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Productivity Comparison between Conventional and Islamic Commercial Banks in Indonesia during the COVID-19 Pandemic

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Abstract

This study was conducted to measure and compare the productivity level between conventional and Islamic commercial banks in Indonesia during the COVID-19 pandemic. The number of samples used in this study was 105 banks consisting of 95 conventional banks and 10 Islamic banks. The level of productivity was measured using the Malmquist Productivity Index (MPI) method and Data Envelopment Analysis (DEA) with an intermediation approach, while the productivity of conventional and Islamic commercial banks was compared using normality and different tests. The results showed that the productivity level of the Islamic banks with a Total Factor Productivity Changes (TFPCH) value of 1.001 was driven by technological advances. Meanwhile, the conventional banks were not productive. On the other hand, the results of the different tests showed that there was no significant difference between the productivity level of the conventional and Islamic banks. Conventional banks must enhance innovations in the use of technology in their operational activities to improve their productivity and maintain their high efficiency achievement. Meanwhile, Islamic banks could improve their efficiency in the operational activities so that they would achieve higher productivity and to innovate continually with the use of technology. During the study observation, there was no study comparing between the productivity level of conventional and Islamic commercial banks during the COVID-19 pandemic in Indonesia. Therefore, this research was the first study to discuss the comparison of productivity level between conventional and Islamic commercial banks in Indonesia during the COVID-19 pandemic.

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I.   Introduction

Banking industries have a vital role in a country's economy since they are intermediation institutions acting in managing funds, such as collecting, distributing funds, and providing payment services (Suzuki & Sastrosuwito, 2011). The data on Indonesian banking statistics issued by Otoritas Jasa Keuangan (2022) (Financial Service Authority) recorded the development of the number of commercial banks in Indonesia from 2015 to 2021. The comparison of the number of conventional and Islamic banks in Indonesia varies greatly, in which the number of conventional commercial banks is much more than Islamic ones.

Table 1. The number of commercial banks in Indonesia

Commercial banks	2015	2016	2017	2018	2019	2020	2021
Conventional	106	103	102	101	96	95	95
Islamic	12	13	13	14	14	14	12
Total banks	118	116	115	115	110	109	107

Source: Otoritas Jasa Keuangan (2022)

These days, there is insignificant competition between conventional and Islamic banks, but the Islamic ones have their place among the public (Salleh & Rani, 2020). Given the challenges of the banking industry are more intense, OJK demanded the financial services institutions to consolidate. Banking industry, such as conventional and Islamic banks are expected to grow rapidly through digitalization with increased use of technology, competition for funds and in interest rate. Thus, the banking sector can stay afloat, grow, and improve their performance.

According to Bank Indonesia (2022b), there has been a digitalization since the last decade, causing a drastic change in people's behavior; and transaction activities are demanded to be mobile, fast, secure, and efficient through various platforms. On the other hand, the COVID-19 pandemic has made people reduce their use of cash. Changes in people's behavior are also driven by safety and convenience factors in conducting transactions during the pandemic with contactless methods. Currently, people are switching to use digital services, such as the use of ATM (an automated teller machine), mobile banking, internet banking, electronic money, and others; so there has been an increase in digital activities carried out by the public to facilitate the transactions.
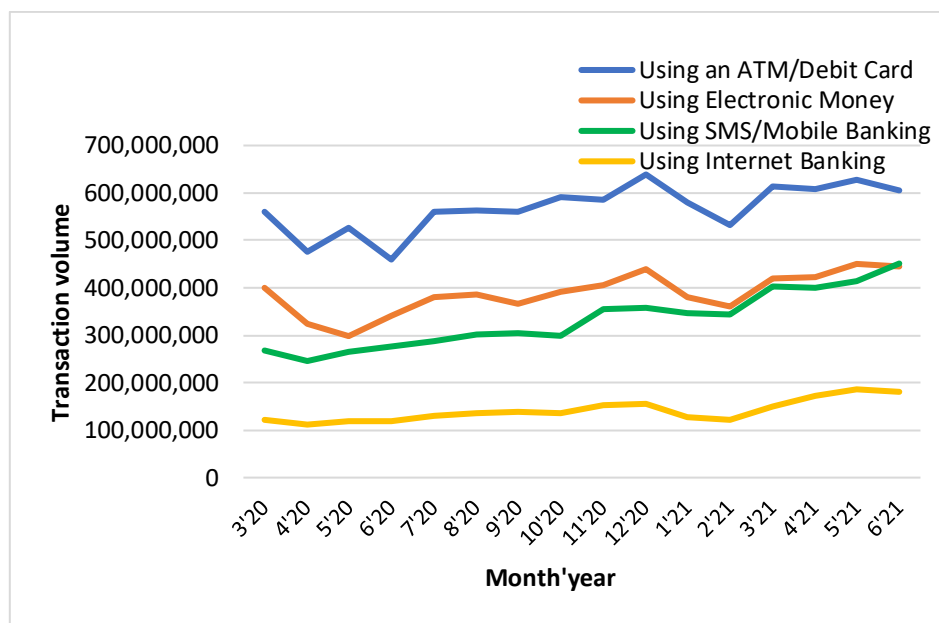
Figure 1. Digital transaction volume during the COVID-19 pandemic in Indonesia
Source: Bank Indonesia (2021)

Based on Figure 1, the volume of digital transactions carried out by the public during the COVID-19 pandemic experienced a positive trend, meaning that many people used the services of digital banking for transaction needs. Of course, commercial bank business activities must also continue to improve innovation in the use of technology through products, services, and operational activities to achieve continually improved performance. According to Bank Indonesia (2022a), it is essential to maintain a balance between fostering the innovation in digital financial services to promote financial inclusion and risks management.

In addition, the impact of the COVID-19 pandemic has also caused the Indonesian economy to slow down, which has an impact on the financial performance of banks in Indonesia (Fakhri & Darmawan, 2021). The bank performance, apart from the level of profitability perspective, can also be seen from how it can work productively and how effective it is in managing its inputs and outputs. It is important for a bank to have a high level of productivity since it is expected to minimize the use of input by generating optimal output (Octrina et al., 2020).

According to Jahan (2019), to measure the productivity level of conventional banks, ones can use input variables, such as interest and non-interest expense. For output variables, ones can refer to interest and non-interest income. While the productivity level of Islamic banks can be measured using input variables, such as profit paid on deposits and operating expense, output variables can be measured using income from investment and non-investment.

