Published: 11 December 2024

Productivity Growth in OIC Countries: SDGs Perspective

Aam Slamet Rusydiana[1], Rachmi Ramdia Ningsih[2]
[1]*Sakarya University, Turkiye*
[2]*IPB University, Indonesia*

Over the past few decades, countries in the Organization of Islamic Cooperation (OIC) have achieved various levels of economic development. In today's sustainable era, increasing efficiency and productivity is one of the goals to be achieved. Development goals, especially the achievement of food security, healthy lives and well-being for all ages, gender equality, inclusive economic growth, and industrialization are important to ensure access to sustainable livelihoods. This study aims to assess changes in total factor productivity and efficiency based on n indicators of sustainable development goals (SDGs) in 49 countries that are members of the OIC during the period 2010 to 2017. Utilizing the Malmquist total factor productivity (TFP) index and Data Envelopment Analysis (DEA), this study estimates the changes in productivity and efficiency that occurred in each OIC member country. The results show that Jordan, Cameroon, Tunisia, Saudi Arabia, and Lebanon are the countries with the highest TFP increase in the observed years. However, the overall productivity of OIC countries has decreased as evidenced by the Malmquist TFP index which is less than one or 0.991. This productivity decline is caused by technical and technological inefficiencies. On the other hand, there are differences in productivity in countries belonging to the GCC, AMU, Sub-Saharan Africa, Middle East countries, and Asian countries. The performance comparison is intended to help identify policies for further improvement for OIC countries in the region.

Keywords: SDGs; Malmquist Productivity Index; DEA; Productivity Change; Efficiency; OIC

OPEN ACCESS

*Correspondence:
Aam Slamet Rusydiana
aamrusydiana@sakarya.edu.tr

Received: 7 July 2024
Accepted: 19 November 2024
Published: 13 December 2024

Citation:
(2024) Productivity Growth in OIC Countries: SDGs Perspective. Islamic Economics Methodology. 3.2.

INTRODUCTION

The Sustainable Development Goals (SDGs), announced at the 2015 OIC Summit, bring a new perspective for member countries in facing global development challenges. With 17 goals and 169 targets, it is expected to promote a more comprehensive development of OIC countries in a global perspective. Currently, performance evaluation is an important agenda to be carried out as it is the foundation in achieving sustainable development goals (SDGs) in the 2030 global development agenda and economic efficiency for OIC countries. For a country, efficiency is very important. The concept of efficiency is often defined as *doing the thing right*. It is usually associated with how a country achieves its goals. In addition, this research is also to reveal that OIC countries as a group cannot achieve the prioritized SDGs by 2030 if the total factor productivity of each OIC country has not been well optimized. In other words, the productivity of the OIC countries is also very important for achieving the targets in the long run.

Determining the limiting factor that becomes the benchmark of whether a country has worked efficiently and productively is important to note. It is not certain that the factor chosen as a variable to measure the level of efficiency can represent the overall aspect. For this reason, a formulation of efficiency and productivity measurement that can involve multi-variables is needed. In the world of efficiency measurement, currently the Data Envelopment Analysis (DEA) approach is widely known. DEA is based on the Cobb Douglas production frontier curve (Farrell, 1957). According to Tsolas and Giokas (2012) DEA is a tool that can be used to measure and compare the performance of a number of service units or business units and DEA can also show the specifications of the inefficiency of these service units. Since the DEA method was first introduced by Charnes, Cooper and Rhodes in 1978, researchers in a number of fields have realized that DEA is an excellent methodology and relatively easy to use in the process of operational modeling for performance evaluation. At the beginning of its development, DEA was very much applied in the banking industry (Sherman and Gold, 1985; Coelli et.al, 1998). However, currently DEA is not only used in research related to the banking industry but related to research in other fields.

Meanwhile, to measure the productivity of the observed Islamic banks, this study uses Malmquist Productivity Index (MPI) analysis. The Malmquist Index is part of the DEA method that specifically looks at the level of productivity of each business unit, so that changes in the level of efficiency and technology used based on predetermined inputs and outputs will be seen. The Malmquist Index is also used to analyze changes in performance over time.

LITERATURE REVIEW

Efficiency and productivity are concepts that show the ratio between inputs and outputs. Both ratios show that efficiency and productivity can be controlled by engineering the management of inputs and outputs, or even both. Efficiency and productivity can be used to measure the performance of a unit of economic activity. An activity can be called efficient if the efforts that have been made provide maximum output, both in quantity and quality. An activity can also be said to be efficient if with minimum effort it can achieve a certain output.

