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Efficiency Analysis Of Commercial Banks And Islamic Commercial Banks : Evidence From Indonesia

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ABSTRACT

The purpose of this study is to examine the efficiency of commercial banks (BUK) and Islamic commercial banks (BUS) in Indonesia, which has a total of 19 BUK and 14 BUS. The CRS and VRS models are used in this study to analyse efficiency with data envelopment analysis over a five-year period (2016-2020) using the intermediary approach. According to the study's findings, there are still many BUKs and BUSs that need to improve their efficiency, as well as many efficient BUKs and BUSs. When comparing the two types of banks, the analysis results show that BUK is more efficient than BUS. The output variables, namely the amount of financing and operating income, are the leading cause of BUK and BUS inefficiency in Indonesia. This study also found that the COVID-19 pandemic reduced the efficiency of the BUK while maintaining or slightly increasing the efficiency of the BUS.

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1. INTRODUCTION

Covid-19, which debuted for the first time in China in December 2019, has rapidly spread across the globe. The consequences of the Covid-19 pandemic have not only been experienced from a health standpoint, but also on a global economic level [1]. The banking business, which is the core of a nation's economy, is a sector that has a significant impact [2]. Commercial banks and Islamic banks make up the majority of the Indonesian financial industry. In 1992, the founding of the first Islamic bank, Bank Muamalat Indonesia, sparked the development of the Islamic financial economy in Indonesia [3];[4];[5]. In 1998, as part of a new banking regulation, Bank Indonesia acknowledged the existence of a dual conventional and Islamic (sharia-based) banking system [6]. In addition, the Islamic financial system is quickly emerging alongside the traditional financial system [7]; [8].

The Covid-19 pandemic has increased the banking sector's credit or financing risk to the point where it cannot freely channel funds because to the elevated default risk. In addition to rising credit risk, the impact of the corona virus pandemic has affected the performance of other banking fundamentals, such as capital, Capital Adequacy Ratio (CAR) from the range of 23-24% as of November 2019 to 21.74% as of March 2020 [9]. In addition to dropping capital, the banking sector also had a decline in third party funds (DPK), which tended to see a

slowdown in growth, as evidenced by the fact that in April 2020, the banking sector's DPK grew by 9.12 percent, a decrease from the previous month. This is projected to continue to undergo a decline if no preparations are made.

The high risk of credit and financing during the corona virus pandemic, followed by a decline in capital and third party funds (DPK), has the potential to cause liquidity problems for the banking industry, particularly for credit institutions whose major business is lending. Covid-19 epidemic affected national banking liquidity [10];[11]. Therefore, financial institutions play a crucial role, one of which is through the Deposit Insurance Agency (LPS) in implementing credit or financing restructuring programs in banks and other policies to preserve the stability of the banking financial system.

In the aftermath of the Covid-19 pandemic in 2020, the resilience of Islamic finance has strengthened. This is demonstrated by the growth of 105 basis points (yoy) in the CAR ratio of Islamic Commercial Banks (BUS) to 21.64%. In the meantime, Islamic banking's function as an intermediary is operating efficiently. Financing supplied (PYD) and Third Party Funds (DPK) expanded by 8.08% (yoy) and 11.98% (yoy), respectively, resulting in an increase of 13.11% (yoy) in Islamic banking assets during this time (yoy). Total Assets, PYD, and DPK of sharia banking reached IDR 608.90 trillion, IDR 394.63 trillion, and IDR 478.80 trillion by the end of 2020 [9].

In the meantime, based on the Global Islamic Finance 2020 report, Indonesia is acknowledged as one of the top countries in the Islamic Finance Country Index (IFCI). Despite attaining a relatively high score of 82.01 in 2020, Indonesia's Islamic finance industry is viewed as having significant growth potential. Islamic banking's market share has increased annually, reaching 6.51 percent at the end of 2020 and 6.55 percent at the start of 2021. Even though this level of market share is an accomplishment in and of itself, Islamic banking still has room for improvement in terms of performance and efficiency. Transformation of sharia business units to sharia commercial banks [12].

