COMPARATIVE STUDY OF EFFICIENCY AND PRODUCTIVITY BETWEEN CONVENTIONAL COMMERCIAL BANKS AND ISLAMIC COMMERCIAL BANKS: EVIDENCE FROM INDONESIA

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Abstract

This study aims to analyze and compare the efficiency and productivity of Conventional Commercial Banks (BUK) and Islamic Commercial Banks (BUS) in Indonesia, with 19 BUK and 14 BUS in Indonesia. This study uses the CRS and VRS models in analyzing efficiency with Data Envelopment Analysis while analyzing productivity using the VRS model using the Malmquist Productivity Index. The results of this study indicate that there are still BUK and BUS bankers who have not achieved maximum efficiency, and there are still many of the two types of banks with low efficiency. The leading cause of the inefficiency of BUK and BUS in Indonesia is caused by output variables, namely the amount of financing and operating income. This study also revealed that the Covid-19 pandemic caused a decrease in the efficiency of the BUK, while the efficiency of the BUS was relatively stable and even slightly increased. Furthermore, based on an analysis of productivity during the Covid-19 pandemic, BUK and BUS in Indonesia experienced an increase due to high technological changes. Then this study also revealed the results of the Malmquist index score. Changes influence changes in productivity efficiency and changes in technology. This study finds that the dominant factor that causes the increase in productivity of BUK and BUS in Indonesia is influenced by technological change factors. Thus, digitalization in the banking industry sector is essential. This research also provides recommendations for several parties, such as practitioners, academics, and regulators.

Keywords:* *Conventional Commercial Banks, Islamic Commercial Banks, Efficiency, Productivity

Introduction

Research Background

Covid-19, which first appeared in China in December 2019, has spread worldwide. The impact of the Covid-19 pandemic has arisen does not only attack from a health perspective but also has a global economic cost (Zheng and Zhang, 2020). The spread of this virus and the preventive measures taken by the government to reduce it are the main reasons for the cessation of production and consumption activities (Arianto, 2021). Likewise experienced by one of the economic sectors, namely the banking industry, which is the heart of a country's economy (Adeabah and Andoh, 2020).

The Indonesian banking system generally consists of commercial and Islamic banks. By having the main objective as fundraising for financing sources, which support economic activities and economic growth. The development of the Islamic finance economy in Indonesia was pioneered by establishing the first Islamic bank, Bank Muamalat Indonesia, around 1992 (Ascarya & Yumanita, 2008a, 2008b; Rusydiana, 2018b). Then in 1998, Bank Indonesia notified that as part of the new banking law, there was a dual banking system, conventional and Islamic (sharia-based) (Seibel, 2007). Furthermore, over time the Islamic financial system developed rapidly side by side with the conventional financial system (Junaidi et al., 2021; Rahmatika, 2014).

According to data from the 2020 Indonesia Islamic Banking Development Roadmap, Indonesian Islamic banking, consisting of Sharia People's Financing Banks (BPRS), Sharia Business Units (UUS), and Sharia Commercial Banks (BUS) continues to develop. As of September 2020, 162 BPRS, 20 UUS, and 14 BUS have contributed to the growth of Islamic banking in Indonesia, with total assets of IDR 575.85 trillion (OJK, 2020).

In 2020, the resilience of Islamic banking is getting stronger. This can be seen from the increase in the CAR ratio of Islamic Commercial Banks (BUS) by 105 bps (YoY) to 21.64%. Meanwhile, Islamic banking, in carrying out its function as an intermediary, is also running well. Disbursed financing (PYD) and Third Party Funds (DPK) grew positively by 8.08% (YoY) and 11.98% (YoY), so the growth of Islamic banking assets during the period was 13.11% (YoY).). As for the total at the end of 2020, Islamic banking assets, PYD, and DPK reached Rp608.90 trillion, Rp394.63 trillion, and Rp475.80 trillion (OJK, 2020).

Meanwhile, based on the Global Islamic Finance 2020 report, Indonesia is recognized as one of the top countries in the Islamic Finance Country Index (IFCI). Despite achieving a relatively

high score of 82.01 in 2020, Indonesia is still considered to have high potential in developing its Islamic finance industry. The market share of Islamic banking has increased from year to year, reaching 6.51% at the end of 2020 and then 6.55% at the beginning of 2021. Although this level of market share is an achievement in itself, Islamic banking still needs to strive for performance and efficiency as well as improvements in facing various emerging challenges, such as competition and conversion of sharia business units into sharia commercial banks (Rusydiana & As-Salafiyah, 2021).

In general, in improving people's welfare, Indonesian banking aims to support the implementation of national development to increase equity, economic growth, and national stability. Indonesian banking operates within a dual banking system or dual-banking system within the framework of the Indonesian Banking Architecture (API) to provide more complete banking service options to the public. Hand in hand, the Islamic banking system, and conventional banking together support the broad mobilization of public funds to increase financing capabilities (Rusydiana et al., 2019). Given this vital role, it is very important to develop a healthy banking system in which banks operate with good performance (Suzuki & Sastrosuwito, 2011).

Efficiency and productivity analysis are very important to do as a form of performance measurement and become one of the main factors in decision-making (Shang, 2005). Using 2 essential components, namely the available inputs to produce maximum output which can be used as one of the leading indicators in measuring competition (Hidayati, 2005). Especially during the Covid-19 pandemic, the measurement of banking efficiency and productivity is very important because banking efficiency is one of the benchmarks that underlies the overall performance of banking.

Therefore, in assessing the performance of each bank, research is needed that specifically assesses the efficiency and productivity of each bank. The measure of bank efficiency is practically measured by the bank's ability to generate operating income using operational costs (Yonnedi & Rahman Panjaitan, 2019). Measurement of efficiency is an essential task in management, to better understand the past achievements of a unit and plan its development in the future (Kao, 2014). Thus, the study of efficiency becomes important considering that competition in the financial services industry is getting more challenging in the era of globalization. In short, only efficient banks will survive, and efficiency itself is related to productivity and profitability (Omar et al., 2007).

In achieving the objectives that have been described, the non-parametric approach of Data Envelopment Analysis (DEA) together with the Malmquist Index was used in this study. As for measuring bank productivity with more than one variable, it is done to get better results. The Malmquist index itself is part of the DEA method which specifically looks at the productivity level of each business unit so that changes in the level of efficiency and technology used will be seen based on predetermined inputs and outputs. In addition, the Malmquist Index is also used to analyze changes in performance over time. So that, in the end, it will be known the productivity of each bank, whether the productivity of a bank is increasing, stable, or decreasing condition (Firmansyah, 2019).