Below is presented the movement of input data (bank expense) and output (bank income) to measure the productivity of conventional and Islamic banks in Indonesia during the COVID-19 pandemic, especially during the period of March 2020 to June 2021, which was obtained from the income statement of all banks.
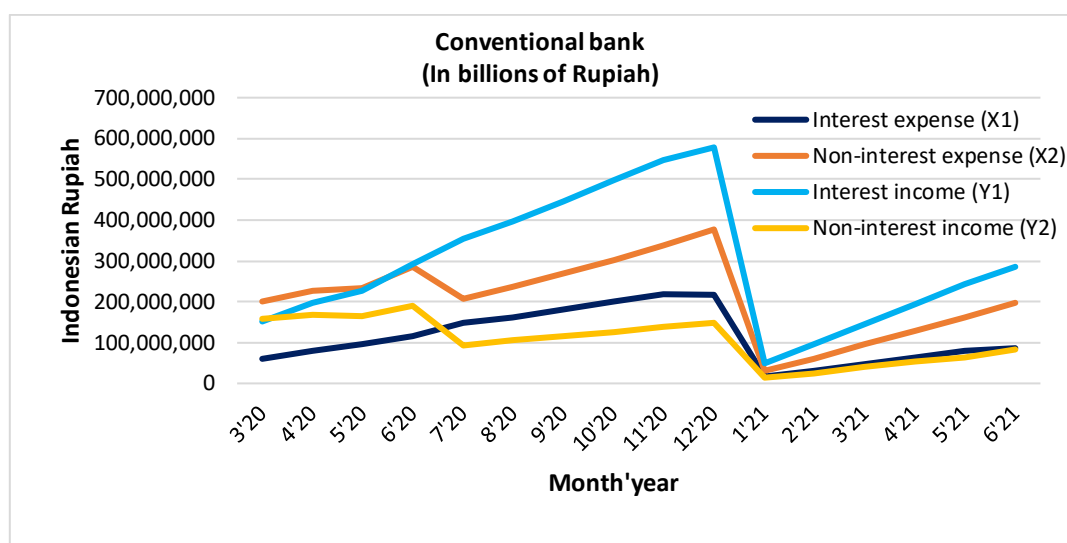
Figure 2. Movement of conventional banks' input and output data
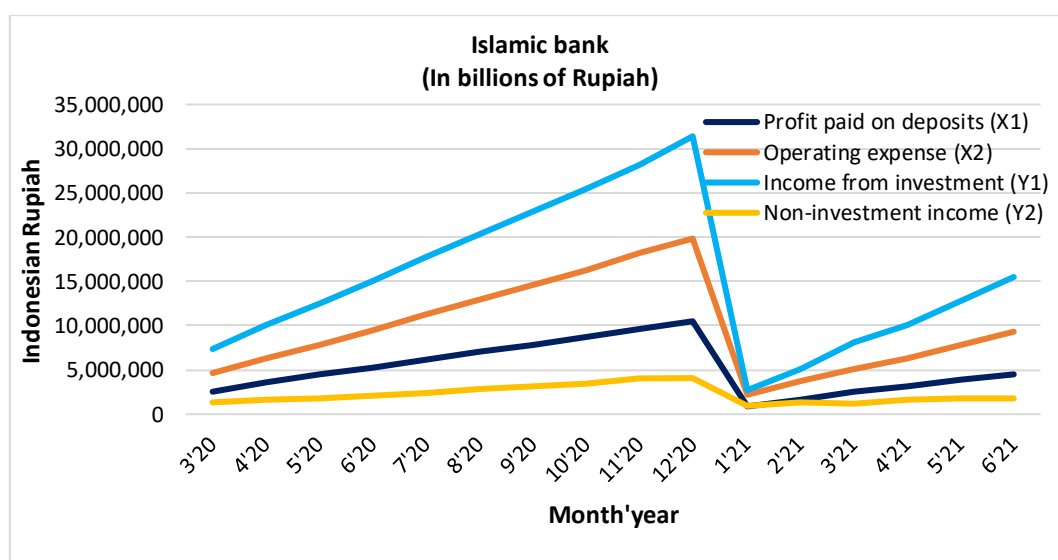Source: Otoritas Jasa Keuangan (2020, 2021)

Figure 3. Movement of Islamic bank input and output data
Source: Otoritas Jasa Keuangan (2020, 2021)

Based on Figures 2 and 3 above, it is seen that during the COVID-19 pandemic the highest use of both conventional and Islamic banks inputs was in December 2020. Thus, the output produced during the period was also considered high. However, the situation opposed to the following month, i.e., in January 2021 where the use of inputs and outputs produced. In January 2021, the use of conventional and Islamic bank inputs dropped drastically, so that there was a drastic decrease in output generated from the previous period. From Figures 2 and 3, we can also conclude that the movement of inputs and outputs from the two different groups of banks was directly proportional. When the input went up, the output also inclined and vice versa. As such, it was interesting to see which banks were more productive in managing their inputs and outputs.

The previous research to measure productivity levels with MPI, conducted by Octrina et al. (2020) determined the productivity levels of conventional banks in Indonesia from 2005 to 2016. The

result was that between the two output models used, the first model tended to be better even though the test results showed less than optimal levels of the use of technology. The results of the first model also showed higher average productivity. Octrina and Mariam (2021) also investigated the productivity of Islamic banks in Indonesia during the period of 2010 to 2019. As the result, in term of the cost approach perspective, Islamic banks showed to have reached a productive stage with a high average of TFPCH score.

Research comparing the productivity between conventional and Islamic banks in Indonesia was conducted by among others, Salleh and Rani (2020) in the period of 2011 to 2018. The result showed that both types of banks had different productivity growth with an average annual percentage. The productivity results of conventional banks were slightly higher than those of the Islamic ones since the contribution of TECHCH became a greatly influencing component on the value of TFPCH.

Analysis on productivity level in the banking sector is a salient issue for bankers, investors, and policymakers because an increase in bank productivity indicates an improvement in its performance. As such, the banks can manage their resources efficiently, maintain low priced-services, and improve their services quality (Bahrini, 2015).

The phenomenon of the COVID-19 pandemic led the authors to compare productivity level of conventional and Islamic commercial banks in Indonesia from the period of March 2020 to June 2021. To the best knowledge of the authors, such a study is the first to conduct as a comparative analysis of the productivity level between conventional and Islamic commercial banks monthly during the COVID-19 pandemic. The study novelty is that the research was conducted during the COVID-19 pandemic in Indonesia with the productivity level analysis and comparison between the conventional and Islamic banks monthly for 16 periods through an intermediation approach, using the Malmquist Productivity Index (MPI) method. The study has a great importance to find out the extent to which the productivity of conventional and Islamic banks was during the COVID-19 pandemic, as well as to determine whether there were significant differences between the productivity of conventional and Islamic banks during the research period. This comparison study was expected to become a reference for investors in investing their capital, which type of bank is more productive in managing their inputs to produce optimal output, especially when a pandemic or crisis prevails. In addition, the results of this study can be used as evaluation material by bank management to improve their productivity.

This study was conducted to measure and compare the productivity level between conventional and Islamic commercial banks in Indonesia during the COVID-19 pandemic, from March 2020 to June 2021. The level of productivity was measured using the Malmquist Productivity Index (MPI) method, by using DEAP 2.1 software. Meanwhile, the productivities of conventional and Islamic commercial banks were compared using normality and different tests using SPSS 24 software.

II. Literature Review

Bank

Law No. 10/1998 on Banking defines a bank as a business that gathers fund from society in the form of savings and distributes the fund to the society in the form of credits and/or others in order to improve people's standard of living. Commercial bank is a bank that performs business

activities conventionally and/or based on Sharia principles, with activities that provide services in payment transferring (Otoritas Jasa Keuangan, 2022a).

There are two types of bank based on their operation, i.e., conventional and Islamic banks. Conventional banks are those using the interest system in their operations. Generally, conventional banks carry out their operational activities by issuing products to collect public funds in the form of current accounts, time deposits, and savings accounts. Furthermore, these banks carry out fund disbursement activities by providing credit. Meanwhile, the Islamic banking system involves the products which do not include riba (interest) and which are according to Shari'ah principles, especially regarding the procedures for making Islamic names using the profit-sharing method. Pricing for products from Islamic banks has certain differences from conventional banks. The basis of the agreement established between the bank and the customer of the funds depositor is based on the type of deposit and its term. Thus, it determines how much profit sharing will be obtained by the depositor of funds (Salman & Nawaz, 2018).