As a form of performance measurement, efficiency analysis is crucial and is one of the most influential variables in decision-making [13]. By combining two essential factors, namely available input and maximum output, one of the primary indicators for gauging competitiveness can be derived [14]. Measuring banking efficiency and productivity is crucial, especially during the Covid-19 pandemic, because banking efficiency is one of the key performance indicators underlying overall bank performance.

In order to examine the performance of each bank, it is necessary to conduct research that precisely evaluates each bank's efficacy. The The ability of a bank to generate operational income while incurring operating expenses is a useful indicator of its efficiency [15].Measuring efficiency is a crucial management activity for gaining a deeper understanding of a unit's past accomplishments and future plans [16]. Given that rivalry in the financial services business is intensifying in the era of globalization, the study of efficiency becomes increasingly significant. In short, only the most efficient banks will survive, and efficiency is correlated with production and profitability [17].

This study employs a non-parametric Data Envelopment Analysis (DEA) approach in order to accomplish the aforementioned goals. The DEA technique focuses on efficiency in particular. The efficiency of the financial services industry has long been the focus of banking research over the past many decades. However, research pertaining to the efficiency and productivity of the dual banking system, comprising Islamic commercial banks and conventional commercial banks, remains sparse.

Purpose Of Study

This research has multiple purposes, including measuring and comparing the efficiency of conventional commercial banks (BUK) and Islamic commercial banks (BUS) using Data Envelopment Analysis (DEA)

(DEA). The second objective of this research is to assess the efficacy of BUK and BUS during the Covid-19 epidemic. Lastly, this study seeks to provide an analysis of potential enhancements in order to determine which variables are responsible for the inefficiency of BUK and BUS in Indonesia.

2. LITERATURE REVIEW

2.1 Efficiency Theory

Microeconomic ideas, specifically consumer theory and producer theory, establish efficiency. The consumer theory seeks to maximise utility or happiness from the individual's perspective, whereas the producer theory seeks to maximise profits or minimise expenses from the producer's perspective. In producer theory, the link between input and output of the production process is A production line describes it. This output represents the highest possible output from the use of each input. Also indicates the technology used by a business or industry unit. A technically efficient business unit is one that operates at the cutting edge of production. The production limit line is depicted in Figure 3.1.

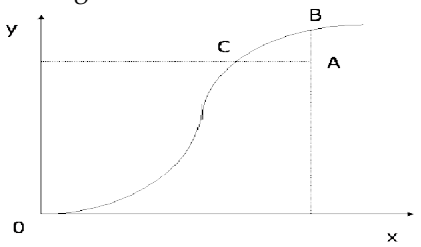

Figure 1. Production Boundary Line

Economic theory distinguishes two types of efficiency: technical efficiency and economic efficiency. Economic efficiency is viewed from a macroeconomic perspective, whereas technical efficiency is viewed from a microeconomic perspective. Technical efficiency is limited to the technical and operational relationships involved in the conversion of inputs to outputs. Furthermore, in a pricing system, efficiency is not guaranteed because prices are subject to macroeconomic policies. Efficiency as having two components: (1) technical efficiency represents a business unit's ability to optimise output over a variety of inputs. (2) Allocative efficiency is the ability of business units to use inputs in optimal pricing-based proportions [18]. Economic efficiency is the result of combining the two types of efficiency. A company is efficient if it can reduce production costs to generate specific outputs while maintaining the overall level of technology and market pricing. Technological efficiency is only one component of overall economic efficiency. To achieve economic efficiency, a corporation must produce the most output with the least amount of input (technical efficiency) and produce output with the best combination at a predetermined price (allocation efficiency).

During the economic change, banking efficiency has become a major concern [19]. All countries in transition have experienced at least one banking crisis, and many have experienced multiple crises. The majority of emerging economies, including Indonesia, have experienced banking crises in the past, making banking efficiency an essential problem. There are numerous parametric and nonparametric studies on banking efficiency. In addition, conventional and Islamic banks are included in the scope of the study.

2.2 Measurement of Efficiency with a Non Parametic Approach

Since its inception in its current form in 1978, researchers in a variety of disciplines (including banking) have found this technique to be effective and simple to implement for modelling operational processes for performance evaluation. On the basis of past research, it was determined that a large number of studies analyzing efficiency performance in banking have utilized data envelopment analysis.