The efficiency of the financial services industry has long been the focus of banking research in recent decades. This is evidenced by the findings of research related to banking efficiency and productivity that have been carried out in Indonesia. Suzuki & Sastrosuwito (2011) calculated the efficiency and productivity of Indonesian Commercial Banks for the period 1994-2008. Research by Omar et al. (2007) has the same goal but focuses on analyzing the National Private Banks in Indonesia. Meanwhile, the research by Yonnedi & Rahman Panjaitan (2019) analyzed the efficiency and productivity of the Regional Development Banks of Indonesia. However, research related to efficiency and productivity in the dual banking system, namely Islamic commercial banks and conventional commercial banks, is still limited.

Research Purpose

There are several objectives of this study, firstly, this study aims to measure and compare the efficiency of Conventional Commercial Banks (BUK) and Islamic Commercial Banks (BUS) using Data Envelopment Analysis (DEA) with CRS and VRS approaches. Second, this study aims to analyze and compare the productivity of Conventional Commercial Banks and Islamic Commercial Banks using the Malmquist Productivity Index with the VRS approach. Third, this study aims to analyze the efficiency and productivity of BUK and BUS during the Covid-19 pandemic. Finally, this study aims to provide an analysis of potential improvement to find out what variables are causing the inefficiency of BUK and BUS in Indonesia.

This research differs from previous research in various aspects. First, this study uses the DEA method to measure efficiency and uses the Malmquist Index method to measure the productivity of Conventional Commercial Banks and Islamic Commercial Banks. Second, this research focuses explicitly on 19 Conventional Commercial Banks and fourteen Islamic

Commercial Banks in Indonesia using the latest data in an observation period of five years (2016-2020). Thus, this research can be used as a guideline for Islamic banks to improve their weaknesses to be able to compete in the global market and achieve the goals that have been set to increase market share. In addition, the goal of strengthening the structure of Islamic banking can be achieved.

Furthermore, this paper is structured as follows. First, this paper presents the background and objectives of the research, the second part reviews the related literature, and the third part describes the methodology, including data and models. The fourth section presents and reports the results, and provides an analysis of the most productive and most efficient conventional and Islamic banks. The fifth section is the closing which contains a summary of the main discussions and recommendations.

Literature Review

Dual Banking System in Indonesia

Along with Indonesia's rapid economic system, financial institutions as intermediary tools are also growing. Since the birth of Law no. 19 of 1998, which amended Law no. 7 of 1992 concerning banking, the term dual banking system emerged, namely the conventional and Islamic banking systems. Currently, the banking industry still dominates the financial system in Indonesia based on the total assets of the financial system (Rahmatika, 2014; Zahra et al., 2018).

In Indonesia, Islamic financial institutions began to emerge with the establishment of Baitut Tamwil-Salman in Bandung and the Ridho Gusti Cooperative in Jakarta in the early 1980s. Then in 1922, the first Islamic Bank was established, namely Bank Muamalat Indonesia (Zulkhibri & Sukmana, 2017). The development of Islamic banks has accelerated since Bank Indonesia, Indonesia's central bank, allowed to open sharia branches in conventional banks. This sharia branch can offer sharia banking products and services that are separate from its conventional parent with its infrastructure, staff, and branches (Ascarya & Yumanita, 2008a).

The dominance of conventional banks that carry out usury-based transactions has made motivation and initiatives by Muslim scholars to empower Sharia law to overcome these problems (Achsani & Kassim, 2021). Recently, Indonesia has not only succeeded in implementing a dual banking system but has also emerged a complete Islamic banking system that operates in parallel with the conventional banking system, namely the Indonesian Islamic banking system (IIB) based on Sharia principles (Junaidi et al., 2021). Islamic banking emerged to meet the demand for Islamic financial services while avoiding illicit practices, such as usury,

maysir, and *gharar*. Islamic banking has also emerged as an answer to public demands for economic and financial activities that align with Islamic teachings and principles (OJK, 2020).

In dynamic competition in the banking industry, Islamic banks are present as businesses that offer financial, investment, and trade opportunities that adhere to sharia principles (Afiatun & Wiryono, 2010). The rapid increase in Islamic banking and the importance of this sector to the country's economy make it essential to have better thought about its efficiency and drivers (Johnes et al., 2014). Efficiency measurement is essential to realize a healthy and sustainable financial performance and a picture of a company's performance. In analyzing a bank's performance, bank efficiency is one of the parameters. In short, a business unit is considered fully efficient if it achieves maximum output for a specific input level or uses a minimum input level to produce a specific output level (Rusydiana & As-Salafiyah, 2021). In addition, with this efficiency assessment, banks are expected to act rationally in minimizing the level of risk faced in carrying out their operational activities (Hidayati et al., 2017).

Thus, an efficient banking system can ensure the smooth running of the state payment system and the effective implementation of monetary policy. To assess the health and performance of the banking industry, the measurement must be checked through the measurement of bank efficiency as researched by several previous researchers who applied parametric and non-parametric approaches in measuring bank efficiency (Amalina et al., 2015). Various methods can be used to measure the performance of banking efficiency, which can be grouped into two main categories: parametric and non-parametric. Furthermore, one of the non-parametric methods commonly used to estimate efficiency scores is Data Envelopment Analysis (DEA) (Hidayati et al., 2017).

Efficiency and Productivity

The concept of efficiency is often seen in terms of costs as inputs and profits as outputs. Business entities always try to keep costs down to the minimum level possible to produce the maximum profit level of output. The concept of efficiency comes from the concept of microeconomics, namely the theory of producers. Producer theory tries to maximize profits or minimize costs from the producer's point of view. In the producer theory, a production frontier curve describes the relationship between inputs and outputs from the production process. This production frontier curve represents the maximum level of output from each input use that represents the use of technology from a company or industry (Hersinta & Akbar, 2013).

Productivity is a concept that measures the ratio of total output to the weighted average of inputs. At the same time, the two essential variants are labor productivity, which calculates the amount of output per unit of labor, and total factor productivity which measures output per unit of total inputs—however, the results scale. The increase has the potential to be significant in many sectors. On some ha scale, declining yields have occurred (Samuelson, Paul, Nordhaus, & William, 2003).