In economic theory, there are two types of efficiency: *economic* efficiency and *technical efficiency*. Economic efficiency has a macroeconomic picture, while technical efficiency has a microeconomic picture. Technical efficiency is the process of converting inputs into outputs. This concept only applies to the internal technical relationship between inputs and outputs. Scale efficiency is associated with the achievement of economies of scale of an entity in carrying out its operations (Ramanathan, 2003). Measurements related to efficiency are usually carried out using non-parametric methods, namely *Data Envelopment Analysis* (DEA).

DEA is a nonparametric method that uses a linear program model to calculate the ratio of outputs and inputs for all units being compared. The advantage of using DEA is that it does not require explicit specification of the function form and requires little structure to form the efficiency frontier. DEA is widely applied in performance evaluation and *benchmarking* in educational institutions, hospitals, financial institutions, *production plans* and others**.** The units used in DEA are called DMUs. This technique can be used to determine how efficiently a DMUs is used by utilizing existing equipment to produce maximum *output***.** The weaknesses that may arise when using this method are *self identifiers* and *near self identifiers*. DEA was first developed by Farrel (1957) who measured the efficiency of a one-input and one-output technique into a multi-input and multi-output technique (Rusydiana & Nugroho, 2017). In this study, the assumptions used are *variable return to scale* (VRS) and output *oriented*. As stated by Johnes (2006), the output-oriented model is a suitable model to achieve economic efficiency.

The concept of productivity is basically the relationship between output and input in a production process. Productivity can be measured partially or totally. Partial productivity is the relationship between *output* and one *input*. Examples of partial productivity that are commonly used are labor productivity which shows the average output per labor, as well as capital productivity which describes the average output per capital. *Total* productivity or commonly referred to as *Total Factor Productivity* (TFP) measures the relationship between output and several inputs together. The relationship is expressed as the ratio of the output index to the aggregate input index. If the ratio increases, it means that more output can be produced using a certain amount of input, or a certain amount of output can be produced using fewer inputs (Coelli et.al, 2005).

In productivity measurement, the most widely used is the *total factor productivity* (TFP) method. This method is used to overcome the weakness of efficiency calculations with more than one input and one output. TFP is measured using an index number that can measure changes in price and quantity over time. In addition, TFP also measures comparisons and differences between entities. The TFP index measures the change in value of N selected outputs from period "a" to "b" where p represents the output price. Indices that are often used to measure TFP are the Malmquist Index, Laspeyres Index, Pasche Index, Fisher Index, and Tornqvist Index. In this study, the Malmquist Index will be used to calculate the level of productivity (TFP).

The Malmquist Index was first created by Sten Malmquist in 1953 to measure productivity. But in its development, the Malmquist Index was introduced by Caves et.al (1982). There are two things calculated in the Malmquist index measurement, namely the *catch-up* effect and the *frontier shift* effect. The *catch-up* effect measures the level of change in relative efficiency from period one to period two. Meanwhile, the *frontier shift* effect measures the level of technological change which is the combination of input and output from period one to period two. The *frontier shift* effect is often referred to as the innovation effect. The Malmquist Index is a bilateral index used to compare the production technologies of two economies (Cooper et.al, 1999). The Malmquist index is based on the concept of *production* function, which measures the maximum production function with predetermined input constraints. In its calculation, this index consists of several results, namely: *efficiency change*, *technological change*, *pure efficiency change*, *economic scale change* and TFP *change*.

The Malmquist index has several favorable characteristics. First, it is a nonparametric method, so it does not require specification of the shape of the production function. Second, the Malmquist index does not require assumptions on the economic behavior of production units such as cost minimization or profit maximization, which is particularly useful when the objectives of producers are different or unknown. Third, the calculation of this index does not require price data, which is often not available. Fourth, the Malmquist productivity index can be broken down into two components: efficiency change and technological change. According to Avenzora and Jossy (2008), this is very useful because the analysis can be done more specifically based on the components. The shortcomings of the Malmquist index measurement include that this method requires *balanced* panel data, so it cannot be done for *time series* data. In the first generation model developed by Caves et.al (1982), there are two models of Malmquist productivity index (Bjurek, 1996). The first is the *'Malmquist input quantity index'* and the second is the *'Malmquist output quantity index'*. Malmquist input quantity index for a unit of production, at observation times t and t+1, for the reference technology in period k, k = t and t+1. The Malmquist input quantity index only measures the change in the observed input quantity between time t and t+1, where:

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

Next, for the Malmquist output quantity index for a production unit, at observation times t and t+1, for the reference technology in period k, k = t and t+1. This Malmquist output quantity index only measures the change in the observed output quantity between time t and t+1, where:

$$MO_k(y_k, x_t, x_{t+1}) = \frac{E_k^O(y_{t+1}, x_k)}{E_k^O(y_k, x_k)}, k = t, t+1 \quad (2)$$