Because intermediation is a fundamental element of Islamic banking, [20] examined the efficacy of 18 Islamic banks from diverse nations between 1997 and 2000 using an intermediation technique. [21] evaluate the efficiency of Islamic banks in Indonesia between 2002 and 2004 using both intermediation and production techniques, as Islamic banking may be viewed as both an intermediary institution and a production

organization. For the same reasons as [20] examined the efficiency of Islamic window banks in Malaysia from 2001 to 2004 using an intermediation technique.

Conducted another study on banking efficiency utilizing DEA (2003) [19];[22]. Efficiency of banks in Croatia from 1995 to 2000 using an intermediation and production approach, as banking served not only as a middleman for loans and investments, but also as a producer of loans and investments [19]. In the meantime, Hadad et al. measured the efficiency of Indonesian banks from 1995 to 2003 using the asset technique to determine the effect of mergers and acquisitions. Examined the cost-effectiveness of selected Islamic and conventional commercial banks in Malaysia between 2006 and 2009. CCR and BCC models as fundamental DEA models to determine the efficiency of Islamic commercial banks in Indonesia from 2007 to 2014. From 2015 to 2020, Riani and Ikhwan measure and compare the efficiency of Islamic and conventional banks in Indonesia and Malaysia [5].

The actions of financial institutions, such as banks, allow for the evaluation of their parametric or non-parametric efficiency. There are three ways to explain the link between input and output variable bank variables. In enterprise microeconomics theory, the production (operational) approach and the intermediary approach utilize the classical methodology. In contrast, the modern approach (or assets) applies a modified version of the classic theory of the firm, which incorporates some of the particularities of bank activities, such as risk management and information processing, as well as several forms of agency problems, which are crucial for explaining the role of financial intermediaries [23].

Using all accessible sources of production, such as labor and physical capital, the production approach defines banking activity as the creation of services for depositors and borrowers. In addition, the intermediation approach characterizes banking activities as those of intermediaries whose responsibility it is to convert money borrowed from depositors (surplus) into money lent to borrowers (deficit). In contrast, the asset approach or modern method attempts to enhance the previous two approaches by including risk management, information processing, and agency difficulties into the classical theory of the enterprise. The following is a summary of the methodology utilized in past studies.

Table 1 Methodology and Input-Output Variables for Efficiency Evaluation

Author	Input	Output
Intermediation Approach		
Ascarya & Yumanita 2007	Labor cost, fixed assets, total deposits	Total loans and Income
Mochtar et al 2007	Labor cost, total deposits, other operating/overhead expenses	Total earning, assets (financing/loans; dealing securities, investment securities, placement with other banks)
Zamir & Rahman 2007	Staff cost, capital (net book value of premises and fixed asset), total deposits & loanable funds.	Loan and advances, income (total interest income, non interest income and income from IBS)
Ascarya & Yumanita 2007	Labor cost, Fixes Assets, Total deposits	Total loan and Income
Sufian 2006	Labor cost, Fixed Assets, Total deposits	Total loans and Income
Ascarya & Yumanita 2007	Staff cost, fixed assets, total deposits	Total loans, other income, liquid assets
Yudhistira 2003	Staff cost, fixed assets, total deposits	Total loans, other income, liquid assets
Jemric & Vujcic 2002	No.of Employees, fixed assets & Software; Total deposits	Total loans, short term securities
Production Approach		
Ascarya & Yumanita 2006	Interest costs, Staff costs, operational costs	Interest income, other operational income
Jemric & Vujcic 2002	Interest and related costs, commissions for services & related costs, labor related adm cost, capital related adm cost	Interest & related revenues, non interest revenues
Asset Approach		
Hadad et al 2003	Staff cost to total assets, interest costs to total assets,	Financing to connected party, financing to other party, financial papers

	other costs to total assets	

Source : Ascarya, 2016

The conclusion of this study is that the asset method is an advanced strategy that considers banks as having not only the traditional intermediate function, but also a variety of new activities. Therefore, the asset-based approach is inappropriate for BUK and BUS, which are focused on funding the real sector. In addition, the production model is applicable to Islamic banking because it regards banking as a general business unit. However, it has grown overly generic and no longer captures the spirit of banking. In the meantime, the intermediation concept can be used to banking because Islamic banking is viewed as an intermediary institution by this approach. However, input and output variables must be selected with care to accurately represent the essence of banking. Factors that are the most similar to banking features. Some alterations may be required to make it more representative [24].

