Productivity of Rural Banks in Central Java: Is Technological Changes Matter?

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This study aimed to analyze the level of productivity, the factors that influence it, the potential for improvement needed, and a comparison of the productivity of Rural Banks (BPR) and Islamic Rural Banks (BPRS) in Central Java. This research also looks at the productivity 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 9 BPR and 7 BPRS in Central Java. The analytical method used is a non-parametric approach, namely the Malmquist Productivity Index (MPI), with secondary data sources derived from BPR and BPRS financial reports on the Financial Services Authority (OJK) website. The results of the study show that during the COVID-19 pandemic, BPR and BPRS experienced an increase in productivity in general, where BPRS showed better performance with higher technology adoption and higher average Total Factor Productivity Changes (TFPCH) values, while the change in efficiency (EFFCH) tends to decrease; As a result, BPRS occupy a better position in quadrants 1 and 2 in the division of the four types of BPR and BPRS based on the level of technology and efficiency. This research also provides recommendations to BPR and BPRS practitioners, management, and regulators.

Keywords: BPR; BPRS; Productivity; Central Java; MPI

INTRODUCTION

The financial sector, especially the banking industry, plays an important role in the economic activities of a country. The strategic role of the bank is as a vehicle that can collect and distribute public funds effectively and efficiently towards improving the people's standard of living (Mawarati, 2016). Therefore, the healthy performance of the banking sector has always been a key issue for researchers and policymakers whose job is to ensure a strong and economically developed country (Sharma et al., 2013).

As part of the banking ecosystem, the existence of Rural Banks (BPR) and Islamic Rural Banks (BPRS) as microfinance institutions is an alternative provider of finance for people who are not reached by the formal banking sector (Wasiaturrahma et al., 2020). As banking Law No. 7/1992, amended by Law No. 10/1998, BPR and BPRS carry out business activities conventionally and based on Sharia principles and do not provide payment traffic services in their activities. Thus BPR and BPRS have several differences from commercial banks. First, they have much smaller capital requirements than commercial banks. Second, their target is to serve the credit needs of farmers, fishermen, small traders, employees, retirees, and other layers of society that banks have not reached so they are not trapped by loan sharks (Iswandari & Anan, 2015).

BPR and BPRS are important in improving the community's economy, especially MSMEs (Maryati, 2014). This is because the main problem for MSMEs is often around the capital. According to data from the Ministry of Cooperatives and SMEs, in 2019, Indonesia had the largest economic entity, namely in the Micro, Small, and Medium Enterprises (MSMEs) sector, with a percentage of 99.9% of the total businesses in Indonesia, and this number is increasing every year, even when in a pandemic. MSMEs have a large share in national economic growth because MSMEs contribute the largest percentage to GDP and absorb up to 97% of the workforce in Indonesia (Coordinating Ministry for Economic Affairs of the Republic of Indonesia, 2021).

Central Java is a province that has great potential to contribute to national economic growth, with a total of 234 BPR and 26 BPRS banks (BPS, 2021). MSME credit growth in the first quarter of 2022 increased again, growing 21.85% (yoy). Based on the MSME group, the share of MSME lending in Central Java was dominated by the micro (42.74%) and small (38.30%) groups. The share of MSME loans in Central Java increased in the quarter under review, reflecting an increase in banking commitment to expanding access to finance (BI, 2022).

According to data from the Indonesian Central Bureau of Statistics, Central Java's economy in the first quarter of 2023 grew 5.04% (yoy). Furthermore, Central Java is the fourth province to support the national economy by contributing to the National GDP of 8.15%, after DKI Jakarta (16.64%), East Java (14.26%), and West Java (12.65%).

Seeing this potential, the development of BPR and BPRS in Central Java needs to be balanced with excellent financial performance. This is important because their small market share is based on micro-enterprises with a high risk of default (Firmansyah, 2014). Sanjaya & Marlius (2017) revealed that BPR, part of the banking industry ecosystem, often competes with other financial institutions. This makes BPR and BPRS required to develop strategies to create a competitive advantage and operate efficiently in industrial competition. As is known, measuring bank productivity, especially BPR and BPRS, is very important so that stakeholders such as banking practitioners and regulators can evaluate and develop strategies going forward to maintain stability and advance the banking industry in Indonesia.