Productivity

Simply put, productivity is a comparison between the inputs used and the outputs produced (Octrina et al., 2020). Productivity can be a determinant of competitiveness at the country, industry, or company level to the individual level (Eskani, 2010). In addition, it is an important factor since it can reflect an enterprise's economic performance. The economic performance of a company consists of operational and financial performance. Operational performance is assessed by the flow of inputs and outputs, while financial performance is assessed from the inflow and exit of funds (Sukmaningrum et al., 2022).

According to Fithri and Sari (2015), the benefit of measuring productivity is that companies can find out how well they are doing, and whether or not the productivity level is by predetermined standards. Measuring the productivity can be directly evaluated with the measurement results as follows:

1) Comparing the measurement results with the standard of productivity that management has set.
2) Seeing how productivity improvements have been achieved over time.
3) Comparing the productivity of similar type of industries that produce similar products or services.

In addition, the productivity measurement is beneficial to be used as a basis for decision making by stakeholders in a company's business. Abbas et al. (2015) explained that MPI is one of the most popular methods used in measuring changes in Total Factor Productivity (TFP) over time. Malmquist (1953) was the one who first created the Malmquist Index to measure productivity in 1953. But as it developed, it was Caves et al. (1982) who introduced this Malmquist Index.

Previous Studies

Previous studies on comparison of productivity between conventional and Islamic commercial banks was conducted by Abbas et al. (2015) using MPI in Pakistan from 2005 – 2009, with a sample of all conventional and Islamic banks operating during the research period without mergers or acquisitions. The input variables used were the number of employees, fixed assets, deposits, and equity, while the output variables used consisted of loans and advances, investment, mark-up (interest) income, and other income. The result showed that productivity

value of Islamic banks was 0.884, while that of conventional banks accounted for 0.893. Although the Total Factor Productivity Change (TFPCH) of conventional banks was higher than that of Islamic banks, the two banks did not productively manage their inputs and outputs since their TFPCH was below 1. In comparison, the results of the study were different from the research results conducted by Khan and Shah (2015), since the latter results showed that Islamic banks in Pakistan were productive. Meanwhile, the conventional banks were not considered productive in managing their inputs and outputs. They compared the level of cost efficiency and growth of Islamic banks, conventional and conventional Islamic windows banks in Pakistan from 2007 – 2011, with the total research sample of 15 banks, consisting of five banks for each banking system. The input variables consisted of the number of employees, fixed assets, and total deposits, while the output variables comprised total loans, other income, and investments. The study results revealed that the cost efficiency of Islamic banks was lower compared to their benchmark banks. Nevertheless, for the growth rate of TFPCH of Islamic banks indicated a dramatic increase compared to their benchmark banks with a TFPCH value of 1,164 for Islamic banks, while other banks had a value below 1.

On the other hand, Rani et al. (2017) analyzed the difference in the productivity of Islamic and conventional banks in Indonesia during the period of 2008 – 2016. In their study, input variables comprised labor costs, fixed assets, and total third-parties funds, while the output variables were total loans or financing, investment portfolios and net operating income. The study results found that Islamic and conventional banks had a decrease in productivity from 2008 to 2016 with TFPCH values below 1, which was 0.961 and 0.914 for conventional banks and Islamic banks, respectively. However, when compared to the results of TFPCH value analysis, the conventional banks were superior to their Islamic counterpart. Another study was conducted by Salleh and Rani (2020), comparing the productivity performance of Islamic banks with conventional banks in Indonesia from 2011 – 2018. The number of research samples accounted for 14 banks, consisting of seven Islamic banks and seven conventional banks. By using the same input and output variables, they found different research results because the two banks were already productive as indicated by the TFPCH value above 1. The results showed the productivity of conventional banks was slightly greater than that of Islamic banks, with the TFPCH value of 1.052 and 1.046 for conventional banks and Islamic banks, respectively. Based on the study results, it indicated technological improvements in both Islamic and conventional banks. Moreover, Rusydiana et al. (2019) tested the efficiency and productivity levels of 115 commercial banks in Indonesia between 2010 to 2016. The data were derived from the population of commercial banks, consisting of 11 Islamic banks and 104 conventional banks. The input variables used were third-party funds, fixed assets, and labor costs, while the output variables comprised productive assets, interest income or revenue sharing, and fee-based income. Based on the study results of MPI estimates, conventional banks had an average with a TFPCH index of 1.004, while Islamic banks had a TFPCH index of 0.943. When compared to the productivity value, the productivity level of conventional banks was higher than Islamic banks.

Johnes et al. (2018) conducted a study to compare the financial performance and productivity of Islamic and conventional banks in the Gulf Cooperation Council (GCC) group of countries consisting of Saudi Arabia, the United Arab Emirates, Qatar, Kuwait, Bahrain, and Oman during the global financial crisis in 2006 to 2012. The input variables consisted of deposits and short-term funding, fixed assets, general and administrative expenses, and equity, whereas the variable outputs were total loans and other productive assets. Their study results showed that the financial performance of conventional banks was higher than that of Islamic banks. Meanwhile, through the MPI approach, it could be revealed that the productivity value accounted for 0.985 and 0.990 for conventional and Islamic banks, respectively. Thus, it can be concluded both

conventional and Islamic banks were not productive. The study results are in line with those conducted by Alsharif et al. (2019) analyzing the productivity of Islamic and conventional banks in the GCC group of countries during the period of 2005 – 2015, with the results showed that the two groups of banks were not productive since their TFPCH value was less than unity. The input variables used were personal expenses, fixed assets, total deposits, and short-term funds, whereas the output variables consisted of total loans and the other earning assets. The results of their research found that Islamic banks were less productive compared to the conventional ones since the TFPCH value was 0.950 and 0.996 for Islamic and conventional banks, respectively.

Jahan (2019) measured and evaluated the productivity performance of 29 commercial banks in Bangladesh during the period of 2011 to 2015. The study used interest expense and non-interest expense as input variables for conventional banks. Meanwhile, interest income and non-interest income were used as the output variables. The variables to compare with Islamic banks were profit paid on deposits and operating expense used as input variables at best. Furthermore, income from investment and non-investment income were used as output variables. The study results on the prod7uctivity performance showed that Islamic banks had a 5-year cumulative TFP average change index of 0.98867 which was relatively higher than conventional banks, i.e., 0.97861. It indicated that both banks were not productive in managing their inputs and outputs.

Finally, Jubilee et al. (2021) conducted a study examining productivity differences between Islamic and conventional banks in 18 countries from the Middle East, Southeast Asia, and South Asia from 2008 to 2017. The study used 385 banks, consisting of 66 Islamic banks and 319 conventional banks. The input variables comprised deposits, labor, and physical capital, whereas loans and investments were used as output variables. The study results showed that Islamic banks were more productive than conventional ones, with TFPCH results of 0.888 and 0.853 for Islamic and conventional banks, respectively. However, the average difference between TFPCH of Islamic and conventional banks were not statistically significant in all regions. Based on the productivity index, the study results conducted by Jahan (2019) and Jubilee et al. (2021) indicated that conventional and Islamic banks had not reached the level of productivity because their value was less than unity.

Based on the literatures, the previous research was conducted for annual basis. On the other hand, this study was conducted in a monthly basis that extended for 16 periods, starting from March 2020 to June 2021.