3. METHODS

3.1 Data Envelopment Analysis (DEA)

According to Boussofiane et al. (1991) and Quanling (2001), data envelopment analysis is a technique for comparing the efficiency of organizational units that are generally similar. In the most basic scenario, where a process or unit has a single input and a single output, efficiency is defined as:

$$Efficiency = \frac{outputs}{inputs}$$

DEA is a multi-factor productivity analysis model that measures the relative productivity of a set of homogenous decision-making units (DMU) [25];[22]. Efficiency rating when multiple inputs and outputs are present:

$$Efficiency = \frac{weighted\ sum\ of\ outputs}{weighted\ sum\ of\ inputs}$$

In the course of its evolution, data envelopment analysis (DEA) has become an increasingly significant instrument for evaluating and enhancing the performance of manufacturing and service operations. DEA serves a similar function as traditional statistical estimation techniques. This method is referred to by statisticians as an estimator [26]. DEA provides insight into the relative efficiency of the "decision-making unit" and provides a cautious estimate of comparative efficiency in instances when there are several inputs and few outputs [27]. This method maximizes the use of limited data and can be used to evaluate technical, allocative, and scale efficiencies [28];[29].

In addition, another benefit of DEA analysis is that the production function does not require a particular form [15]. The DEA model as a nonparametric evaluation model. Subjective effect on parameter settings is minimized, hence enhancing evaluation precision and study applicability. DEA models can be separated into scale models of variable returns, BBC-DEA models, and scale models of variable returns from the standpoint of scale returns [30].

3.2 Model Development

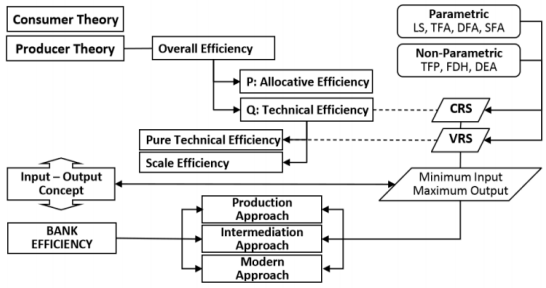

Figure 2 DEA Model
Source : Ascarya et al (2008)

Since its launch in 1984, the DEA Charnes, Cooper and Rhodes (CCR) model and the Banker, Charnes and Cooper (BCC) model have been the two most popular versions [31]. The fundamental distinction between the CCR and BCC models is the management of returns to scale. The CCR model assumes Constant Return to Scale (CRS), whereas the BCC model assumes Variable Return to Scale (VRS) for each DMU (Ascarya & Yumanita, 2006). CRS thinks that any increase in a specific proportion of inputs will be accompanied by a commensurate increase in output. CRS can therefore be

implemented when the observed DMU is running at the optimal scale. However, an institution's inefficiency results from competition and budgetary limits. In anticipation of this, Banker, DEA model employing the VRS methodology [32].

The VRS method can generate Technical Efficiency (TE), also known as Pure Technical Efficiency (PTE). VRS assumes that an input multiplied by X cannot yield an output multiplied by X, hence the output may be higher or less than X [21]. Using frontier estimations based on CRS and VRS, it is possible to separate the overall technical efficiency utilizing the CRS method (TECRS) into pure technical efficiency (TEVRS) and scale efficiency (SE) using the following equation: TECRS = TEVRS x SE [31].

An institution must be attuned to issues of output scale, often known as Return to Scale (RTS). Business [33]can encounter one of three RTS conditions: growth RTS (IRS), return to constant size (CRS), or reduction RTS (DRS). According to the IRS condition, output will increase by more than y times for every x-fold increase in inputs. In the meantime, the CRS condition assumes that one year of output will be produced if each output contributes 1x input. This differs from the DRS condition, which implies that an increase of one unit of input would result in a decrease of one unit of output.