However, research that raises information related to BPR and BPRS productivity is still very limited. As far as the author's observation, no research specifically examines the level of productivity of BPR and BPRS in Central Java from 2016 to 2021. Several previous studies, such as Krishnasamy et al. (2004) measured the productivity of commercial banks in Malaysia in 2000-2001 using non-parametric DEA and MPI methods.

Abbas et al. (2015) compared the performance of Islamic and conventional banks by calculating the Malmquist Index during the 2005-2009 period. Kamaruddin et al. (2017) explored the level of productivity of Islamic banks focusing on selected Southeast Asian countries in 2006-2014. Mawarati (2016) compared the efficiency and productivity levels of BPRS in Indonesia's Western and Eastern regions for the 2013-2015 period. Herindar et al. (2021) conducted a productivity study of 92 BPRS in Indonesia during 2016-2021. Rusydiana & Assalafiyah (2022) measure the productivity level of BPRS during the 2013-2020 period.

Based on some of these previous studies, no research specifically addresses the level of productivity of BPR and BPRS in Central Java from 2016-2021. Therefore, this study fills the existing gap by measuring the productivity level of BPR and BPRS.

LITERATURE REVIEW

BPR and BPRS

In Law No. 10 of 1998, the type of bank can be divided into commercial banks and rural banks/credit banks (including BPRS). Rural Banks (BPR) and Islamic Rural Banks (BPRS) have the same roles and functions, and it's just that the operational systems that are run by both are different. Like other Islamic financial institutions, BPRS operates under an interest-free policy (Wasiaturrahma et al., 2020).

This concept stipulates that no payment system in a BPRS may involve interest. Islam prohibits interest, which is repeated several times in the verses of the Qur'an as usury (Ar-Ruum: 39; Al-Baqarah: 130; Al-Baqarah: 278-279). Riba is defined as an extra advantage over principal assets (Chaudhry, 1999). BPRS are prohibited from providing additional credit to customers, nor are they allowed to accept loans in this form. In contrast, BPRS offer and receive interest-free loans called charitable loans or qardh hasan.

Unlike the BPRS, the conventional BPR operational system regulates savings accounts with interest. In addition, BPR charges interest on the loans they provide to customers (Yuwana et al., 2012). BPR commercial practices are prohibited in Islam because usury is seen as a form of injustice. A payment system in which creditors can receive interest payments in addition to the principal amount is considered unfair.

On the other hand, borrowers do not have to generate returns (Ahmad et al., 2011). BPRS uses many alternative transactions. To get funds, they offer deposit accounts and mudharabah accounts. In this account, the bank can deposit money as needed for commercial purposes (Ajija et al., 2018). Mudharabah accounts offer profit-sharing agreements to clients. Generally, in Indonesia, each BPRS uses profit sharing based on the proportion determined at the beginning of the agreement.

Account holders can experience losses and profits from the initial profit-sharing agreement. In other words, customer profit participation depends on the monthly BPRS income (Beck et al., 2010). In addition, according to Ika and Abdullah (2011), remittances must follow the Islamic code of ethics outlined in Islamic fiqh, such as the prohibition of allocating funds to unlawful or unethical industries such as liquor, casinos, pork, fake news, or slanderous media, and other unethical industries.

Regardless of the difference in operational systems, the two banks, BPR and BPRS, play an important role in the economy because they function as intermediaries between households and the economic or financial sector (Nashihin & Harahap, 2014). Moreover, BPR and BPRS are also part of the financial sector, which is important in supporting sustainable finance and national economic recovery in Indonesia.

Productivity

The concept of productivity is defined as the ratio of output to input. Productivity is also defined as a combination of effectiveness and efficiency. Effectiveness is related to the expected output according to the target. At the same time, efficiency is the minimum use of resources with maximum results to formulate productivity (Gaspersz, 1998) in Nurasyiah et al. (2019). In KBBI, the word productivity is defined as the ability to produce something. This concerns producing the maximum amount of goods and services by efficiently utilizing human resources and all other input units (Rustyani & Rosyidi, 2018).

Therefore productivity is often interpreted as a comparison between the output and input of certain units (Sedarmayanti, 2001; Saari, 2006; Nurasyiah et al., 2019). Measuring factor productivity means focusing on the output or income of an industry which results in profit or factor costs (Caves et al., 1982). Meanwhile, according to Nurasyiah et al. (2019), productivity measurement complements efficiency measurement. This is because there will be many possibilities in an industry that is in an efficient but unproductive condition and vice versa.