Conceptual Framework

There is a relationship with the theory of research to be carried out. The author must identify and examine several relevant theories so that they can produce theoretical framework and make it easier to make research hypothesis statements and solve the problems raised. The conceptual framework in this research is as follows:
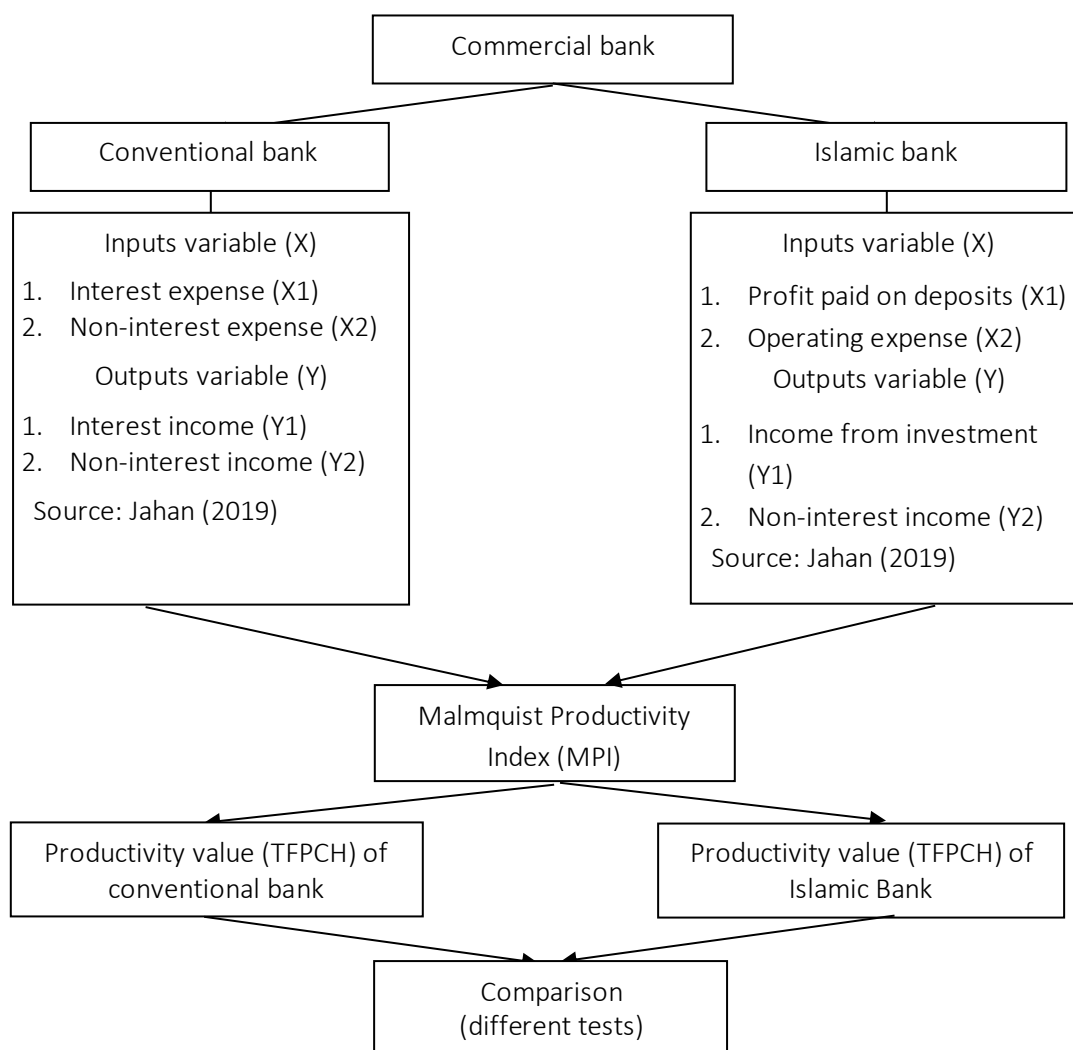
Figure 4. Conceptual Framework
Source: Processed by researchers

Commercial banks are divided into two categories based on their operational activities, namely conventional and Islamic banks. Conventional and Islamic banks require input and output variables to measure their productivity. The meaning of the input and output variables used to measure the level of productivity of conventional banks according to Otoritas Jasa Keuangan (2017) is as follows:

1) Interest expenses refer to contractual interest and amortization of transaction costs, which arise because of the bank's business activities.

2) Non-interest expenses are expenses consisting of administrative and general expenses, research and development, marketing, allowance for the write-off of productive assets, and other operating expenses, which arise because of the bank's business activities.

3) Interest income is income derived from loans disbursed to third parties instead of that from other banks, placements in other banks, and Bank Indonesia certificates. In addition, there are provisions, discount amortization, transaction fees that can be distributed directly on productive assets.

4) Non-interest income is income other than interest income earned by a bank, which comes from profits from the sale of securities, foreign exchange sales, transaction service income, recovery of allowances for the write-off of productive assets, receipt of written-off productive assets, and others.

Meanwhile, the purpose of the input and output variables used to measure the level of productivity of Islamic banks according to Otoritas Jasa Keuangan (2019) is as follows:

1) Profit paid on deposits or profit sharing for investment fund owners is the entire profit sharing provided by bank to investment fund owners in current accounts, savings, time deposits, and other transactions based on profit sharing agreements. The profit sharing for investment fund owners is non-profit sharing and profit sharing, such as to non-bank third parties, other banks, and transactions between offices.
2) Operating expenses are all expenses incurred, such as compensation expenses to Bank Indonesia, *wadiah* entrustment bonuses, insurance and guarantee premiums, allowances for asset write-off, depreciation or amortization, loss of impairment of other assets, maintenance and repair of *ijarah* assets, loss of disposal of *ijarah* assets, loss of disposal of expropriated collateral, research and development, education and training, labor, rent, marketing, goods and services, losses from the sale of foreign exchange and others, arising from the business activities of the bank.
3) Income from investment or income from disbursement of funds is the total income obtained from the distribution of funds, such as in the form of placements in other Islamic banks, Bank Indonesia, receivables, financing, multi-service transactions, and *ijarah*.
4) Non-investment income is income derived from activities carried out by the bank, such as bank income as a *mudharib* in bound investment, services, profits from foreign exchange sales, PPAP recovery, correction of reserves for the decline in the value of other assets, profits from disposal of *ijarah* assets and others.

The input and output variables used in this study were precisely in the bank's income statement. The variables were selected through an intermediation approach that viewed the banks as the intermediators, which means that the bank can transfer and convert financial assets from surplus units to deficit units (Novandra, 2014). Thus, when the intermediation function runs well, the use of funds will be more optimal and efficient. This argument is also supported by the research of Sufian and Kamarudin (2014), Abbas et al. (2015), Rani et al. (2017), Bhatia et al. (2018), Johnes et al. (2018), Octrina et al. (2019), Rusydiana et al. (2019), Salleh and Rani (2020), Jubilee et al. (2020), Jubilee et al. (2021), Octrina and Mariam (2021), and Bayiley (2022), who used an intermediation approach in their research.

Then, the input and output variables will be measured for productivity using the Malmquist Productivity Index (MPI) method through DEAP 2.1 software. MPI is part of the Data Envelopment Analysis (DEA) method that can be used to analyze the productivity level of each business unit, and MPI can also analyze the changes in performance (Octrina et al., 2020).

Finally, the results of the productivity value will be subject to a different test to see how far the productivity differs between conventional and Islamic banks.

III. Methodology

Data

This study is a quantitative research with descriptive research objectives. The research used secondary data in the form of panel data obtained from the publication of monthly financial statements of each bank obtained from its official website and the OJK. This study was conducted during the COVID-19 pandemic in Indonesia, especially from March 2020 to June 2021. The samples were selected using non-probability sampling with purposive sampling techniques. The samples used in this study were the population of commercial banks in Indonesia consisting of 95 conventional banks and 10 Islamic banks. The selected samples were conventional and Islamic commercial banks that did not merge and use their inputs for operational activities in the research period. The collected data were processed using DEAP 2.1 and SPSS 24 software. The input variables (X) and output (Y) used in the study for conventional bank were interest expense (X1), non-interest expense (X2), interest income (Y1), and non-interest income (Y2). Meanwhile, the variables for Islamic bank were profit paid on deposits (X1), operating expense (X2), income from investment (Y1), and non-investment income (Y2). These variables were selected based on the intermediation approach.