Productivity is a relationship between output and input in production, and productivity can be measured partially or totally; partial productivity is the relationship between output and one input. An example of partial productivity that is often used is labor productivity which shows the average output per worker, or capital productivity which describes the average output per capita. Total productivity, commonly called Total Factor Productivity (TFP), measures the relationship between output and several inputs simultaneously. The relationship is expressed in the ratio of the output index to the aggregate input index. If the ratio increases, more output can be produced using a certain amount of input or a certain number of inputs. Outputs can be produced using fewer inputs (Avenzora, 2008).

Efficiency and productivity are often used as measuring tools to calculate the achievement of a financial institution. This is usually associated with financial institutions achieving their goals. Therefore, efficiency and productivity can be seen in financing and operations as outputs and fixed assets, labor, and customer funds as inputs. Efficiency can be known by calculating the ratio of output and input, while productivity is the relationship between output and input (Putra, Syifadhiya, Widyastiti, & Pambuko, 2018).

Previous Study

Since DEA was first introduced in 1978 in its current form, researchers in several fields (including banking) have realized that this methodology is very good and easy to use for modeling operational processes for performance evaluation. Based on previous research, it was found that many studies discussing efficiency performance in banking have been carried out using data envelopment analysis methods. Ismail et al. (2013) examined the cost efficiency of selected Islamic and conventional commercial banks during the period from 2006 to 2009 in Malaysia. DEA results reveal technical efficiency as the main contributor to the cost efficiency of conventional commercial banks and allocative efficiency as the main contributor to the cost efficiency of Islamic commercial banks. This shows that conventional commercial banks have

been efficient in utilizing information and electronic technology. Islamic commercial banks, on the other hand, have been efficient in allocating and utilizing their resources. Moreover, scale efficiency was found to be the main source of technical efficiency for Islamic and conventional commercial banks, indicating that size is important in improving bank efficiency.

Riani & Ikhwan (2022) measure and compare the efficiency of Islamic and conventional banks in Indonesia and Malaysia, from 2015 to 2020. These results are used to identify input or output variables that must be improved if the Decision-Making Unit (DMU) needs to improve efficiency in informing potential repair. In addition, this study shows that Covid-19 has had an impact on reducing the efficiency level of Bank Indonesia and Malaysia. Meanwhile, Bank Indonesia is relatively efficient compared to Bank Malaysia. However, Islamic banks are more affected by Covid-19 than conventional banks. The most important performance variable that banks must improve during the Covid-19 pandemic is total financing.

In addition to the research above, some have also combined the Malmquist Productivity Index (MPI) to measure productivity and efficiency levels. The studies that have been conducted by Afiatun & Wiryono (2010) analyzed the efficiency and changes in Total Factor Productivity of the banking industry during the period 2004-2009 and looked at the performance of Islamic banking as a new player in the Indonesian banking industry. Furthermore, the Non-parametric Data Envelopment Analysis (DEA) method is used in analyzing the efficiency. Meanwhile, in measuring changes in the Total Factor Productivity of the Islamic banking industry, the Malmquist Productivity Index is used. From the calculation of relative efficiency with input-oriented DEA as well as the assumption of Variable Returns to Scale, these results indicate that the efficiency of Islamic banks in the 2004-2009 period is on average lower than conventional banks; except for the period July 2004 to December 2005. Three Islamic banks were analyzed for this study, namely Bank Muamalat, Bank Syariah Mandiri, and Bank Syariah Mega, ranking 3rd, 10th, and 13th respectively in the productivity index. However, the results of the t-test concluded that the efficiency and productivity of Islamic banks and conventional banks were not statistically significantly different. These results indicate that Islamic banking in general can compete with conventional banking in Indonesia.

Abbas et al (2015) calculated the Malmquist Index of Islamic and conventional banks to compare performance in the sample period 2005-2009. The results showed that the compilation results using the DEA method and the Malmquist Index showed that the Malmquist productivity growth index of Islamic banks remained higher for Islamic banks in 2007 and 2008

compared to conventional banks. However, in 2009, this index also shows that conventional banks achieved higher productivity changes. As the results of the Malmquist TFP index show that the technological change index is the main source of productivity decline, Islamic banks should focus on introducing new technologies that can lead to a positive shift in production limits. They have to diversify their services and products. They must introduce cutting-edge banking technology to provide dynamic, secure, and reliable banking services to their customers. As Islamic banks are not efficient at scale, they have to increase their branch network to take advantage of economies of scale and provide more coverage to their clients.

Kamarudin et al (2017) explore the productivity level of Islamic banks, especially in selected Southeast Asian countries from 2006 to 2014. In addition, this study also investigates the potential determinants of bank-specific characteristics and macroeconomic conditions that can affect the productivity of the banking sector. The results show that domestic and foreign Islamic banks have shown progress in total factor productivity changes solely associated with increased efficiency changes (EFFCH) which are primarily managerial rather than scale related. Foreign-owned banks are slightly more productive than domestic-owned banks, associated with higher EFFCH but not significantly different. In addition, the determinants of capitalization, liquidity, and the world financial crisis have a significant effect on the productivity level of Islamic banks.

Basri et al. (2018) evaluate the impact of foreign Islamic banks in Malaysia by measuring their contribution to the growth of the Malaysian Islamic banking industry with a sample of 16 IBs in Malaysia from 2008 to 2015. Data Envelopment Analysis (DEA) is used to measure the efficiency level of each bank and the comparative performance between Domestic and foreign IBs in the country. In addition, the Malmquist Productivity Index measures changes in its components between subjects and the same time frame. DEA results show that domestic Islamic banks are considered more efficient than most domestic Islamic banks that outperform foreign Islamic banks. The study also found that based on the Malmquist Productivity Index, the least efficient banks based on DEA experienced improvements in technical efficiency, technology, and total factor productivity (TFP).

As indicated in the literature, we found mixed findings about the impact of determinants on productivity levels in global Islamic and conventional banks, but research in Indonesia was found to be limited in examining the efficiency and productivity of banking performance of both conventional commercial banks and Islamic commercial banks. Given this knowledge gap, this study analyzes and compares efficiency and productivity between conventional commercial

banks and Islamic commercial banks using the latest data from 2016-2020.