PREVIOUS STUDY

The author found several previous studies that examined the productivity of banking institutions, but not much has focused on microfinance institutions such as BPR and BPRS. It was found in previous research that there were differences in the selection of input and output variables in measuring productivity in banking institutions. Krishnasamy et al. (2004) measured the productivity of commercial banks in Malaysia in 2000-2001 using non-parametric DEA and MPI methods. The results of this study indicate that total factor productivity increased in eight banks except for EON Bank Berhad, which remained the same. At the same time, Public Bank Berhad recorded a decrease in productivity. Productivity growth is due to technological changes rather than technical efficiency changes.

Alfiatun & Wiryono (2010) analyzed efficiency and Total Factor Productivity using the DEA and MPI methods. This study uses input variables consisting of total savings and total loans. In comparison, the output

variables include total loans and total assets. The findings show that the efficiency of Islamic banks in the 2004-2009 period was, on average lower than that of conventional banks.

Abbas et al. (2015) compared the performance of Islamic and conventional banks by calculating the Malmquist Index during the 2005-2009 period. The results show that the productivity of Islamic banks decreased compared to conventional banks in 2007 but increased in 2008-2009. Kamaruddin et al. (2017) explored the level of productivity of Islamic banks focusing on selected Southeast Asian countries in 2006-2014. Putri (2022) review on Islamic banking productivity research using bibliometric approach. Otherwise, Aufa et al., (2022) also Uula & Maulida (2022) try to measure the performance of BPR-BPRS industry from the perspective of efficiency.

In addition, this study also investigates the potential factors of bank-specific characteristics and macroeconomic conditions that can affect the productivity of the banking sector. The findings show that foreign-owned banks are more productive than domestic-owned banks due to higher efficiency (EFFCH) change, but the difference is insignificant. In addition, the determinants of capitalization, liquidity, and the world financial crisis significantly affect Islamic banks' productivity levels.

Although research measuring the productivity levels of BPR and BPRS is still limited, several studies can serve as a reference, such as Mawarati (2016) comparing the efficiency and productivity levels of BPRS in Western and Eastern Indonesia for the 2013-2015 period. The study results show that the BPRS in the West Region is more efficient than the BPRS in the East Region. Meanwhile, regarding productivity, the BPRS in the Eastern Region is more productive than the BPRS in the West.

Herindar et al. (2021) conducted a study of 92 BPRS in Indonesia during the 2016-2021 period. This study uses fixed asset input variables, labor costs, and third-party funds. In comparison, the output variables used are the amount of financing provided and operating income. By using the MPI, the findings of this study show that the overall level of BPRS productivity has increased, and it is known that changes in efficiency and technology have affected the increase in BPRS

productivity. The results of this study also compare the regions of Java and outside Java, where BPRS Java has a higher level of productivity than BPRS outside Java.

The author also found research by Rusydiana & Assalafiyah (2022) which measured the productivity level of BPRS during the 2013-2020 period by analyzing the BCC model as the basic model. The input variables are fixed assets, labor costs, third-party funds, and paid-in capital. In contrast, the output variables include the amount of financing and operating income. The results show that BPRS in Indonesia generally has experienced a decline in productivity, but it has increased in the last two years.

This research tries to fill the research gap related to the productivity of banking institutions, especially in micro banking institutions such as BPR and BPRS. This study focuses on measuring the level of productivity of BPR and BPRS in Central Java that have met the research sample criteria. This study also analyzes the effect of the Covid-19 pandemic on the productivity of BPR and BPRS in Central Java.

METHOD

The DEA-based Malmquist Productivity Index (MPI) method was initially introduced by Caves, Christensen, and Diewert (CCD) in 1982 (Caves et al., 1982) and empirically applied by Färe, Grosskopf, Lindgren, and Roos in 1992 (Färe et al., 1992) and Färe, Grosskopf, Norris, and Zhang in 1994 (Färe et al., 1994). Non-parametric (Malmquist) and parametric (Fischer and Tornqvist) indices vary in their behavioral assumptions and recognize random errors in the data, also known as noise. The advantage of applying the MPI index compared to others is that it does not require a price while eliminating technological structure assumptions.