Model Development

Data Envelopment Analysis (DEA) was first introduced by Charnes, Cooper, and Rhodes in 1978. Since then, its utilization and development have grown rapidly including in many banking-related applications (Ascarya & Yumanita, 2008). This technique focuses on decision-making units (DMUs), which convert a given amount of inputs to specific output. Further DEA can be input oriented, output oriented or unoriented model. DEA can also work with a small number of observations but it does not allow for random error, which means any deviation from the frontier would be treated as inefficiency. This shortcoming can possibly result in overstatement of relative efficiency results (Bhatia et al., 2018).

According to Coelli et al. (2005) there are two DEA models, such as the Constant Return to Scale (CRS) and Variable Return to Scale (VRS) models. The CRS model assumes that all companies operate at an optimal scale. However, due to imperfect competition, government regulations, financial constraints, and others that may cause companies not to operate at an optimal scale, it can use the VRS model because the VRS model assumes that the company is not at an optimal scale. In addition, VRS allows for the conclusion that the addition of one input unit does not have to produce an additional one unit of output, because it can produce less or more than one. Meanwhile, the CRS assumption is the opposite, i.e., the addition of one unit of input will result in the addition of one unit of output.

Malmquist Productivity Index (MPI) is part of DEA. To derive the MPI through an output orientated, DEA model requires data on inputs and outputs to be fed into the model. There are mainly two approaches in modeling bank behavior which are - the production approach and the intermediation approach. The production approach is the traditional banking approach. According to production approach, banks use three input factors; namely labor, capital, and banking funds to produce a vector of three outputs in the form of short-term loans, long-term loans, and other earning assets. The intermediation approach is viewed as non-traditional approach that suggests bank borrows depositor's funds and channels them to deficit units as loans and other assets in the intermediation approach (Jahan, 2019). The input (X) and output (Y) variables used in the study with an intermediation approach are:

Table 2. Input and output variables for MPI

Varible	Conventional banking variable	Islamic banking comparing variable
Inputs	Interest expense (X1)	Profit paid on deposits (X1)
	Non-interest expense (X2)	Operating expense (X2)
Outputs	Interest income (Y1)	Income from investment (Y1)
	Non-interest income (Y2)	Non-investment income (Y2)

Source: Jahan (2019)

The research conducted by Jahan (2019) is very relevant and accommodates this research because it was carried out over a monthly period and given the limited availability of data in the monthly financial reports of Indonesian banks, which only display statements of financial position and income statements. Thus, the data in Table 2 above are obtained from the income statements. Although research conducted by Jahan (2019) used an annual period, in this research we used a monthly period, which is of course a novelty in this research because there has been no research that has measured and compared productivity on a monthly basis. In addition, the input and output variables used are based on an intermediation approach, which is also in accordance with the background of this research. From the background and the previous research above, the hypotheses of this study are:

H0: There is no significant difference in productivity between conventional and Islamic commercial banks.

H1: There is a significant difference in productivity between conventional and Islamic commercial banks.

Method

Malmquist Productivity Index (MPI) is part of the Data Envelopment Analysis (DEA) method that can be used to analyze productivity level of each business unit using predefined inputs and outputs. Thus, it can be seen how the change in the level of efficiency and use of technology. In addition, MPI can also analyze the changes in performance (Octrina et al., 2020).

Measuring the productivity of financial institutions can use an output approach because it is considered more appropriate, considering that financial services institutions are inclined to maximize output using available inputs. Therefore, this study used an output approach assuming Variable Return to Scale (VRS) that allows for the conclusion in the addition that 1 unit input does not have to produce an additional 1 unit of output, as it can produce smaller or greater than 1 (Coelli et al., 2005).

Some advantages of the characteristics of the Malmquist Index according to Octrina et al. (2019) are as follows:

1) This index is classified as nonparametric method that does not require specifications regarding the form of the production function.
2) It does not require assumptions about the economic behavior of the unit of production, such as profit maximization or cost minimization. So, it will be useful when the purpose of the producers is unknown or different.
3) The index calculation does not require data on input and output prices that are normally unavailable.

4) Productivity measurement through this index can be divided into two components, i.e., efficiency and change in the use of technology.

According to Rusydiana (2018), MPI is based on a concept of production functions, which can be used to measure maximum production functions using predefined input limits. The results of this index calculation are efficiency change (EFFCH), scale efficiency change (SECH), pure efficiency change (PECH), technological change (TECHCH), and total factor productivity change (TFPCH). According to Fare et al. (1994) total factor productivity change (TFPCH) can be used to see efficiency change (EFFCH) and technological change (TECHCH). Meanwhile, scale efficiency change (SECH) and pure efficiency change (PECH) are two components from efficiency change (EFFCH). Fare et al. (1994) also describes the MPI formula with output-oriented:

$$M_0(x^{t+1}, y^{t+1}, x^t, y^t) = \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \left[\left(\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^{t+1}, y^{t+1})} \right) \left(\frac{D_0^t(x^t, y^t)}{D_0^{t+1}(x^t, y^t)} \right) \right]^{\frac{1}{2}} \quad (1)$$

The latest production functions are listed in x^{t+1}, y^{t+1} and the current period's production function is listed with x^t, y^t. For the function of observation distance using technology, it is listed in $D_0^t(x^{t+1}, y^{t+1})$. Meanwhile, the ratio outside brackets measures changes in relative efficiency, i.e., how far the change in production is observed between the years t and t+1. The geometric average of the two ratios in parentheses can capture a shift in technology, between the two periods evaluated at x^t and x^{t+1}. If MPI is divided down into efficiency and technology change, then equation (1) is divided down into:

$$\text{Efficiency Change} = \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \quad (2)$$

$$\text{Technology Change} = \left[\left(\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^{t+1}, y^{t+1})} \right) \left(\frac{D_0^t(x^t, y^t)}{D_0^{t+1}(x^t, y^t)} \right) \right]^{\frac{1}{2}} \quad (3)$$

If $x^t = x^{t+1}$ and $y^t = y^{t+1}$, There is no change in input and output between those periods. That is, the productivity index indicates no change i.e., M = 1. Decreased productivity occurs when M<1, and increase in productivity occurs when M>1.

VI. Results and Discussions

Results

Descriptive Statistics

The descriptive statistical analysis in this section was carried out using input and output variables to measure the productivity of conventional and Islamic commercial banks. So, it would be seen the lowest, highest, average, and standard deviation of the variable used. This descriptive statistical analysis used SPSS 24 software.

Input variables from conventional banks are interest expense and non-interest expense, while the output variables are interest income and non-interest income. The descriptive statistical results of input and output variables used by conventional banks are as follows:

Table 3. Descriptive statistical results of conventional bank variables

Variables	N	Minimum	Maximum	Mean	Std. Dev
Interest expense (X1)	1520	2,191	34,811,751	1,186,220.37	3,016,311.919
Non-interest expense (X2)	1520	1,731	78,545,800	2,208,712.44	6,392,698.418
Interest income (Y1)	1520	2,616	109,958,749	3,093,119.27	8,899,056.876
Non-interest income (Y2)	1520	0	29,606,639	1,109,622.99	3,303,623.894

Source: Data processed by researchers (2022)

Table 3 above shows the results of descriptive statistical values of variables used for 95 conventional commercial banks for 16 months from March 2020 to June 2021:

The lowest value of interest expense of 2,191 was obtained by JP Morgan Chase Bank NA in January 2021, while the highest value of interest expense of 34,811.751 was obtained by Bank BRI in December 2020. The average value of interest expense is 1,186,220.37 with a standard deviation of 3,016,311.919.