Research Methods

Data

This study aims to analyze the efficiency and productivity of 14 Islamic Commercial Banks in Indonesia during a five-year observation period in the 2016-2020 period. In researching efficiency and productivity, input and output variables are needed. This study uses input and output variables that refer to the research conducted by (Hadad et al., 2003) and (Almas, 2018). The variables in this study can be seen in table 1 below:

Table 1. Input and Output

No.	Input	Definition
1	Fixed asset	Tangible assets that are used for the production and supply of goods and services, for rental to other parties, or for administrative purposes, and are expected to be used for more than one period.
2	Labor Expenses	Labor costs are the price charged for the use of human labor.
3	Third-Party Funds	Funds collected by banks from the general public consist of demand deposits, savings deposits, and time deposits.
No	**Output**	**Definition**
1	Financing Amount	The financing components used are Murabahah, Mudharabah, and Musyarakah financing, while credit includes all types of loans.
2	Operating Income	In the form of total operating income from the bank concerned

This study uses two approaches, one of which is to measure efficiency using MAX DEA software and to measure the Malmquist productivity index using DEAP 2.1 software.

Research Approach

Data Envelopment Analysis

Data Envelopment Analysis was originally developed by Charnes, Cooper & Rhodes (1978) and later developed again by Banker, Charnes, & Cooper (1984) to measure the productivity and efficiency of business units. DEA is widely used to measure technical efficiency, including financial institutions (Sharma et al., 2013). The DEA method can provide information about

Decision Making Units (Islamic Banks) that are inefficient in using input and output variables. This method also provides information on how much input and output must be adjusted to achieve efficiency. There are two basic models in the analysis using DEA including the Charnes, Chopper & Rhodes (CCR) model and the Bankers, Charnes & Rhodes (BCR) model.

The BCC/BCR model in which the BCR model assumes changes in the output value produced by the DMU is different for each proportion of changes in certain input values. This is in line with the Variable Return to Scale (VRS), which means that each input does not necessarily produce the same output. Meanwhile, the CCR model assumes that the change in the output value generated by the DMU is constant for every proportion of the change in the regular input value. This is in line with the CRS (Constant Return to Scale Model) which means that each input produces the same output.

Malmquist Productivity Index (MPI)

The DEA-based Malmquist Productivity Index (MPI) was originally introduced by Caves, Christensen, and Diewert (CCD) in 1982 and applied empirically by Färe, Grosskopf, Lindgren, and Roos in 1992 and Färe, Grosskopf, Norris, and Zhang in 1994. In this study, changes in the productivity of Islamic banks were measured using MPI with output orientation. Next, the Total Factor Productivity Change (TFPCH) will be determined to be a Technological Change (TECHCH) and an Efficiency Change (EFFCH). EFFCH changes are associated with Pure Technical Efficiency Change (PTECH), and Scale Efficiency Change (SECH). The interaction between efficiency indices is shown in Figure 1:

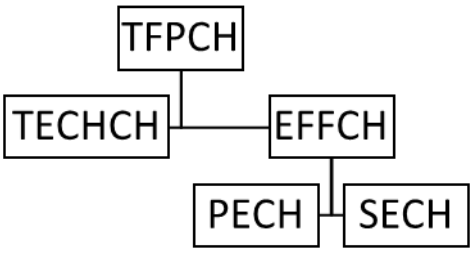

Figure 1. Productivity Index

The efficiency change index can be further decomposed into mutually comprehensive PECH (Pure Efficiency Changes) components, calculated relative to VRS technology and SECH (Scale Changes) components, capturing deviations between VRS and CRS technologies according to Färe's suggestion. Factors of change in productivity can be seen through the value of the Efficiency Change Index (EFFCH) and Technology Change Index (TECHCH) to explain changes in productivity. Meanwhile, the 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 of Conventional Commercial Banks and Islamic Commercial Banks.

Result and Discussion

Banking Efficiency Analysis

Efficiency Score of Conventional Commercial Banks (BUK) in Indonesia

Table 2. Average BUK Efficiency Score in Indonesia

Bank	CRS	VRS
Bank BTPN	0,812	0,907
Bank Central Asia (BCA)	0,624	0,973
Bank Commonwealth	0,562	0,699
Bank Danamon	0,824	0,994
Bank Ganesha	0,495	0,509
Bank Mandiri	0,683	0,988
Bank Mizuho	0,966	0,973
Bank Negara Indonesia (BNI)	0,638	0,948
Bank Panin	0,667	0,891
Bank Rakyat Indonesia (BRI)	0,638	1,000
Bank Tabungan Negara (BTN)	0,896	0,973
Bank UOB	0,513	0,700
Bank Victoria	0,456	0,502
BJB	0,602	0,651
PT Bank DKI	0,721	0,751
PT Bank Mega	0,491	0,640
PT Bank Permata	0,589	0,838
PT Maybank Indonesia	0,623	0,861
Sinarmas	0,849	0,861

Table 2 above shows the average efficiency score of Conventional Commercial Banks in Indonesia with a total of 19 banks. Measurement of banking efficiency is carried out using two approaches, namely Constant Return to Scale (CRS) and Variable Return to Scale (VRS).

Efficiency results based on CRS analysis show that no BUK achieves maximum efficiency (1,000). However, several banks have a fairly high-efficiency score, including Mizuho Bank (0.966), State Savings Bank (0.896), Sinarmas (0.849), Bank Danamon (0.824), and Bank BTPN (0.812). In addition, there are also banks with the lowest efficiency, including Bank Victoria (0.456), PT Bank Mega (0.491), and Bank Ganesha (0.495).

Furthermore, the analysis of the BUK efficiency score using the VRS approach shows that only one bank has achieved maximum efficiency (1,000), namely Bank Rakyat Indonesia. Then other BUKs have a fairly high-efficiency score, including Bank Danamon (0.994), Bank Mandiri (0.988), Bank Central Asia (0.973), Mizuho Bank (0.973), State Savings Bank (0.973), and Bank Negara Indonesia (0.948). Besides that, some banks have the lowest efficiency compared to other banks, namely Bank Victoria (0.502) and Bank Ganesha (0.509).