In this study, changes in the productivity of BPR and BPRS are measured using output-oriented MPI and assign changes in Total Factor Productivity Change (TFPCH) to Technological Change (TECHCH) and Efficiency Change (EFFCH). EFFCH changes are associated with Pure Technical Efficiency Change (PTECH) and Scale Efficiency Change (SECH) changes, following Färe et al. (1994). The interaction between efficiency indices is shown below:
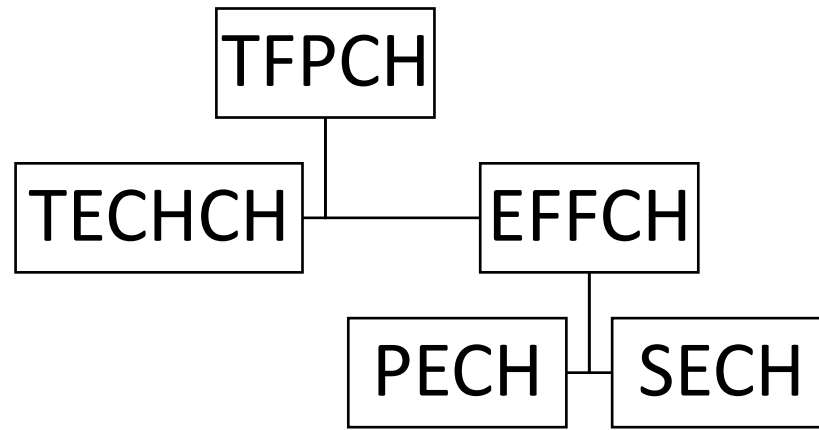
Figure 1: Productivity Index

The efficiency change index can be further decomposed into a mutually comprehensive PECH (pure efficiency changes) component, calculated relative to the VRS technology and the SECH (scale changes) component, capturing changes in deviations between VRS and CRS technologies according to the suggestion of Färe et al. (1994).

The first-generation model was developed by Caves et al. (1982). There are 2 (two) Malmquist productivity index models, namely the 'Malmquist input quantity index' and the 'Malmquist output quantity index.' The Malmquist input quantity index for production units, at the time of observation t and t + 1, for the reference technology in the period k, k = t, and t + 1. The Malmquist input quantity index measures the change in the quantity of the input observed between times t and t + 1, where:

$$MI_k\left(y_k, x_t, x_{t+1}\right) = \frac{E_k^I\left(y_k, x_t\right)}{E_k^I\left(y_k, x_{t+1}\right)} , \ k = t, \ t+1 \quad (1)$$

The Malmquist output quantity index for production units, at observation times t and t + 1, for the reference technology in periods k, k = t, and t + 1. The Malmquist output quantity index only measures the change in the quantity of output observed between times t and t + 1, where:

$$MO_k\left(y_t, y_{t+1}, x_k\right) = \frac{E_k^O\left(y_{t+1}, x_k\right)}{E_k^O\left(y_t, x_k\right)} , \ k = t, \ t+1 \quad (2)$$

Bjurek (1996) introduced a new definition of the Malmquist productivity index for units of production between t and t + 1 based on the level of technology at times k, k = t, and k = t + 1, following the tradition of most productivity indices. The index constructed is the

ratio between the output index and the input index, according to the Tornqvist productivity index, where:

$$MTFP_k \ = \frac{MO_k(y_t, y_{t+1}, x_k)}{MI_k(y_k, x_t, x_{t+1})}$$

$$= \frac{E_k^O \frac{y_{t+1}, x_k}{E_k^O}(y_t, x_k)}{E_k^I \frac{y_k, x_t}{E_k^I}(y_k, x_{t+1})} ,$$

$$k = t, \ t + 1 \qquad (3)$$

The above equation describes the ratio between the output and Malmquist input indexes. If the productivity index value is more significant than the number 1, productivity has increased. However, the productivity level will decrease if the index value is less than 1. Meanwhile, if it is equal to 1, then the productivity level will stagnate.

As for the estimation of TFP growth and components that refer to the Malmquist Index using the Cobb-Douglas theory. The Cobb-Douglas production function can be written as follows:

$$Y = A * L^a * K^{(1-a)} \quad (4)$$

The equation is expressed as a measure of total factor productivity, where scalar A has economic value. The geometric weighted average of the inputs is used to produce the actual output. Thus, A can be interpreted as real output per unit of input. This is a better productivity measure than Y/L and Y/K, which are partial productivity measures that do not consider the possible number of other inputs used. The method used to measure productivity in this study is the Malmquist

Productivity Index as an extension of Data Envelopment Analysis (Uula & Maziyyah, 2022).