The lowest value of non-interest expense of 1,731 was obtained by the Bank Bisnis Internasional in January 2021, while the highest value of non-interest expense of 78,545,800 was obtained by Bank BRI in December 2020. The average value of non-interest expense is 2,208,712.44 with a standard deviation of 6,392,698.418.

The lowest value of interest income of 2,616 was obtained by Bangkok Bank in January 2021, while the highest value of interest income of 109,958,749 was obtained by Bank BRI in December 2021. The average value of interest income is 3,093,119.27 with a standard deviation of 8,899,056.876.

The lowest value of non-interest income of 0 was obtained by Bank Digital BCA in January, February, and March 2021, while the highest value of non-interest income of 29,606,639 was obtained by Bank BRI in December 2020. The average value of non-interest income is 1,109,622.99 with a standard deviation of 3,303,623.894.

Meanwhile, the input variables from Islamic banks are profit paid on deposits and operational expenses, while the output variables are income from investment and non-investment. The following table presents the descriptive statistical results of input and output variables used by Islamic banks.

Table 4. Descriptive statistical results of Islamic bank variables

Variables	N	Minimum	Maximum	Mean	Std. Dev
Profit paid on deposits (X1)	160	16,764	1,610,047	282,098.53	281,343.074
Operating expense (X2)	160	8,535	2,442,424	366,861.21	441,458.894
Income from investment (Y1)	160	22,014	4,037,474	672,411.54	721,770.924
Non-investment income (Y2)	160	1,489	846,457	86,268.28	141,001.799

Source: Data processed by researchers (2022)

Based on Table 4 above, from 10 Islamic banks during the period March 2020 to June 2021 it can be concluded that:

The lowest value of profit paid on deposits of 16,764 was obtained by Bank Syariah Bukopin in January 2021, while the highest value of profit paid on deposits of 1,610,047 was obtained by Bank Muamalat Indonesia in December 2020. The average value of profit paid on deposits is 282,098.53 with a standard deviation of 281,343.074.

The lowest value of operating expense of 8,535 was obtained by Bank Victoria Syariah in January 2021, while the highest value of operating expense of 2,442,424 was obtained by Bank BTPN Syariah in December 2020. The average value of other operating expenses is 366,861.21 with a standard deviation of 441,458.894.

The lowest value of income from investment of 22,014 was obtained by Bank Syariah Bukopin in January 2021, while the highest value of income from investment of 4,037,474 was obtained by Bank BTPN Syariah in December 2020. The average value of income from investment is 672,411.54 with a standard deviation of 721,770.924.

The lowest value of non-investment income of 1,489 was obtained by Bank BTPN Syariah in January 2021, while the highest value of non-investment income of 846,457 was obtained by Bank Muamalat Indonesia in November 2020. The average value of non-investment income is 86,268.28 with a standard deviation of 141,001.799.

Malmquist Productivity Index (MPI)

The following table presents the results of productivity level from conventional and Islamic banks using the Malmquist Productivity Index (MPI) approach. The banks' productivity is viewed from the value of TFPCH. This MPI was processed using DEAP 2.1 software generating five index components. The productivity results of conventional banks are presented in Table 5 and those of Islamic banks are listed in Table 6.

Table 5. Conventional bank productivity results

No	Period	EFFCH	TECHCH	PECH	SECH	TFPCH	Description
1	March 2020	0.999	1.018	1.029	0.971	1.017	Productive
2	April 2020	1.052	0.933	1.001	1.051	0.982	Unproductive
3	May 2020	0.988	0.990	1.070	0.923	0.978	Unproductive
4	June 2020	1.127	0.889	0.954	1.181	1.001	Productive
5	July 2020	0.989	0.981	0.899	1.100	0.970	Unproductive
6	August 2020	1.023	0.973	1.024	1.000	0.995	Unproductive
7	September 2020	1.006	0.988	1.021	0.985	0.994	Unproductive
8	October 2020	0.993	1.006	0.978	1.016	0.999	Unproductive
9	November 2020	0.961	1.045	0.967	0.993	1.004	Productive
10	December 2020	0.969	0.990	1.085	0.893	0.959	Unproductive
11	January 2021	0.922	1.152	0.865	1.066	1.061	Productive
12	February 2021	1.036	0.955	1.096	0.945	0.989	Unproductive
13	March 2021	1.054	0.973	1.061	0.993	1.026	Productive
14	April 2021	0.975	1.025	1.014	0.962	1.000	Productive
15	May 2021	1.023	0.980	1.010	1.012	1.002	Productive
16	June 2021	0.996	0.999	1.007	0.989	0.996	Unproductive
	Mean	**1.006**	**0.992**	**1.003**	**1.003**	**0.998**	**Unproductive**

Notes: productive if the TFPCH value ≥ 1.

Source: Data processed by researchers (2022)

From these results, conventional banks are considered unproductive because the results of their TFPCH of 0.998<1 with a standard deviation of 0.0234. The TFPCH value of conventional banks is driven by efficiency change (EFFCH) with a value of 1.006, rather than technological change (TECHCH) with a value of 0.992. In March 2020, June 2020, November 2020, January 2021, March 2021, April 2021, and May 2021, conventional banks were productive in managing their inputs and outputs. However, in April 2020, May 2020, July 2020, August 2020, September 2020, October 2020, December 2020, February 2021, and June 2021 conventional banks were not productive in managing their inputs and outputs. During the research period, conventional banks achieved the highest productivity in January 2021 with a TFPCH value of 1.061 driven by technological change with a TECHCH value of 1,152. Meanwhile, the lowest level of productivity was achieved by conventional banks in December 2020 with a TFPCH value of 0.959 driven by technological change.

Table 6. Islamic bank productivity results

No	Period	EFFCH	TECHCH	PECH	SECH	TFPCH	Description
1	March 2020	1.006	1.006	1.011	0.995	1.012	Productive
2	April 2020	1.030	0.935	1.023	1.006	0.963	Unproductive
3	May 2020	1.010	0.970	1.005	1.004	0.979	Unproductive
4	June 2020	1.009	1.000	1.009	1.000	1.009	Productive
5	July 2020	1.016	0.986	1.015	1.001	1.002	Productive
6	August 2020	0.989	1.047	1.007	0.983	1.036	Productive
7	September 2020	0.999	1.008	1.001	0.998	1.007	Productive
8	October 2020	0.995	1.008	0.995	1.000	1.003	Productive
9	November 2020	1.000	1.002	0.994	1.006	1.002	Productive
10	December 2020	1.007	0.926	1.001	1.005	0.932	Unproductive
11	January 2021	0.885	1.248	0.922	0.959	1.104	Productive
12	February 2021	1.017	0.967	1.020	0.997	0.983	Unproductive
13	March 2021	0.986	1.042	0.998	0.988	1.027	Productive
14	April 2021	0.993	0.992	0.980	1.013	0.985	Unproductive
15	May 2021	1.004	0.993	1.015	0.989	0.997	Unproductive
16	June 2021	1.036	0.954	0.993	1.044	0.989	Unproductive
	Mean	0.998	1.003	0.999	0.999	1.001	Productive

Notes: productive if the TFPCH value ≥ 1.
Source: Data processed by researchers (2022)

If we view based on average TFPCH, the Islamic banks has reached the level of productivity with the value of 1.001>1 and a standard deviation of 0.0366. The value is driven by technological change with a TECHCH value of 1.003, rather than change in efficiency with an EFFCH value of 0.998. In March 2020, June 2020, July 2020, August 2020, September 2020, October 2020, November 2020, January 2021, and March 2021, Islamic banks were productive in managing their inputs and outputs. However, they were not productive in managing their output inputs in April 2020, May 2020, December 2020, February 2021, April 2021, May 2021, and June 2021.