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

Tornqvist productivity index, the index is constructed as a ratio between an output index and an input index:

$$MTFP_k = \frac{MO_k(y_t, y_{t+1}, x_k)}{MI_k(y_k, x_t, x_{t+1})} = \frac{E_k^O(y_{t+1}, x_k)/E_k^O(y_k, x_t)}{E_k^I(y_k, x_t)/E_k^I(y_k, x_{t+1})}, k = t, t+1 \quad (3)$$

The equation above describes the ratio between the output index and the Malmquist input index. If the value of the productivity index is greater than 1, then there has been an increase in productivity. If the index value is less than 1, the productivity level has decreased, while if the index value is equal to 1, the productivity level has not changed. Furthermore, this study has two main objectives, namely measuring the level of productivity change of OIC member countries and looking at the level of efficiency of OIC countries that are the object of research.

PREVIOUS STUDIES

Some research that applies productivity measurement of TFP change values, for example, was conducted by Young (1994). Young ranked Asian countries based on changes in total factor productivity. In his study, Young showed that Taiwan, South Korea, Japan and Singapore had higher factor accumulation growth than other Southeast Asian countries. However, in 1995, Young revealed that East Asian economies had significantly lower TFP growth values. TFP growth in Singapore, for example, was estimated at 0.2% in 1986-1990. Young's findings are consistent with research conducted by Yuan (1986, 1985) and Kim and Lau (1994). In a later study, Taylor (2007) showed that Singapore's output growth in 1966-1980 was due to an increase in the number of factor inputs, especially labor inputs rather than TFP growth. In his book, Taylor revealed that Singapore relied heavily on factors of production to generate higher economic growth rates. Kim and Lau (1994) suggested several reasons for the decline in productivity efficiency for newly industrialized countries (NICs) in the late 1950s and 60s. The productivity decline was caused by possible scale effects that are difficult to measure with conventional econometric approaches, then the relative lack of research and development due to underinvestment in public spending as well as lack of technological improvements. Then, capital resources were not driven intensively with technology.

Meanwhile, other research on the efficiency or productivity of OIC member countries was conducted by Mohamad and Said (2011) and Masri and Asbu (2018). In their study, Mohamad and Said (2011) used DEA to estimate how well Organization of Islamic Cooperation (OIC) countries utilize their resources. Using one input and four outputs, the authors applied three versions of an output-oriented DEA model assuming VRS to assess the relative macroeconomic performance of 54 OIC member countries for the period 2003-2007. It was found that by applying three different versions of the model, consistent results were obtained. Iran and Yemen are fuel exporting countries and belong to the category of non-developed countries. However, both countries top the performance list of OIC member countries. Meanwhile, out of 33 fuel-exporting countries that fall under the developed country category, nine countries were found to be at the top of the list. Then, the results were analyzed to identify the possible benefits and sources of inefficiency of each country.

Then, based on research conducted by Masri and Asbu (2018) on measuring efficiency and productivity in the health system. In achieving sustainable development goals and in particular the movement towards universal health coverage, it is imperative to curb the waste of resources to ensure the population's sustainable access to necessary and effective health services without enduring financial hardship. Results show that overall, total factor productivity in OIC countries decreased by 3.8%. This was due to a 9.1% decline in technical change, which overshadowed the 5.8% increase in efficiency. The decline in TFP over the study period is likely to hamper the achievement of the sustainable development goal targets of ensuring healthy lives and improving well-being for all at all ages. Other studies on this topic also done by Pratomo et al., (2023), Devi (2023), Uula et al., (2024), and Prakoso (2020).

RESEARCH METHOD

In this study, the estimation of TFP growth and its components refers to the Malmquist Index and uses the Cobb-Douglas production function. The Cobb-Douglas production function can be written as follows:

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

The equation is expressed as a measure of total factor productivity, where the scalar A is economic. It is the *geometric weighted average of* the *inputs* used to produce *real output*. Thus, A can be interpreted as *real output per unit of input*. This is a better measure of productivity compared to Y/L and Y/K which are partial productivity measures that do not take into account the possibility of other inputs being used. Then, the method used to measure efficiency in this study is Data Envelopment Analysis (DEA).

This study was conducted on a sample of 49 OIC member countries between 2010-2017. The data used to present SDGs sub-goals 2, 3, 5, 8, and 9 in measuring TFP change and economic efficiency are sourced from SESRIC. In detail, the data used as inputs and outputs are stated in Table 1.