Factors of change in productivity can be seen through the value of the Efficiency Change Index (EFFCH) and Technology Change Index (TECHCH) to explain the change in productivity. Meanwhile, Pure Efficiency Change Index (PECH) and Scale Efficiency Change Index (SECH) were used to determine the cause of changes in the efficiency change index (EFFCH). The Total Factor Productivity (TFP) value shows the change in the index. If the value of M > 1 indicates an increase in productivity, M = 1 indicates no increase in productivity, and M < 1 indicates a decrease in productivity in BPR and BPRS.

This research was conducted on 16 BPR and BPRS in Central Java within six years, from 2016 to 2021. The number of BPR and BPRS that became the object of this study was 16 operating in Central Java based on the total amount of data obtained in full because of the method. In this case, the incoming panel data must be complete. Central Java BPR and BPRS, whose data is relatively complete based on input and output factors for six years (2016 to 2021), only 16 BPR and BPRS, while others are not registered because the data collected is incomplete.

In this study, the input variables used are operational costs, third-party funds, and fixed assets, while the output variables used are financing provided and operating income. The analytical tools used in this study to measure the Malmquist productivity index are DEAP 2.1 software. Islamic bank productivity calculations use the BCC or VRS approach with output orientation.

RESULT AND DISCUSSION
BPR and BPRS Productivity in Central Java

Table 1 describes the results of the analysis using the Malmquist Productivity Index (MPI) of BPR and BPRS in Central Java which are the objects of observation in this study.

Table 1: Average Score of BPR and BPRS Malmquist Index per year

Year	EFFCH	TECHCH	PECH	SECH	TFPCH
2016-2017	0,853	1,590	0,985	0,867	1,357
2017-2018	1,175	0,703	1,019	1,153	0,826
2018-2019	0,774	0,676	0,829	0,933	0,754
2019-2020	1,166	0,553	1,175	0,992	0,645
2020-2021	1,010	1,662	1,007	1,003	1,678
Mean	**0,982**	**1,000**	**0,997**	**0,985**	**0,982**

Table 1 describes the changes in total productivity (TFPCH) of BPR and BPRS in Central Java and the influencing factors, namely changes in technology (TECHCH) and changes in efficiency (EFFCH) during the observation period. Based on the MPI processing results, it can be concluded that the level of productivity of BPR and BPRS has fluctuated from year to year. In 2016-2017, the productivity levels of BPR and BPRS increased, as indicated by the TFPCH value (1.357). The increase in productivity in this period was influenced by the increase in technological change (TECHCH) with a value of (1.590), although the change in efficiency (EFFCH) decreased (0.853). This explains that technological changes contribute more to increased productivity than efficiency changes.

The 2017-2018 period explains that the productivity levels of BPR and BPRS have decreased, where the TFPCH value (0.826) has decreased. The decrease in the level of productivity in this period was influenced by changes in efficiency (1.175) which increased and became the highest level of change in efficiency throughout the period. While the change in technology (0.703) decreased. This explains that the decrease in productivity is influenced by changes in efficiency that increase and changes in technology that decrease.

The 2018-2019 period to the 2019-2020 period showed a significant decrease in productivity levels, where the TFPCH values were (0.754) and (0.645), respectively. The 2019-2020 period has the lowest decline in productivity levels throughout the research period. In the 2018-2019 period, the decline in productivity levels was affected by changes in efficiency (0.774) and changes in technology (0.676) which

decreased. Whereas in the 2019-2020 period, the decline in productivity was affected by changes in efficiency (1.166) which increased, and changes in technology (0.553) which decreased and was the lowest level of technological change throughout the research period. It can be concluded that the decrease in productivity levels in both periods, technological changes contributed the most compared to changes in efficiency.

Furthermore, the 2020-2021 period shows that the productivity levels of BPR and BPRS in Central Java have significantly increased and are the highest productivity levels throughout the study period, namely TFPCH (1,678). The increase in productivity in this period was equally influenced by an increase in changes

in efficiency (1.010) and changes in technology (1.662). However, technological changes contribute more than changes in efficiency to increased productivity, as seen from both values.

Then, based on the average MPI value during the 2016-2021 period, it can be concluded that the productivity level of BPR and BPRS in Central Java has decreased, as indicated by a decreased TFPCH value (0.982). This decrease in productivity levels was equally influenced by changes in efficiency (0.982) and changes in technology (1.000). This explains that changes in efficiency have contributed to the decline in the productivity of BPR and BPRS in Central Java.