Efficiency Score of Islamic Commercial Banks (BUS) in Indonesia

Table 3. Average BUS Efficiency Score in Indonesia

Bank Umum Syariah	CRS	VRS
PT Bank Aceh Syariah	0,337	0,657
PT Bank BNI Syariah (BSI)	0,137	0,647
PT Bank BRI Syariah (BSI)	0,096	0,413
PT Bank Jabar Banten Syariah	0,227	0,303
PT Bank Mega Syariah	0,225	0,282
PT Bank Muamalat Syariah	0,435	0,676
PT Bank Panin Dubai Syariah	0,090	0,172
PT Bank Syariah Bukopin	0,302	0,313
PT Bank Syariah Mandiri (BSI)	0,109	0,765
PT Bank Tabungan Pensiunan Nasional Syariah	0,376	0,806
PT Bank Victoria Syariah	0,095	0,100
PT BCA Syariah	0,238	0,245
PT BPD Nusa Tenggara Barat Syariah	0,087	0,134
PT Maybank Syariah Indonesia (PT Bank Net Syariah)	0,724	0,728

In addition to analyzing the efficiency of Conventional Commercial Banks (BUK), this study also aims to analyze the efficiency of Islamic Commercial Banks (BUS) in Indonesia with a total of 14 banks. In analyzing bank efficiency, this study uses the CRS and VRS approaches. Table 3

above shows the results of the average BUS efficiency score in Indonesia. If we look at the results of the average efficiency score using the CRS and VRS approaches, it is known that none of the banks has succeeded in achieving maximum efficiency (1,000). From the results of the average score of BUS efficiency in Indonesia, it shows that BUS still really needs to improve efficiency because it is in the category of banks with low efficiency.

If you review the results of the average efficiency score using the CRS approach, there is one bank that has a fairly high efficiency compared to other BUS, namely PT Maybank Syariah Indonesia (0.724), while other banks fall into the category with low efficiency with a score below 50%. Then if you look at the average efficiency score using the VRS approach, there are three banks with high efficiency compared to other BUS, including PT Bank Tabungan Pensiunan Nasional Syariah (0.806), PT Bank Syariah Mandiri (0.765), and PT Maybank Syariah Indonesia (0.728). Meanwhile, another BUS falls into the low category with an efficiency score below 70%.

Comparison of BUK and BUS Efficiency Trends in Indonesia Using the CRS Approach

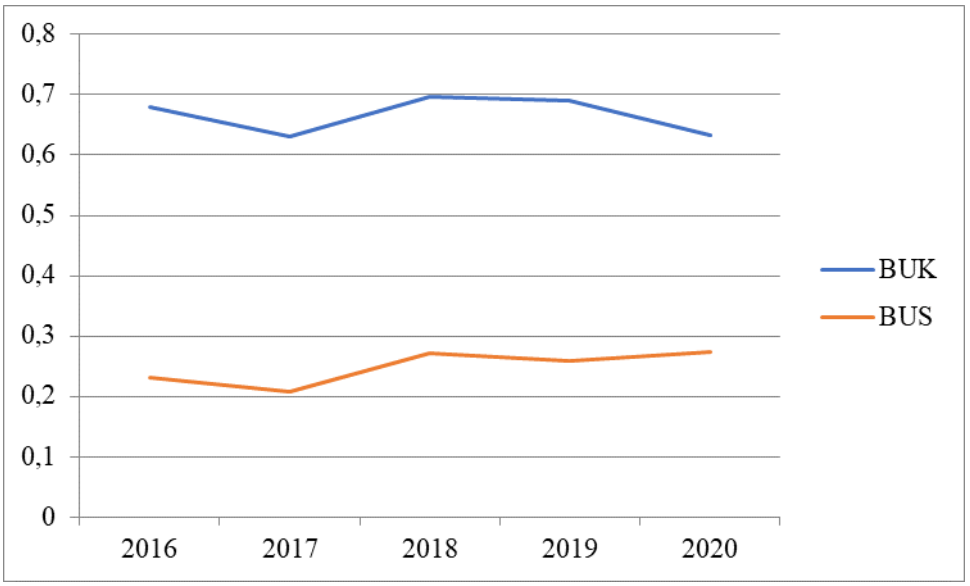

Figure 2. Trends in BUS and BUK Efficiency with the CRS Approach

Figure 2 above is the trend of BUS and BUK efficiency in Indonesia using the CRS approach. From the graph, it can be seen that BUK has a higher efficiency than BUS. From the figure above, it can be seen that the trend of BUK and BUS efficiency fluctuates every year. For the analysis of the trend of BUK efficiency, it can be seen that in 2017 the efficiency decreased, then increased again in 2018. Furthermore, in 2019 the efficiency increased slightly but not significantly, and in the following year, 2020 the efficiency of the BUK again decreased. The next analysis is the trend of BUS efficiency with the CRS approach which showed a decline in 2017 and then increased

again in 2018. Furthermore, in 2019 BUS efficiency again decreased, and in the following year, 2020, BUS efficiency increased slightly although not significantly.

Comparison of Trends in BUK and BUS Efficiency in Indonesia Using the VRS Approach

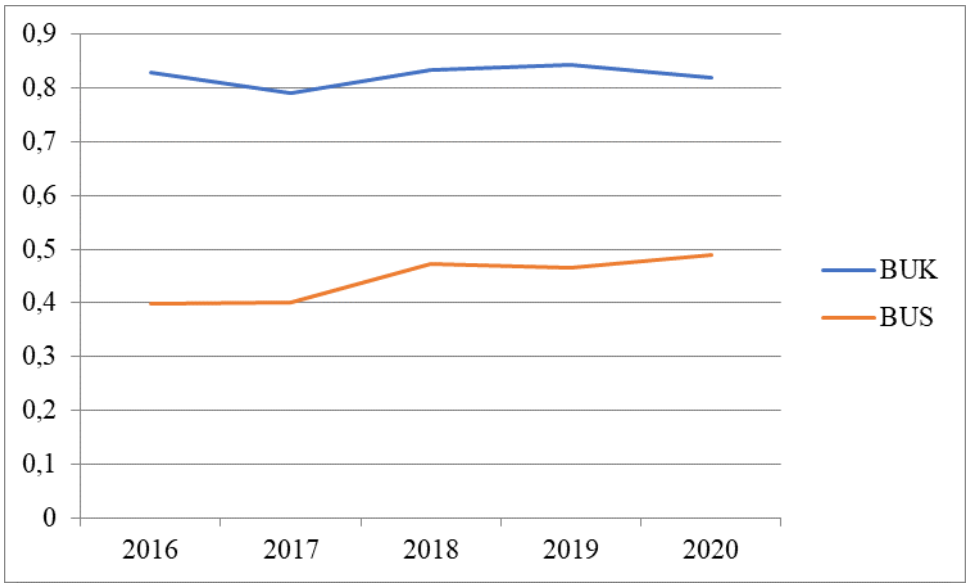

Figure 3. Trends in BUS and BUK Efficiency with VRS Approach

Figure 3 below is a trend of BUS and BUK efficiency in Indonesia using the VRS approach. Similar to using the CRS approach, in the VRS approach it can be seen that BUK has higher efficiency than BUS. From the figure above, it can be seen that the trend of BUK and BUS efficiency fluctuates every year. For BUK efficiency trend analysis, it can be seen that in 2017 efficiency decreased, then increased again until 2019 although not significantly. In the following year, 2020, the efficiency of BUK again decreased. The next analysis is the trend of BUS efficiency with the VRS approach which shows an increase from 2017 to 2018. Furthermore, in 2019 BUS efficiency again decreased, and in the following year, 2020, BUS efficiency increased slightly although not significantly.

