, L. N. (2020). Analisis Efisiensi Bank Pembiayaan Rakyat Syariah (Bprs) Di Jawa Timur Menggunakan Data Envelopment Analysis (Dea) Periode 2012-2018. *Jurnal Ekonomi Syariah Teori Dan Terapan*, *7*(2), 319-331.

Li, Q., Chen, S., He, L., Huang, G., Li, R., & Pan, W. (2022). Application of Two-Stage Network Super-Efficiency DEA to Efficiency Analysis of Chinese Commercial Banks. *Journal of Mathematics*, *2022*. https://doi.org/10.1155/2022/5747753

Mardhiyaturrositaningsih & Mahfudz, M. S. (2020). Dampak Pandemi Covid-19 Terhadap Manajemen Industri Perbankan Syariah: Analisis Komparatif. Jurnal Ekonomi Dan Manajemen, 2(1), 1–10.

Marsondang, A., Purwanto, B., & Mulyati, H. (2019). Measurement of Efficiency and Analysis of Bank Internal and External Factors that Affect It. *Jurnal Manajemen Dan Organisasi*, *10*(1), 48–62.

Masrizal, Sukmana, R., Fianto, B. A., & Gultom, R. Z. (2022). Does economic freedom fosters Islamic rural banks efficiency? Evidence from Indonesia. *International Journal of Productivity and Performance Management*. https://doi.org/10.1108/IJPPM-11-2021-0660

Miranti, T., Aulia, N. A., & Pimada, L. M. (2022). How the covid-19 outbreak affects the efficiency of Islamic rural banks? *EL DINAR: Jurnal Keuangan dan Perbankan Syariah*, *10*(1), 56-68.

Nashihin, M. & Harahap, L., (2014). The Analysis of The Efficiency of BPR-S: Production Function Approach vs Financial Ratios Approach. *Procedia Social and Behavioral Science*, *115* (licies 2013), 188-197

Nicola, M., Alsafi, Z., Sohrabi, C., Kerwan, A., Al-jabir, A., Iosifidis, C., Agha, M., & Agha, R. (2020). The

socio-economic implications of the coronavirus pandemic (COVID-19): A review. *International Journal of Surgery*, *78*(April), 185–193. https://doi.org/10.1016/j.ijsu.2020.04.018

Chiu, Y. H., Jan, C., Shen, D. B., & Wang, P. C. (2008). Efficiency and capital adequacy in Taiwan banking: BCC and super-DEA estimation. *Service Industries Journal*, *28*(4), 479–496. https://doi.org/10.1080/02642060801917604

Li, Q., Chen, S., He, L., Huang, G., Li, R., & Pan, W. (2022). Application of Two-Stage Network Super-Efficiency DEA to Efficiency Analysis of Chinese Commercial Banks. *Journal of Mathematics*, *2022*. https://doi.org/10.1155/2022/5747753

Rusydiana, A. S., & Firmansyah, I. (2022). Shariah Stock Emitent Efficiency Strategy in Digital Era: Application of DEA Super-Efficiency and Interpretive Structural Modeling. *Review on Islamic Accounting*, *2*(1).

Rusydiana, A. S., & Hasib, F. F. (2020). Super Efisiensi dan Analisis Sensitivitas DEA: Aplikasi pada Bank Umum Syariah di Indonesia. *Amwaluna: Jurnal Ekonomi Dan Keuangan Syariah Vol.*, *4*(1), 41–54.

Rusydiana, A. S., Sukmana, R., & Laila, N. (2022). Measuring the Efficiency of Waqf Fund in Indonesia. *Journal of Islamic Monetary Economics and Finance*, *8*, 153–174. https://doi.org/10.21098/jimf.v8i0.1650

Setyono, F., Istiqomah, Y. N. A., Ilmundhita, S., & Mujib, A. (2021). Analisis Efisiensi Perbankan Syariah Pada Masa Pandemi Covid-19 Menggunakan Data Envelopment Analysis (DEA). *I-Finance: a Research Journal on Islamic Finance*, *7*(1), 11-30.

Sholihah, E. (2021). Efisiensi Kinerja Keuangan Sektor Perbankan Indonesia di Masa Pandemi Covid-19. Jurnal Riset Manajemen Sains Indonesia, 12(2), 287–304.

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

Widiyaningtias, A., & Dura, J. (2022). Analisis Komparatif Financial Performance BPR dan BPRS Jawa Timur Sebelum dan Saat Pandemi Covid-19. *Owner: Riset Dan Jurnal Akuntansi*, *6*(2), 1486-1497.

Yasin, A., & Fisabilillah, L. W. P. (2021). Analisis Komparasi Kinerja Keuangan Bank Perkreditan Rakyat (BPR) Sebelum dan Pada Pandemi Covid-19. *EQUILIBRIUM: Jurnal Ilmiah Ekonomi dan Pembelajarannya*, *9*(2), 142-152.