Summary of the Average Malmquist Index of BPR and BPRS in Central Jawa

Table 2: Average Productivity of BPR and BPRS in 2016-2021

Firm	EFFCH	TECHCH	PECH	SECH	TFPCH
BPR Bank Solo	0,968	0,874	1,000	0,968	0,847
BPR Sejahtera Artha Sembada (PT) Kota Pekalongan	0,940	0,888	1,000	0,940	0,835
BPR BKK Purwodadi (Perseroda) Grobogan	0,979	0,921	1,006	0,973	0,902
BPR Central Artha Kota Tegal	1,005	0,989	1,005	1,000	0,994
BPR Dhanatani cepiring Kendal Jateng	1,008	0,881	1,007	1,000	0,888
BPR Citanduy Cilacap Jateng	1,031	0,864	1,027	1,004	0,891
BPR Bank Sukoharjo (PERSERODA)	1,000	1,009	1,000	1,000	1,009
BPR BKK Mandiraja (Perseroda) Banjarnegara	0,915	1,148	0,959	0,954	1,050
BPR Bank Karanganyar Jawa tengah	0,948	1,030	0,953	0,995	0,977
BPRS Gala Mitra Abadi (PT) Grobogan	1,000	1,072	1,000	1,000	1,072
BPRS Artha Amanah Ummat (PT) Semarang	1,000	1,048	1,000	1,000	1,048
BPRS Arta Leksana (PT) Banyumas	1,000	1,032	1,000	1,000	1,032
BPRS Suriyah	0,986	1,007	1,000	0,986	0,993
BPRS Artha Surya Barokah semarang	0,977	0,980	1,000	0,977	0,958
BPRS Bina Finansia kota semarang	0,961	1,119	0,995	0,966	1,075
BPRS Mitra Harmoni Kota Semarang	1,000	1,223	1,000	1,000	1,223
Mean	**0,982**	**1,000**	**0,997**	**0,985**	**0,982**

Based on Table 2, the average productivity of BPR and BPRS throughout the study period shows a decrease in productivity (0.982). This productivity increase was affected by a decrease in the average efficiency change (EFFCH) with a value of (0.982), and technological change (TECHCH) contributed with a value of (1.000). The decrease in efficiency can be caused by a decrease in the EFFCH forming factor, namely a decrease in Pure Efficiency Change (PECH) with a value of (0.997) and Scale Efficiency Change (SECH) (0.985).

Furthermore, the analysis was carried out individually on BPR and BPRS, and it can be concluded that the institution with the highest productivity is BPRS Mitra Harmoni Semarang City, with a value of (1.223). The high level of productivity at BPRS Mitra Harmoni Semarang City is influenced by the constant value of EFFCH (1,000) and increasing TECHCH (1,223). Then, BPR and BPRS with the lowest productivity value were obtained by BPR Sejahtera Artha Sembada (PT) Pekalongan City with a productivity value of (0.835),

where low productivity was affected by a decrease in EFFCH (0.940) and TECHCH (0.888).