Analysis of BUK and BUS Productivity in Indonesia

Comparison of Trends in BUK and BUS Productivity in Indonesia using the VRS

Total Factor Efficiency Changes (TFPCH) are influenced by Efficiency Changes (EFFCH) and Technological Changes (TECHCH). Meanwhile, Pure Efficiency Changes (PECH) and Scale Efficiency Changes (SECH) are used to determine the causes of changes to Efficiency Changes (EFFCH). If the TFPCH value shows M>1, this indicates that there has been an increase in

productivity. M=1 indicates that there has been no increase in productivity, and M<1 indicates a decrease in bank productivity.

Table 4. Malmquist Index Score for Conventional Commercial Banks

year	effch	techch	pech	sech	tfpch
2016-2017	0,987	1,121	1,000	0,987	1,106
2017-2018	0,974	0,919	0,961	1,013	0,894
2018-2019	0,984	1,006	1,008	0,976	0,990
2019-2020	0,056	35,777	0,676	0,083	1,998
Mean	**0,479**	**2,468**	**0,900**	**0,533**	**1,183**

Table 4 above shows the Malmquist index score for conventional commercial banks in Indonesia. The results of the TFPCH score show that bank productivity has fluctuated from year to year. If you look at the average productivity score over the five-year observation period, it is known that BUS productivity has increased with changes in technology (TECHCH) which have increased, although changes in efficiency (EFFCH) have decreased.

As already mentioned, productivity is determined by changes in technology and efficiency. In 2016-2017 it is known that the average bank productivity has increased with changes in technology that have increased, even though bank efficiency has decreased. Furthermore, in 2017-2018, it is known that bank productivity has decreased with changes in technology and the efficiency of both has also decreased. Then in 2018-2019, it is known that productivity decreased, but when compared to the previous year productivity increased. In that year it was known that technological change experienced a slight increase, although efficiency decreased. Finally, in 2019-2020 it is known that bank productivity has increased significantly with changes in technology that have experienced a drastic increase, although efficiency has decreased significantly compared to previous years. From the results of further analysis regarding the productivity of Conventional Commercial Banks in Indonesia, it can be seen that the dominant factor influencing the increase in bank productivity is technology.

Table 5. Malmquist Index Score for Islamic Commercial Banks

Year	effch	techch	pech	sech	tfpch
2016-2017	3,690	0,174	1,509	2,445	0,642
2017-2018	1,138	1,132	1,037	1,097	1,289
2018-2019	0,871	0,973	0,901	0,966	0,847
2019-2020	0,752	8,901	1,027	0,732	6,693
Mean	**1,288**	**1,143**	**1,097**	**1,174**	**1,472**

Table 5 above shows the Malmquist Index Score for Islamic Commercial Banks (BUS) in Indonesia. From the table, it can be seen that during the five-year addressing period, the average bank experienced an increase in productivity followed by an increase in technological change and efficiency change. In 2016-2017 it is known that bank productivity has decreased with changes in technology that have decreased, although changes in efficiency have increased. Furthermore, in 2017-2018 it is known that bank productivity has increased with changes in technology and efficiency, both have increased. Then in 2018-2019, it was discovered that bank productivity had decreased again with the value of technological change and efficiency both having decreased. Finally, in 2019-2020 it is known that bank productivity has increased significantly with changes in technology that have also experienced a significant increase, although changes in efficiency have decreased. From the results of an analysis of the productivity of Islamic Commercial Banks (BUS) in Indonesia, it is known that technology has a dominant influence on increasing bank productivity.

The Impact of the Covid Pandemic on Bank Efficiency and Productivity

The Impact of the Covid-19 Pandemic on the Efficiency of BUK and BUS in Indonesia