DEA detects reasonably efficient reference point DMUs from the available data set, defines efficient limits as best-practice production technologies, and assesses the inefficiency of other interior sites. All inefficient DMUs will fall below the threshold for efficiency. In addition to generating efficiency scores for each DMU, the DEA chooses which DMU will serve as a standard for less efficient DMUs.

$$Efficiency of\ DMU_0 = \frac{\sum_{k=1}^{p} \mu_k y_{k0}}{\sum_{i=1}^{m} v_i x_{i0}}$$

DMU = *decision making unit*

n = *number of DMU evaluated*

m = *different inputs*

xij = *number of input i consumed by DMUj*

p = *different outputs*

ykj = *number of output k produced by DMUj*

4. RESULTS AND DISCUSSION

4.1 Data Description

The financial statements of Conventional Commercial Banks and Islamic Commercial Banks in Indonesia for the period 2016 to 2020 provide the necessary data for this empirical analysis. This study utilizes a sample of 19 conventional and 14 Islamic commercial banks in Indonesia. The following is a list of banks whose efficiency is measured as part of this study.

Table 2: List of Indonesian BUK and BUS Names

Conventional Bank	Islamic Conventional Bank
Bank Mandiri	PT Bank Aceh Syariah
Bank Rakyat Indonesia (BRI)	PT Bank BNI Syariah (BSI)
Bank Central Asia (BCA)	PT Bank BRI Syariah (BSI)
Bank Tabungan Negara (BTN)	PT Bank Jabar Banten Syariah
Bank Negara Indonesia (BNI)	PT Bank Mega Syariah
Bank Panin	PT Bank Muamalat Syariah
Bank Danamon	PT Bank Panin Dubai Syariah
Bank BTPN	PT Bank Syariah Bukopin
PT Bank Permata	PT Bank Syariah Mandiri (BSI)
PT Maybank Indonesia	PT Bank Tabungan Pensiunan Nasional Syariah
PT Bank Mega	PT Bank Victoria Syariah
PT Bank DKI	PT BCA Syariah
BJB	PT BPD Nusa Tenggara Barat Syariah
Sinarmas	PT Maybank Syariah
Bank Victoria	
Bank Ganesha	
Bank UOB	
Bank Mizuho	
Bank Commonwealth	

This study will utilize a modified intermediation approach to more accurately depict BUK and BUS operations, have also done [24];[3];[4]. Therefore, we suppose that BUK and BUS produce Total Loans (y1) and Income (y2) by utilizing Total Deposits (x1), Labor (x2), and Fixed Assets (x3). This study

does not include liquid assets as an output variable since BUK and BUS do not trade in financial instruments on financial markets; rather, they finance the real economy.

4.2 *Banking Efficiency Anlysis*

Conventional Commercial Bank (BUK) Efficiency Score in Indonesia

Table 3 Average BUK Efficiency Score in Indonesia

Name of Banks	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

The average efficiency score of 19 Conventional Commercial Banks in Indonesia is displayed in Table 2 above. Two methods, Constant Return to Scale (CRS) and Variable Return to Scale (VRS), are utilized to evaluate the efficiency of banks (VRS). Analysis conducted by the CRS reveals that no BUK reaches optimum efficiency (1,000). Several banks, notably Bank Mizuho (0.96), Bank Tabungan Negara (0.89), Sinarmas (0.84), Bank Danamon (0.80), and Bank BTPN (0.80), have fairly high efficiency rankings (0.812). Bank Victoria (0.456), PT Bank Mega (0.491), and Bank Ganesha are also among the banks with the lowest efficiency (0.495).

Moreover, research of BUK efficiency scores using the VRS method reveals that only one bank, the People's Bank of Indonesia, achieves maximum efficiency (1,000). Bank Danamon (0.994), Bank Mandiri (0.988), Bank Central Asia (0.973), Bank Mizuho (0.973), Bank Tabungan Negara (0.973), and Bank Negara Indonesia (0.973) are more BUKs with quite good efficiency scores (0.948). Additionally, Bank Victoria (0.502) and Bank Ganesha (0.502) are the banks with the lowest efficiency relative to other banks (0.509).