During the 16 months research period, just like conventional banks, Islamic banks also achieved the highest level of productivity in January 2021 with a TFPCH value of 1.104 driven by technological change, rather than change in efficiency, with a TECHCH value of 1.248. Islamic banks achieved the lowest level of productivity in December 2020 with a TFPCH value of 0.932 driven by the change in efficiency, rather than technological change.

At the beginning of the COVID-19 outbreak in Indonesia, i.e., in March 2020, the government had not issued various policies. Therefore, conventional and Islamic banks were still performing normal activities in their business. But in the following months, there were policies such as large-scale social restrictions, which limited community mobilization to break the chain of the spread of COVID-19 in Indonesia. In addition, the COVID-19 pandemic certainly increased the burden on banks because every bank including the head office and branches must provide the needs for health protocols, such as masks, hand sanitizers, and other safety measures. Then the WFH and WFO employee policies had great impacts on the bank's operational activities. The results of the productivity analysis revealed that Islamic banks could control their business activities to maintain their productivity during the pandemic by utilizing technology. On the other hand, conventional banks had not achieved productivity during the pandemic.

Discussions

TFPCH Normality Data Test

The normality data test was taken based on the TFPCH of each bank monthly for the samples. Data normality tests on conventional commercial banks were conducted using the Kolmogorov Smirnov (K-S) test because the number of data is ≥50.

Table 7. Results of conventional banks' TFPCH normality data test

	Kolmogorov-Smirnov		
	Statistic	df	Sig.
March 2020	0.299	95	0.000
April 2020	0.344	95	0.000
May 2020	0.280	95	0.000
June 2020	0.314	95	0.000
July 2020	0.332	95	0.000
August 2020	0.216	95	0.000
September 2020	0.186	95	0.000
October 2020	0.162	95	0.000
November 2020	0.221	95	0.000
December 2020	0.230	95	0.000
January 2021	0.212	95	0.000
February 2021	0.272	95	0.000
March 2021	0.266	95	0.000
April 2021	0.213	95	0.000
May 2021	0.278	95	0.000
June 2021	0.264	95	0.000

Source: Data processed by researchers (2022)

Table 7 presents the results of the normality data test of TFPCH from 95 entities of conventional banks monthly. Based on the significant level of K-S during March 2020 to June 2021, which is 0.000<α (0,05), it suggests that H0 be rejected and H1 be accepted. It means that data is not normally distributed. Meanwhile, the TFPCH normality data test of Islamic banks as shown in Table 6 performed using the Shapiro-Wilk (S-W) test because the number of data is <50.

Table 8. Results of Islamic banks' TFPCH normality data test

	Shapiro-Wilk		
	Statistic	df	Significant
March 2020	0.900	10	0.217
April 2020	0.895	10	0.191
May 2020	0.799	10	0.014
June 2020	0.970	10	0.895
July 2020	0.914	10	0.313
August 2020	0.450	10	0.000
September 2020	0.953	10	0.708
October 2020	0.969	10	0.885
November 2020	0.977	10	0.949
December 2020	0.573	10	0.000
January 2021	0.967	10	0.859
February 2021	0.833	10	0.036
March 2021	0.954	10	0.711
April 2021	0.909	10	0.271
May 2021	0.931	10	0.456
June 2021	0.845	10	0.051

Source: Data processed by researchers (2022)

Table 8 describes the results of the normality data test of TFPCH from 10 entities of Islamic commercial banks every month. So, it can be observed that in March 2020, April 2020, June 2020, July 2020, September 2020, October 2020, November 2020, January 2021, March 2021, April 2021, May 2021, and June 2021, the significant levels > α (0.05), which suggests that H0 be accepte and the TFPCH data of Islamic banks are normally distributed. Meanwhile, in May 2020, August 2020, December 2020, and February 2021, the significant levels of < α (0.05), which means that H0 is rejected and H1 is accepted. Hence, the data are not normally distributed.

Thus, it can be concluded that the normality test of conventional bank based on TFPCH data every month is not normally distributed with consistency, while Islamic banks data are inconsistent because there were periods when the data were normally distributed, and some were not normally distributed. The average TFPCH data test of conventional and Islamic banks is taken from the data in Table 2 and 3. The normality test was conducted using S-K because the data is <50. Thus, the results are shown in Table 9 below.

Table 9. Results of normality data test of conventional and Islamic banks' mean TFPCH

	Shapiro-Wilk		
	Statistic	df	Significant
Mean TFPCH from Conventional Bank	0.918	16	0.158
Mean TFPCH from Islamic Bank	0.896	16	0.068

Source: Data processed by researchers (2022)

Based on Table 9, the average significance value of conventional bank TFPCH is 0.158>α (0.05), which means that H0 is accepted; thus, the data is normally distributed. On the other hand, the average significance value of TFPCH of Islamic banks is 0.068>α (0.05), which means than H0 is

accepted; thus, the data is normally distributed. It can be concluded from the results that the average TFPCH value of conventional and Islamic banks are normally distributed.

Hypothesis test

Based on the results of the TFPCH normality data test of both conventional and Islamic bank every month, hypothesis testing can be performed using the Mann-Whitney U test because the test does not require that the data must be normally distributed. The following table presents the results of hypothesis testing using the TFPCH data of each bank every month.

Table 10. The difference test results of conventional and Islamic bank TFPCH values

Mann-Whitney U test			
	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
March 2020	446.500	5,006.500	-0.311	0.756
April 2020	350.000	405.000	-1.365	0.172
May 2020	452.000	507.000	-0.251	0.802
June 2020	384.500	4,944.500	-0.988	0.323
July 2020	465.500	520.500	-0.104	0.917
August 2020	354.000	4,914.000	-1.321	0.186
September 2020	345.500	4,905.500	-1.414	0.157
October 2020	421.500	4,981.500	-0.584	0.559
November 2020	438.000	4,998.000	-0.404	0.686
December 2020	385.500	4,945.500	-0.977	0.329
January 2021	423.500	4,983.500	-0.562	0.574
February 2021	437.000	492.000	-0.415	0.678
March 2021	429.500	4,989.500	-0.497	0.619
April 2021	430.000	485.000	-0.491	0.623
May 2021	461.500	516.500	-0.147	0.883
June 2021	402.000	457.000	-0.797	0.425

Source: Data processed by researchers (2022)

The results of the difference testing in Table 8 between conventional and Islamic banks during the period March 2020 to June 2021 had a value Asymp. Sig (2-tailed)>α (0.05). Thus, H0 is accepted and H1 is rejected, which means there is no significant difference in productivity between conventional and Islamic commercial banks on monthly basis.

The results of the difference test between the average TFPCH of conventional and Islamic banks listed in Tables 5 and 6 can be seen in Table 11 below, using the independent sample T test because the average TFPCH data of conventional and Islamic banks is normally distributed.