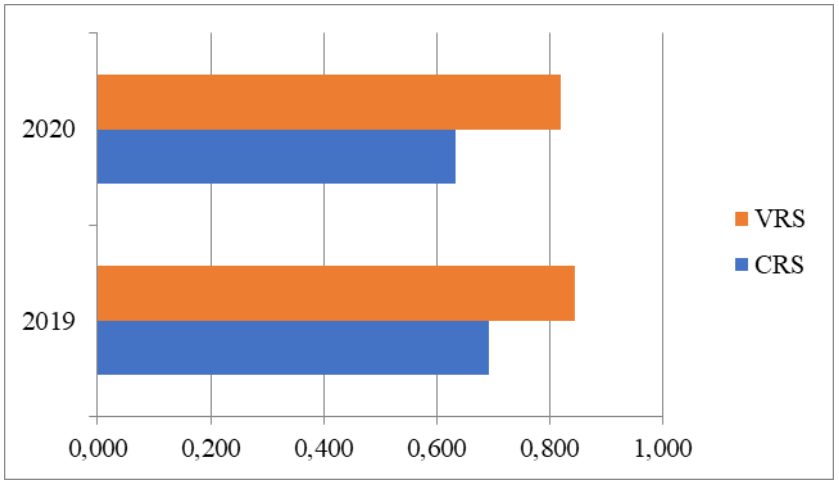

Figure 4. BUK Efficiency Score during the Covid-19 Pandemic

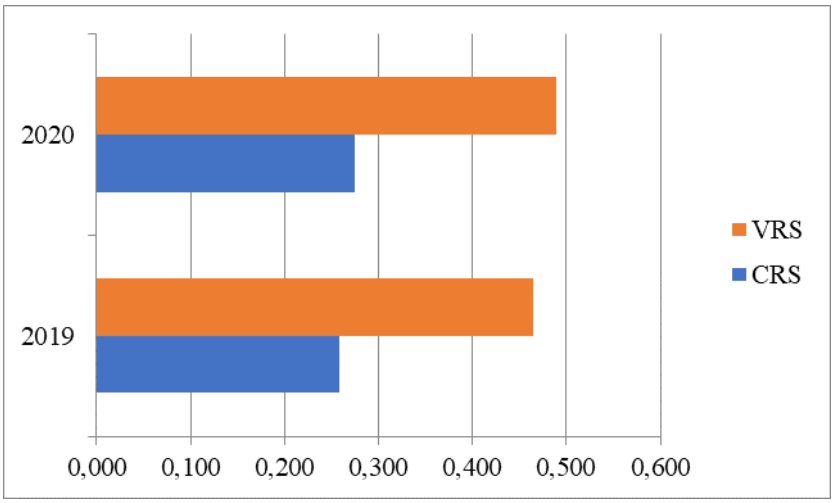

Figure 5. BUS Efficiency Score during the Covid-19 Pandemic

Figures 4 and 5 above show the efficiency scores of Conventional Commercial Banks (BUK) and Islamic Commercial Banks (BUS) in Indonesia during the Covid-19 pandemic. From these results, it can be seen that during the Covid-19 pandemic, Conventional Commercial Banks experienced a decrease in efficiency using both the CRS and VRS approaches. In contrast to Conventional Commercial Banks, during the Covid-19 pandemic, the efficiency of Islamic Commercial Banks (BUS) was relatively stable and experienced a slight increase, although not significantly.

The Impact of the Covid-19 Pandemic on the Productivity of BUK and BUS

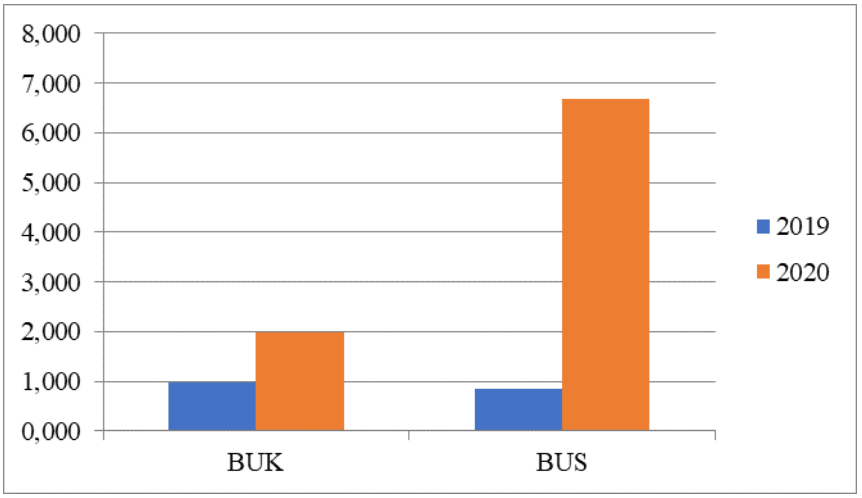

Figure 6. BUK and BUS Productivity Scores in Indonesia During the Covid-19 Pandemic

Figure 6 above is a graph of the productivity scores of Conventional Commercial Banks (BUK) and Islamic Commercial Banks (BUS) in Indonesia. In the analysis of bank productivity, it is known that during the Covid-19 pandemic, BUS and BUK in Indonesia experienced an increase in productivity, especially BUS which experienced a significant increase in

productivity. If you look at the analysis of the factors that affect productivity, during the Covid-19 pandemic, both BUK and BUS experienced a decline in terms of changes in efficiency, but in terms of technology experienced a very significant increase. The increase in terms of technological change is what causes bank productivity to increase, even though changes in efficiency experience a significant decrease.

The Impact of the Covid Pandemic on Bank Efficiency and Productivity

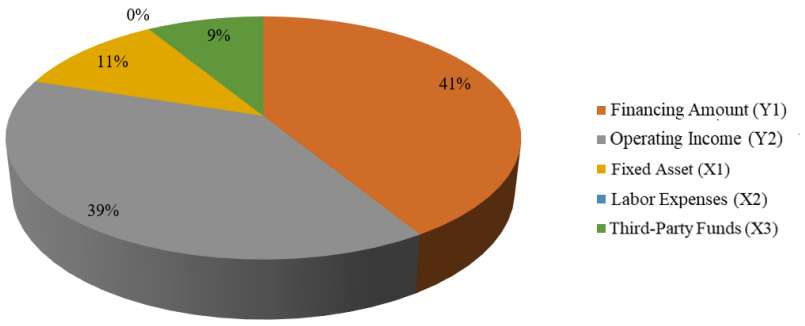

Figure 7. BUK Potential Improvement Analysis

Potential Improvement analysis is carried out to analyze the input and output variables that cause bank inefficiencies. The results of the potential improvement analysis can be used as a reference for companies to improve efficiency in the following year. Then the potential improvement analysis is carried out by relinquishing the last year of the research period which in this case is 2020. Figure 7 shows the results of the potential improvement analysis of Conventional Commercial Banks in Indonesia, from these results it can be seen that the causes of BUK inefficiency mostly come from output variables namely the amount of financing and operating income. In order for banks to improve efficiency, the output variable, namely the amount of financing, needs to be increased by 41% and operating income needs to be increased by 39%.

In addition to providing an analysis of potential improvement for BUK, this research also provides an analysis of potential improvement for BUS in Indonesia. Figure 8 shows the results of the potential improvement analysis of Islamic Commercial Banks in Indonesia. Similar to Conventional Commercial Banks, from these results it can be seen that the cause of bank inefficiency comes from the output variables, namely the amount of financing and operating income. So that Islamic Commercial Banks can increase their efficiency, the output variable, namely the amount of financing, needs to be increased by 55% and operating income needs to be increased by 31%.

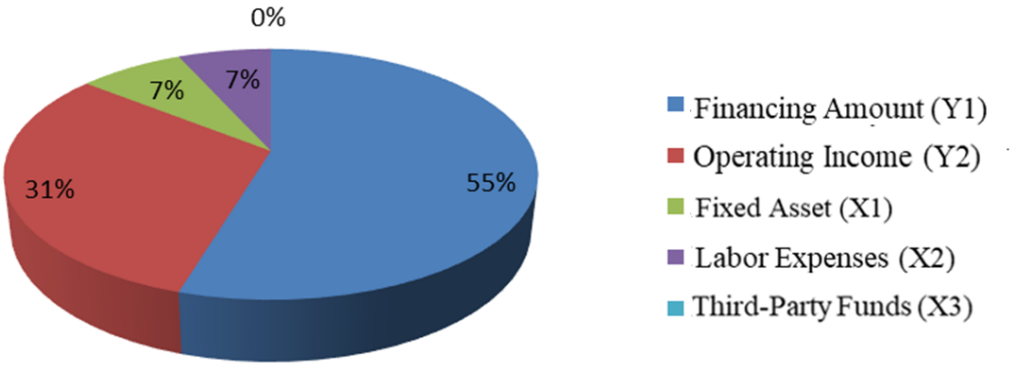

Figure 8. BUS Potential Improvement Analysis

Findings

From the results of the analysis that has been carried out regarding the Efficiency and Productivity of Conventional Commercial Banks (BUS) and Islamic Commercial Banks (BUS) in Indonesia, there are several findings from this study. The first finding is related to the average efficiency scores of BUK and BUS in Indonesia. The results of this analysis show that there are still many banks that have not achieved maximum efficiency. From these results, it is also known that several banks have a quite high efficiency using both the CRS and VRS approaches, but there are also several banks with low efficiency. Furthermore, related to the efficiency comparison trend between Conventional Commercial Banks and Islamic Commercial Banks in Indonesia. The results of the analysis show that conventional commercial banks have a higher efficiency score than Islamic commercial banks in Indonesia.