Islamic Commercial Bank (BUS) Productivity Ranking in Indonesia

Table 4. The Average Islamic Commercial Bank Productivity Score in Indonesia

Islamic Commercial Bank	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 examining the efficiency of Commercial Banks, the purpose of this study is to analyze the efficiency of 14 Islamic Commercial Banks in Indonesia. This study employs the CRS and VRS methods for analyzing bank efficiency. The findings of the average BUS efficiency scores in Indonesia are displayed in Table 3 above. According to the results of the average efficiency score calculated using the CRS and VRS methods, not a single bank has achieved maximum efficiency (1,000). Based on the results of the average efficiency score of BUS in Indonesia,

it can be concluded that BUS is in the category of inefficient banks and must improve its efficiency.

If we examine the findings of the average efficiency score using the CRS method, we find that PT Maybank Syariah Indonesia (0.724) has relatively good efficiency compared to other BUS, while other banks fall into the low efficiency category with scores below 50%. PT Bank Syariah Mandiri Pension Savings (0.806), PT Bank Syariah Mandiri (0.765), and PT Maybank Syariah Indonesia have relatively good efficiency when compared to other BUS when utilizing the VRS method to calculate the average efficiency score (0.728). While other BUS fall into the low efficiency group with a score below 70%.

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

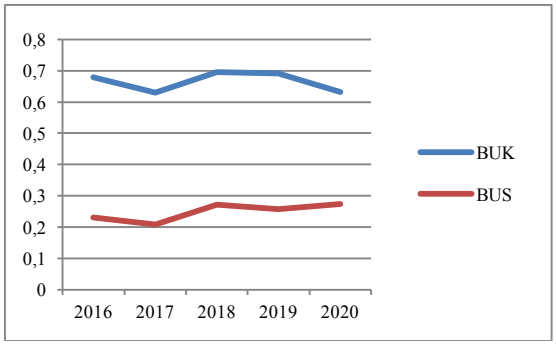

Figure 2 Efficiency Trend of BUS and BUK Using CRS Approach

Using the CRS method, Figure 2 depicts the efficiency trend of BUS and BUK in Indonesia. It can be observed from the graph that BUK is more efficient than BUS. The graph demonstrates that the efficiency trend of BUK and BUS swings every year. The examination of BUK efficiency trends reveals that the efficiency declined in 2017 and then increased again in 2018. In addition, the BUK's efficiency has grown slightly but not significantly in 2019, and it has declined again the next year, in 2020. Next is a trend analysis of BUS efficiency using the CRS method, which reveals a reduction in 2017 followed by an increase in 2018. Then, in 2019, BUS efficiency declined once more, and in the following year, 2020, BUS efficiency increased somewhat but not much.

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

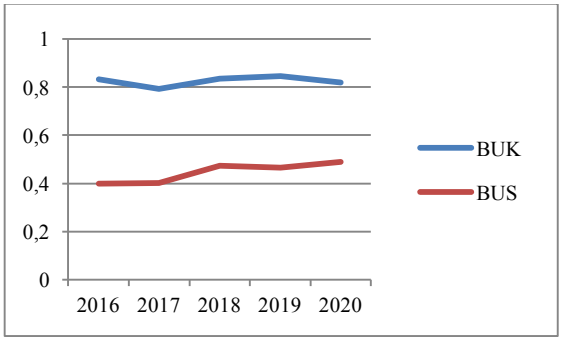

Figure 3 Efficiency Trend of BUS and BUK Using VRS Approach

Using the VRS method, Figure 3 depicts the efficiency trend of BUS and BUK in Indonesia. In a manner comparable to the CRS method, the VRS method reveals that BUK is more efficient than BUS. The graph demonstrates that the efficiency trend of BUK and BUS swings every year. For the BUK efficiency trend analysis, it can be shown that efficiency declined in 2017 and then climbed again through 2019, albeit not by a substantial amount. In the next year, 2020, BUK's effectiveness has fallen once more. The following research examines the upward trend in BUS efficiency with the VRS technique from 2017 to 2018. Then, in 2019, the efficiency of BUS declined once more, and in the subsequent year, 2020, the efficiency of BUS increased slightly but not significantly.