BPR and BPRS Productivity in Central Java During the Covid-19 Pandemic

The phenomenon of the Covid-19 pandemic at the end of 2019 and its spreading to Indonesia in early 2020 certainly has a global impact not only on the health sector but also on the economic sector, especially the financial industry, where in this study, BPR and BPRS are micro-scale intermediary institutions. For this reason, the following analysis explains the productivity of BPR and BPRS during the Covid-19 pandemic.
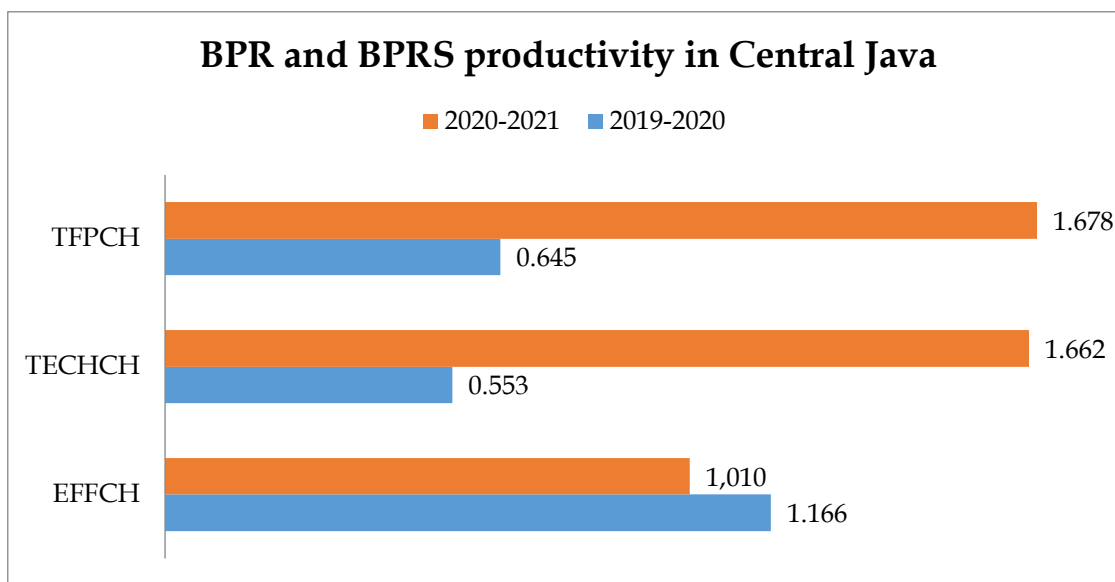

Figure 2: BPR and BPRS productivity in Central Java

Figure 2 describes the productivity levels of BPR and BPRS in Central Java during the Covid-19 period, starting from 2019-2021. It can be concluded that the productivity levels of BPR and BPRS increased during the Covid-19 pandemic. The TFPCH value shows this in the 2020-2021 period (1.678), which experienced a significant increase compared to the 2019-2020 period (0.645). The same thing happened to TECHCH, where the TECHCH value in the 2020-2021 period (1.662) was higher compared to the previous period, which only reached a value (0.553). In EFFCH, there was a slight decrease in the 2020-2021 period (1,010) compared to the 2019-2020 period (1,166). Based on this, it can be concluded that technological changes have contributed to increasing the productivity of BPR and BPRS in Central Java during the Covid-19 pandemic.

Malmquist Index Quadrant

At this stage, BPR and BPRS in Central Java will be grouped into four quadrants based on efficiency and productivity, with high and low categories. Efficiency and productivity values are seen from the industry average. If the value of efficiency and productivity is higher than the industry average, it indicates a high category and vice versa. If efficiency and productivity are below the industry average, it indicates a low category.

Quadrant 1 describes BPR and BPRS with high category efficiency and productivity, and it can be considered that these BPR and BPRS have a high level of productivity. Quadrant 2 includes high productivity, but on the other hand, efficiency is still low. Quadrant 3 includes BPR and BPRS groups with low productivity and high efficiency. And quadrant 4 explains the BPR and BPRS groups with productivity and efficiency both showing the low category.

Table 3: Quadrant Malmquist Index BPR and BPRS

Quadrant 1 (High Technology, High Efficiency)	Quadrant 2 (High Technology, Low Efficiency)
1. BPR Bank Sukoharjo (PERSERODA) 2. BPRS Gala Mitra Abadi (PT) Grobogan 3. BPRS Artha Amanah Ummat (PT) Semarang 4. BPRS Arta Leksana (PT) Banyumas 5. BPRS Mitra Harmoni Kota Semarang	1. BPR BKK Mandiraja (Perseroda) Banjarnegara 2. BPR Bank Karanganyar Jawa tengah 3. BPRS Suriyah 4. BPRS Bina Finansia kota semarang
Quadrant 3 (Low Technology, High Efficiency)	**Quadrant 4 (Low Technology, Low Efficiency)**
1. BPR Central Artha Kota Tegal 2. BPR Dhanatani cepiring Kendal Jateng 3. BPR Citanduy Cilacap Jateng	1. BPR Bank Solo 2. BPR Sejahtera Artha Sembada (PT) Kota Pekalongan 3. BPR BKK Purwodadi (Perseroda) Grobogan 4. BPRS Artha Surya Barokah semarang

Based on Table 3, it can be concluded that BPR and BPRS dominate in quadrant 1 with a total of 5 BPR and BPRS. Then quadrant 2 and quadrant 4 have 4 banks in each quadrant. Next is quadrant 3, with a total of 3 banks. Based on this, many BPR and BPRS in Central Java already have a high level of technological change. But on the other hand, the efficiency level of BPR and BPRS in Central Java is still in the low category. This is evidenced in quadrants 2 and 4, which show low efficiency.