Table 1. Input and Output Grouping

No.	Input	Output
1	*Labor*	*(2)Prevalence of Undernourishment*
2	*Capital*	*(3)Infant Mortality Rate*
3		*(5)Proportion of Seats Held by Women in Parliaments*
4		*(8)Annual Growth Rate of Real GDP per Capital*
5		*(9)Manufacturing Value Added as a Proportion of GDP*

The *analysis tool* used in this research is DEAP 2.1 The analysis for efficiency measurement will be conducted twice. First, the calculation of efficiency using CRS approach introduced by Charnes et.al (1978). Second, the efficiency measurement using VRS approach which was introduced by Banker et.al (1984).

RESULTS AND DISCUSSION

Table 2. Productivity Levels of OIC Member Countries 2010-2017

Year	EFFCH	TECHCH	PECH	SECH	TFPCH
2	0.811	1.240	0.942	0.862	1.006
3	1.013	0.989	1.031	0.982	1.001
4	1.024	1.002	0.985	1.040	1.027
5	1.181	0.782	1.044	1.132	0.924
6	0.954	1.039	0.959	0.994	0.991
7	1.004	0.996	1.022	0.982	1.000
8	1.019	0.969	0.985	1.035	0.987
Mean	**0.996**	**0.995**	**0.995**	**1.001**	**0.991**

Table 2 presents the MPI analysis for all OIC member countries in 2010-2017. With components, namely technical efficiency change (EFFCH) which is further broken down into pure efficiency change (PECH) and scale efficiency change (SECH) as well as technical or technological change (TECHCH). If the Malmquist index score (*TFP Change*) is greater than one (TFPCH > 1), it indicates that there is an increase in total factors of production (TFP) and vice versa. Also, if the EFFCH and TECHCH index scores are greater than one, it means that there is an increase in technical and technological change. Based on Table 2, it can be seen that the total factor productivity of OIC member countries fluctuates. The highest productivity achieved by OIC member countries occurred in period four, which amounted to 2.7 percent or 1.027. Meanwhile, the lowest value occurred in period five, which was 0.924. Overall, the annual average values of the EFFCH and TFCH indices were 0.996 and 0.995, respectively. The decline in both technical efficiency and technological efficiency led to a decline in TFP. The decline in productivity implies that the *concern of* OIC countries towards achieving sustainable development can be said to be not optimal.

Based on the results of the analysis of productivity changes using the TFCH index presented in Table 3, it can be seen that 21 out of 49 OIC member countries are greater than one. This indicates that there is a decrease in the average TFP during the observed period. The five countries with the highest marginal growth of total factor productivity are Jordan at 6.8 percent, Cameroon at 6.4 percent, Tunisia at 6.2 percent, Saudi Arabia at 5.7 percent and Lebanon at 5.5 percent. This implies that the five countries made significant improvements to human and capital resources during the period under study.