Impact of the Covid Pandemic on Bank Productivity and Efficiency

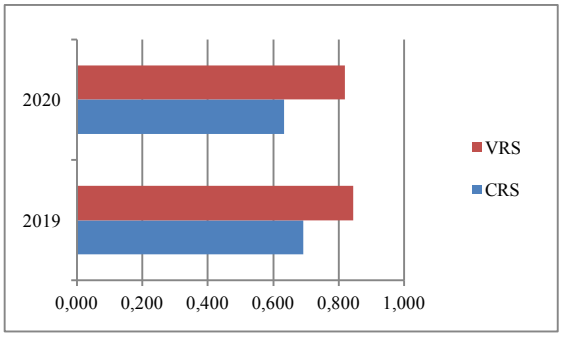

Figure 4 Graph of BUK Efficiency Score During The Covid-19 Pandemic

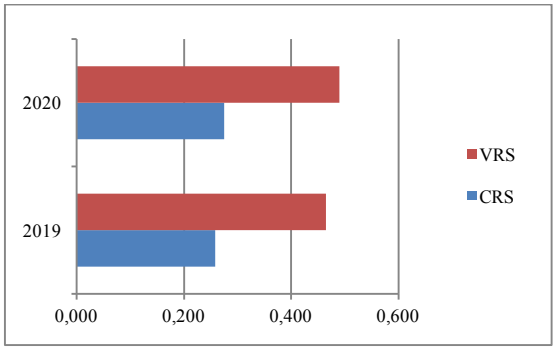

Figure 5 Graph of BUS Efficiency Score During The Covid-19 Pandemic

Figures 4 and 5 depict the efficiency ratings of conventional and Islamic commercial banks in Indonesia during the Covid-19 pandemic. Using both the CRS and VRS approaches, the efficiency of conventional commercial banks decreased during the Covid-19 pandemic, as shown by these results. During the Covid-19 pandemic, unlike conventional commercial banks, the efficiency of Islamic commercial banks (BUS) remained relatively stable and slightly increased, albeit not significantly.

Analysis of Potential Improvements of BUK and BUS in Indonesia

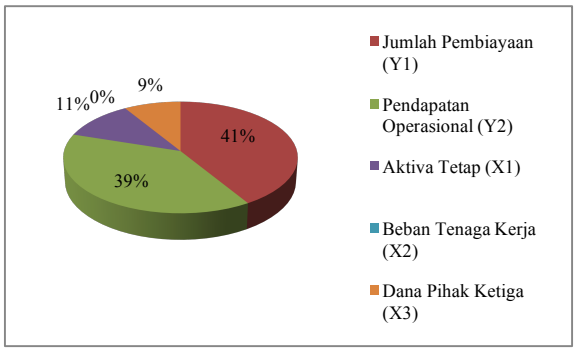

Figure 6 Potential Improvement of BUK

Potential Improvement analysis is conducted to examine the input and output variables that contribute to bank inefficiency. Companies can use the results of the prospective improvement study as a guide to increase their efficiency the next year. The prospective improvement analysis is then conducted by abandoning the final year of the research period, 2020 in this case. Figure...depicts the outcomes of the possible improvement study of Conventional Commercial Banks in Indonesia; based on these outcomes, it is evident that the majority of the causes of BUK inefficiency stem from output variables, namely the quantity of financing and operational income. The output variable, meaning the amount of financing, must increase by 41% and operational revenue must increase by 39% for banks to become more efficient.

In addition to a potential improvement analysis for BUK, this study also includes a potential improvement analysis for BUS in Indonesia. Figure 8 depicts the findings of an investigation of prospective enhancements for Islamic Commercial Banks in Indonesia. Similar to Conventional Commercial Banks, it is evident from these results that the inefficiency of banks stems from the output variables, namely financing and operational revenue. To boost the efficiency of Islamic Commercial Banks, the output variable, namely the quantity of financing, must increase by 55%, while operating income must increase by 31%.