FINDINGS

This study aims to test and analyze the productivity of BPR and BPRS during the Covid-19 pandemic. In the context of this pandemic, several findings show that BPR and BPRS have generally experienced increased productivity.

Increased productivity during this pandemic was largely influenced by technological changes and increasingly widespread digitalization (Ansori, 2019). These banks are actively leveraging technology to improve operational efficiency, speed up processes, and provide better service to customers. The application of digital technology, such as online banking services, mobile banking applications, and non-cash transactions, has helped optimize the productivity of BPR and BPRS (Kaur et al., 2021; Mbama & Ezepue, 2018; Shaikh et al., 2017).

However, there was a decrease in efficiency changes (EFFCH) in the same period. Although productivity has increased, efficiency gains do not

appear to have kept pace with this growth. Factors such as rapid changes in business processes, the need for adaptation to new technologies, and operational constraints during a pandemic can affect efficiency performance in the short term (Abdul-Majid et al., 2010; Sufian & Noor, 2009).

Interestingly, this study also found that BPRS tends to be more productive than BPR. This is reflected in the Total Factor Productivity Changes (TFPCH) values which are, on average higher in BPRS. This better performance may be due to using more efficient business models, success in adopting new technologies, and a strong focus on Sharia principles (Eliza & Susanti, 2020).

The division of the BPR and BPRS quadrants based on the level of technology and efficiency provides further understanding of the performance of these two types of banks. The analysis results show that BPRS are superior in terms of productivity, especially in quadrants 1 and 2 which represent a high level of technology and good efficiency. This indicates that the BPRS has succeeded in optimizing the use of technology and implementing processes that are more efficient in facing the challenges of the pandemic (Mohd Salleh & Rani, 2020; Rusydiana et al., 2021).

The division of the BPR and BPRS quadrants also provides insight into the differences in performance based on the level of technology and efficiency. BPRS, which dominates quadrants 1 and 2, demonstrated that they have successfully adopted high technology and implemented efficient processes, which have positively

impacted their productivity. On the other hand, BPR in quadrants 3 and 4 may need to pay attention to technology development and efficiency improvements to increase their productivity.

These findings provide important insights into the context of the banking industry, especially in facing the challenges of the pandemic. BPR and BPRS can take advantage of technological changes and digitalization to improve their performance and meet customer needs efficiently (Abbas et al., 2015; Darussalam et al., 2019; Safiullah, 2021).

This research provides important information about the productivity of BPR and BPRS during the Covid-19 pandemic. Technological change and digitization have positively impacted productivity in both, although efficiency may need some attention. BPRS tend to be more productive and obtain higher TFPCH scores. Quadrant analysis also describes the distribution of different characteristics between BPR and BPRS. This research forms the basis for developing strategies and policies to increase the productivity of the banking sector in the future.

CONCLUSION

This study aims to analyze and measure the productivity of Rural Banks (BPR) and Islamic Rural Banks (BPRS) in Central Java, as well as identify the factors affecting the productivity of the two types of banks during the 2016-2021 period using the Malmquist Productivity Index (MPI). Based on the research results, there are several findings. During the COVID-19 pandemic, BPR and BPRS generally experienced an increase in productivity influenced by technology adoption. Even though there is a decrease in changes in efficiency, BPRS tends to be more productive than BPR with higher average TFPCH scores. The quadrant division shows that BPRS dominates quadrants 1 and 2, indicating a better position in terms of technology and efficiency level. For this reason, BPR and BPRS need to pay attention to technology development and digitization. Thus, it is hoped that BPR and BPRS can continue to increase their productivity and provide more efficient and innovative banking services to the public.

RECOMMENDATION

Based on the results of this research, the recommendation for BPR and BPRS practitioners and management is to continue investing in technology and digitization to improve operational efficiency and increase productivity. BPR and BPRS also need to improve human resource capabilities through training and skills development following technological developments and to increase collaboration with third parties, such as technology service providers, to adopt the latest innovations and accelerate digital transformation.

The recommendation for regulators and financial authorities is to encourage implementing policies that support technology adoption in the banking sector, including BPR and BPRS. Likewise, developing programs and incentives to encourage BPR and BPRS to improve operational efficiency and adopt relevant technology.

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