Table 11. The difference test results for the average TFPCH of conventional and Islamic banks

| | | \multicolumn{2}{c|}{Levene's Test for Equality of Variances} | \multicolumn{7}{c|}{t-test for Equality of Means} |
| | | | | | | | | | 95% Confidence Interval of the Difference |
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean TFPCH	Equal variances assumed	0.889	0.353	-0.327	30	0.746	-0.0036	0.0109	-0.0258	0.0186
	Equal variances not assumed			-0.327	25.518	0.746	-0.0036	0.0109	-0.0259	0.0188

Source: Data processed by researchers (2022)

Table 11 above presents the results of the difference test in the average value of TFPCH between conventional and Islamic banks. Based on the Levene's test, it shows that the F value accounts for 0.889 with a significance level of 0.353, which indicates a uniform data variant because of a significant rate of 0.353>α (0.05). Thus, to determine the independent sample, T-test can use the assumption of uniform data variants (equal variances assumed).

The independent sample T-Test showed that the t count value is -0.327 with a significant level of 0.746>α (0.05). Thus, H0 is accepted, which suggests that there is no significant average difference in productivity between conventional and Islamic commercial banks. An average difference (mean difference) of -0.003 was obtained from the difference in average productivity between conventional banks which is 0.998 and Islamic banks of 1.001. Thus, with a confidence level of 95%, the range of average productivity difference (TFPCH) of conventional and Islamic banks is -0.0257 to 0.0186.

Therefore, the comparison of the average productivity fluctuation between conventional and Islamic banks on monthly basis is presented in Figure 5 below.
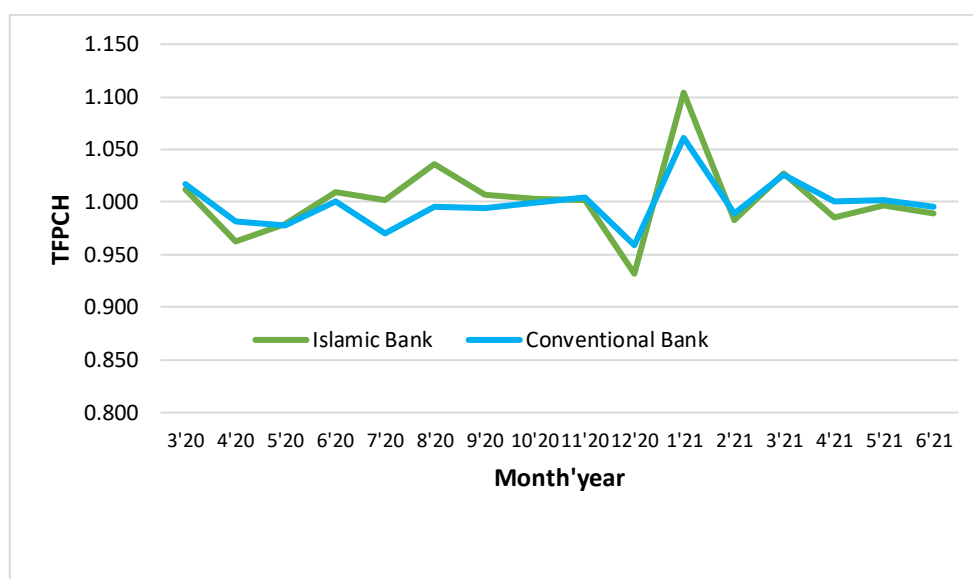
Figure 5. Comparison of TFPCH of conventional and Islamic banks
Source: Data processed by researchers (2022)

Based on Figure 5 above, we can observe that both conventional and Islamic banks in December 2020 was at the lowest productivity, while the highest productivity was achieved in January 2021. Taking into account the phenomenon of input and output movements in Figures 2 and 3 above, in December 2020, the use of conventional and Islamic bank inputs was high to produce high output as well. Yet, the productivity measurements show that in December 2020, conventional and Islamic banks were not productive. Meanwhile, based on Figures 2 and 3 above, we can see it that in January 2021, there was a decrease in the use of inputs so that the output produced by both conventional and Islamic banks decreased, as well. However, the results of productivity measurement showed that in the January 2021, both conventional and Islamic banks achieved the highest productivity during the research period.

Hence, these results show that high use of inputs and outputs produced does not necessarily means that a company or an organization is productive in managing their inputs and outputs. On the contrary, a company or an organization that uses little input and the resulting output does not necessarily means that it has poor productivity. Therefore, it can be stated that to be productive, the company or organization must manage their inputs and outputs optimally.

VII. Conclusion and Recommendation

Conclusion

The MPI analysis results show that the average TFPCH of conventional banks is not very high, indicating that conventional banks are not productive in managing their inputs and outputs. But even so, they are already efficient in managing their inputs and outputs, which is indicated by the average achievement of EFFCH values that are quite high. The conventional banks are not productive because they do not optimally use technology for their operations, which is indicated by a low average TECHCH value. Therefore, conventional banks must improve the use of

technology in terms of products, services, and operational activities to achieve optimal productivity levels.

On the other hand, the MPI analysis results of Islamic bank show the average TFPCH value that is quite high, which implies that Islamic banks are productive in managing their inputs and outputs. Although the average TFPCH value is not in line with the low average EFFCH value, Islamic banks are inefficient in managing their inputs and output. The average TFPCH value of Islamic banks is quite high, driven by the average value of TECHCH which is quite high, as well. Therefore, Islamic banks can utilize optimally the technology owned for their operational activities. However, Islamic banks are also required to improve their efficiency in managing their inputs and outputs to maintain their level of productivity.

The average TFPCH data of both conventional and Islamic banks during the study period were normally distributed. The comparison between the productivity of conventional and Islamic banks in Indonesia does not mean a significant difference although the result of conventional banks is not productive but Islamic banks are productive. It means that the difference between the TFPCH value of conventional and Islamic banks does not have significant difference.

Recommendation

Based on the results, it is suggested that banks are to make optimal use of technology to reach a high productivity level, such as improving services through mobile banking, internet banking, ATM, e-money, and other technologies in their operational activities. Based on the research results, there are still many banks not optimal in technological utilization. In addition, banks must also be able to perform cost efficiency, so that the output produced is optimal. Based on the study results, there are still many banks not efficient in managing their inputs and outputs. Therefore, banks must be able to utilize technology and perform cost efficiency to achieve high level of productivity and produce optimal output. From the output, the bank must also be able to allocate its funds as well as possible, so that the bank's fund circulation runs smoothly and produces optimal output as well. Therefore, the banks can achieve high productivity when banks can allocate their funds appropriately. When the bank is productive, it can increase investor confidence to deposit their funds in the bank.

In addition, investors must be able to choose the right bank when they invest for good returns and this can be sourced from the bank's investment capacity in financial technology and efficiency in their operational activities. Consequently, the bank can be chosen as an investment platform for the reinforced return.

The government must also continue to encourage banks to sustain for innovation in providing maximum service to the public. The government as an authority institution to regulate the banking system in Indonesia can make policies for unproductive banks to merge. So, it is hoped that when conducting a bank merger, it will be productive because the resources are increased, and collaboration will occur to achieve shared goals.

Author Contributions

Conceptualization, Fajra Octrina and Almi Jamilah.; Methodology, Almi Jamilah.; Investigation, Fajra Octrina and Almi Jamilah.; Analysis, Almi Jamilah.; Original draft preparation, Almi Jamilah.; Review and editing, Fajra Octrina and Almi Jamilah.; Visualization, Almi Jamilah.; Supervision, Fajra Octrina.

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Conflicts of Interest

We do not have any conflict of interest, there was no interference from any party in the research or writing of this article.

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