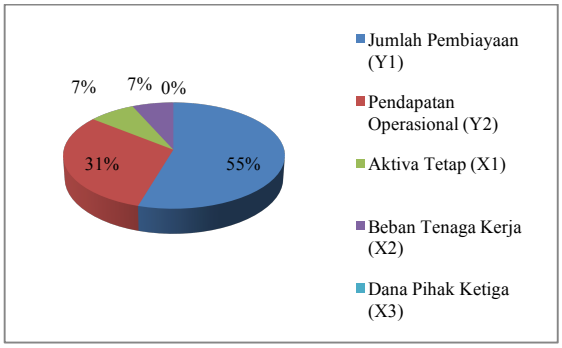

Figure 7 Potential Improvement of BUS

Findings

From the results of the analysis conducted on the Efficiency and Productivity of Conventional Commercial Banks (BUS) and Islamic Commercial Banks (BUS) in Indonesia, this study reveals a number of discoveries. The initial finding relates to the average efficiency ratings of BUK and BUS in Indonesia. The findings of this investigation

indicate that many banks have not yet achieved maximum efficiency. Using both the CRS and VRS techniques, there are a number of banks with relatively high efficiency, but there are also a number of banks with relatively poor efficiency. In addition, regarding the comparative efficiency trend between conventional and Islamic commercial banks in Indonesia. The investigation reveals that conventional commercial banks in Indonesia have a higher efficiency score than Islamic commercial banks.

There are several issues that cause inefficiency in the banking business, notably Islamic commercial banks in Indonesia, including the incapacity of banks to balance the usage of input and output variables. An institution is efficient if it utilizes its input to achieve the greatest output without wasting resources [34]. Institution is efficient if it can maximize output at a certain level of input, or if it can reduce costs (input) to obtain a given level of output. The causes of the inefficiencies of the two types of banks will be explained in the potential improvement analysis.

The following finding relates to the effect of the Covid-19 epidemic on the efficiency and productivity of BUK and BUS in Indonesia. In the examination of banking efficiency, it can be seen that during the Covid-19 epidemic, the efficiency of BUK in Indonesia has declined, whilst the efficiency of BUS in Indonesia has been reasonably stable and even slightly risen albeit not significantly.

Since research conducted by [35] indicates that since the Covid-19 epidemic entered Indonesia, all Indonesian banks have witnessed a decline in terms of collection and financing, this decline affects the effectiveness of the bank in question. In the instance of the Covid-19 epidemic, the Indonesian banking industry's average degree of efficiency dropped due to a decrease in income and finance distribution, while operating costs continued to rise to fulfill the daily needs of banking operations. Therefore, it is essential to develop the banking industry in order to obtain the highest level of efficiency.

The final findings of this study pertain to an evaluation of potential banking enhancements. According to the findings of this analysis, the inefficiency of BUK and BUS in Indonesia is due to the output factors, specifically the quantity of funding and operational income. Two aspects of evaluation can be used to determine the efficiency of financing. The first is the bank's ability to produce output, which in this case is low-cost financing; this feature is closely related to the financing ratio and the growth of bank assets. In addition, the second factor is the bank's success in limiting risk in financing, or the bank's capacity to channel funding and minimize risk. Enhancing the efficacy and efficiency of financial goods will stimulate the expansion of bank assets and profits. In addition, this would strengthen the role of banks in managing consumer funds so that their allocation for the common good is more effective and efficient [36].

5. CONCLUSION

The purpose of this study is to examine and contrast the efficiency and productivity of 19 conventional commercial banks (BUK) and 14 Islamic commercial banks (BUS) in Indonesia over a five-year observation period (2016-2020). This study employs two methods for measuring efficiency, namely CRS and VRS with Data Envelopment Analysis as an intermediate method.

There are still numerous BUKs and BUSs in Indonesia that have not achieved maximum efficiency, and there are even BUKs and BUSs with low efficiency, as determined by the DEA analysis of efficiency. Based on the findings of the investigation, it is known that BUK is more efficient than BUS when comparing the two types of banks.

The results of an analysis of the efficacy of BUK and BUS in Indonesia during the Covid-19 pandemic, specifically in the final two years of the research period (2019-2020), indicate that the efficacy of BUK has decreased, while the efficacy of BUS has remained relatively stable and has even slightly increased. Then, based on the outcomes of the possible improvement

analysis conducted by BUK and BUS in Indonesia, it is determined that the variable responsible for bank inefficiency is the output variable, namely the quantity of financing supplied and operational revenue.

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