Various factors cause inefficiency in the banking industry, especially Islamic commercial banks in Indonesia, including the inability of banks to balance the use of input and output variables as described in Figures 7 and 8. The results of the potential improvement analysis carried out discussed the input and output variables that cause bank inefficiencies. In short, an institution can be said to be efficient if it can use its input to produce maximum output without wasting resources (Naufal & Firdaus, 2018). Line with Prativi, Dewi & Lubis (2020) states that an institution is said to be efficient if it can produce maximum output at a certain level of input, or can minimize costs (input) to achieve a certain level of output. The causes of the inefficiencies of the two types of banks will be explained in the potential improvement analysis.

The second finding of this study can be seen from the Malmquist Index scores of BUK and BUS in Indonesia. As already mentioned, bank productivity is influenced by two factors, namely changes in technology and efficiency. In the case of BUK and BUS in Indonesia, it is known that the dominant factor causing an increase in bank productivity is influenced by changes in

technology. As explained in Figure 6, it is known that during the Covid-19 pandemic, there was an increase in the productivity of both BUS and BUK in Indonesia which indicates that this increase occurred on the side of technological change. Thus digital transformation in the banking industry needs to be carried out and is one of the strategies to make it more competitive (Bahrini, 2015; Rani et al., 2020). Digital technology is needed by banks to assist in the process of completing all work, changing the way banks interact with customers, and creating new sources of income (Norafni et al., 2020).

The fourth finding of this study is related to the impact of the Covid-19 pandemic on the efficiency and productivity of BUK and BUS in Indonesia. In the analysis of banking efficiency, it can be seen that during the Covid-19 pandemic, the efficiency of BUK in Indonesia has decreased, meanwhile, the efficiency of BUS in Indonesia has been relatively stable and even slightly increased although not significantly. In contrast to the efficiency analysis, during the Covid-19 pandemic, the productivity of both BUK and BUS experienced an increase due to changes in technology which also experienced a very significant increase.

As research conducted by Ningsih and Mahfuz (2020) shows that since the Covid-19 pandemic entered Indonesia, all banks in Indonesia have experienced a decline in terms of collection and financing, this decline certainly affects the efficiency of the bank concerned. In the case of the Covid-19 pandemic, the average level of efficiency for the banking industry in Indonesia decreased due to a decrease in income and financing distribution, while banking operational costs continued to increase to meet the daily needs of banking operations. Therefore, it is very necessary to make efforts to improve the banking sector to achieve an optimal level of efficiency

The fifth finding of this study is related to the analysis of banking potential improvement. From the results of this analysis, it is known that the cause of the inefficiency of BUK and BUS in Indonesia comes from the output variables, namely the amount of financing and operating income. Efficiency in financing can be measured by two aspects of assessment, the first is the bank's ability to produce output, which in this case is low-cost financing, and this aspect has a close relationship with the financing ratio and the development of bank assets. Furthermore, the second aspect is the bank's performance in minimizing risk in the financing, or the bank's ability to channel financing and minimize risk (Iskandar, 2012). Improving the efficiency and effectiveness of financing products will encourage the growth of banking assets and profitability. In addition, this will also increase the role of banking in managing customer funds

so that their allocation can be more effective and efficient for the common good (Hibatullah & Nurcahyani, 2021).

Conclusion

This study aims to analyze and compare the efficiency and productivity of Conventional Commercial Banks (BUK) and Islamic Commercial Banks (BUS) in Indonesia with a total of 19 BUK and 14 BUS during the five-year observation period (2016-2020). In measuring efficiency, this study uses two approaches, namely CRS and VRS using Data Envelopment Analysis, meanwhile to analyze the productivity of this study using the VRS model using the Malmquist Productivity Index.

The results obtained from the efficiency analysis using DEA show that there are still many BUK and BUS in Indonesia that have not achieved maximum efficiency, and there are even BUK and BUS that have low efficiency. When compared between the two types of banks, based on the results of the analysis it is known that BUK has higher efficiency compared to BUS.

Furthermore, this study also reveals the results of the Malmquist index score on BUK and BUS in Indonesia changes in productivity are influenced by the level of changes in efficiency and changes in technology. This study found that the dominant factor causing the productivity of BUK and BUS in Indonesia was influenced by technological change.

Based on the results of an analysis of the efficiency of BUK and BUS in Indonesia during the Covid-19 pandemic, namely in the last two years of the research period (2019-2020), the results show that the efficiency of BUK has decreased, meanwhile the efficiency of BUS has been relatively stable and has even increased slightly. Furthermore, when viewed from a productivity standpoint during the Covid-19 pandemic, BUK and BUS experienced an increase in productivity due to high changes in terms of technology, even though changes in efficiency had decreased. Then, based on the results of the potential improvement analysis from BUK and BUS in Indonesia, it shows that the variable causing bank inefficiency comes from the output variable, namely the amount of financing provided and operating income.

Recommendation

There are several suggestions from the research results for some parties, both practitioners, academics, and regulators. For banking practitioners, especially BUK and BUS in Indonesia, it is hoped that they can maximize the amount of financing to the public by offering financing products that are more competitive than conventional products. Besides, marketing techniques

must be more innovative so that they can be absorbed by various circles of society. The next suggestion for banking practitioners is that they must improve the quality of innovation and use of technology and create digital banking products for customers. Then, suggestions for academics are to update information on banking efficiency and productivity by upgrading the research period and expanding the object of research. With further research conducted by academics, it is hoped that they can find ways to improve banking efficiency and productivity. Finally, there is a suggestion for regulators, namely that technology and digitalization regulatory support is needed for Islamic banking to improve quality and productivity.

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