Table 3 Average Productivity Levels of OIC Countries 2010-2017

DMU	EFFCH	TECH	PECH	SECH	TFPCH	DMU	EFFCH	TECH	PECH	SECH	TFPCH
Afghanistan	1.000	0.993	1.000	1.000	0.993	**Kyrgyzstan**	0.953	0.949	0.961	0.992	0.905
Albania	1.010	1.037	1.000	1.010	1.048	**Lebanon**	1.047	1.008	1.037	1.009	1.055
Azerbaijan	0.924	1.012	0.946	0.976	0.935	**Malaysia**	1.000	0.987	1.000	1.000	0.987
Bahrain	1.000	0.981	1.000	1.000	0.981	**Mali**	1.000	0.995	1.000	1.000	0.995
Bangladesh	0.926	0.909	1.000	0.926	0.842	**Mauritania**	0.978	0.983	0.976	1.002	0.961
Benin	0.975	0.993	0.967	1.009	0.968	**Morocco**	1.028	1.008	1.040	0.989	1.037
Brunei	0.981	0.967	1.004	0.977	0.948	**Mozambique**	0.963	0.967	0.989	0.973	0.931
Burkina Faso	0.973	1.000	0.976	0.996	0.973	**Niger**	0.993	0.969	0.960	1.035	0.962
Cameroon	1.051	1.012	1.045	1.006	1.064	**Nigeria**	0.929	0.989	0.930	0.999	0.918
Chad	1.000	0.860	1.000	1.000	0.860	**Oman**	0.976	0.979	0.976	1.000	0.956
Comoros	0.991	1.037	0.985	1.006	1.027	**Pakistan**	0.984	1.018	1.000	0.984	1.002
Cote d'Ivoire	0.971	0.992	1.000	0.971	0.963	**Qatar**	1.000	0.979	1.000	1.000	0.979
Djibouti	1.061	0.971	1.007	1.053	1.030	**Saudi Arabia**	1.068	0.990	1.053	1.014	1.057
Egypt	1.000	1.037	1.000	1.000	1.037	**Senegal**	1.013	1.021	1.012	1.001	1.034
Gabon	1.020	1.025	0.990	1.030	1.046	**Sierra Leone**	1.024	1.001	0.989	1.035	1.025
Gambia	0.922	1.023	0.904	1.021	0.944	**Sudan**	1.001	1.014	1.001	1.000	1.014
Guinea	1.016	1.012	1.039	0.978	1.028	**Tajikistan**	1.000	0.972	1.000	1.000	0.972
Guinea-Bisau	1.000	1.024	1.000	1.000	1.024	**Togo**	0.962	1.018	0.977	0.985	0.979
Guyana	1.016	1.002	1.008	1.008	1.018	**Tunisia**	1.021	1.041	1.000	1.021	1.062
Indonesia	0.986	0.996	0.998	0.988	0.982	**Turkey**	1.000	0.975	1.000	1.000	0.975
Iran	1.006	1.004	0.982	1.024	1.010	**Turkmenistan**	1.005	1.001	1.000	1.005	1.006
Iraq	1.005	1.013	0.994	1.010	1.018	**Uganda**	1.004	1.001	0.989	1.015	1.005
Jordan	1.060	1.007	1.051	1.009	1.068	**UAE**	1.000	1.014	1.000	1.000	1.014
Kazakhstan	1.000	1.024	1.000	1.000	1.024	**Uzbekistan**	0.972	0.997	0.976	0.996	0.969
Kuwait	1.000	0.968	1.000	1.000	0.968	**Mean**	**0.996**	**0.995**	**0.995**	**1.001**	**0.991**

As can be inferred from Table 3, the decline in average total factor productivity is due to a decline in technical and technological efficiency. It is observed that the technical change component in the Malmquist TFP index of 18 countries is less than one, ranging from 0.922 to 0.993. On the other hand, according to the technological change index (TECHCH), Tunisia, Comoros, Eqypt, and Albania obtained the highest technological improvements (ranging from 1.037-1.041). The reference countries for technical efficiency include Saudi Arabia, Djibouti, and Jordan, which are 6.0 to 6.8 percent. Of the 12 countries listed that have technical changes from the Malmquist TFP index of more than one percent (range 1.3 to 6.8), one of them is a high-income country from the GCC (*Gulf Cooperation Council Countries*) region, namely Saudi Arabia. In general, there is a decline in productivity in this region. The decline was caused by inefficiencies in technology and technical efficiency that tended to stagnate. Meanwhile, other countries included in the *middle east countries* region saw an increase in total factor productivity with the exception of Turkey where the TFCH index is less than one. An increase in total factor productivity also occurs in the countries included in the AMU (*Arab Maghreb Union*), where the TFCH index ranges between 1.062 and 1.037 except Mauritania which is only worth 0.961. On the other hand, countries belonging to the sub-Saharan Africa and *Asian Countries* groups tend to experience a decline in annual average total factor productivity. In the sub-saharan Africa group, the decline is due to technical inefficiency, and the smallest value is owned by Gambia at 0.922. Meanwhile, the *Asian Countries* group is caused by inefficiency in technology, where the smallest value is owned by Bangladesh with a value of 0.909.

From the data processing that has been done, the results are shown in (Figure 1). As shown in Figure 1, the CRS efficiency value of OIC member countries in the observed period shows an increase. The overall average efficiency value is 0.822. There are 18 countries that have a relative efficiency value (*technical efficiency*) equal to one, such as Afghanistan, Bahrain, Bangladesh and others. Figure 1 shows that during the study period there were 26 countries that achieved the highest VRS efficiency (relative efficiency value = 1). Overall, the average value of efficiency in the VRS model also increased by 0.879, which is higher than CRS. This shows that an increase in a country's input efficiency provides optimal results towards the output target, namely the achievement of the five goals in the SDGs. On the other hand, there are also countries that are considered the least efficient in both models (CRS and VRS) including Djibouti and Sierra Leone. Where in the CRS model the relative efficiency value is only 0.162 and 0.366 and in the VRS model it is 0.447 and 0.488. Uganda, Turkmenistan, Tunisia, Nigeria, Kyrgyztan, Iraq, Gambia, and Albania are known to be efficient only in the VRS DEA model. Other relevant studies on this topic can be found at Khan (2018), Yusof (2007), and also Nuraini & Rusydiana (2023).

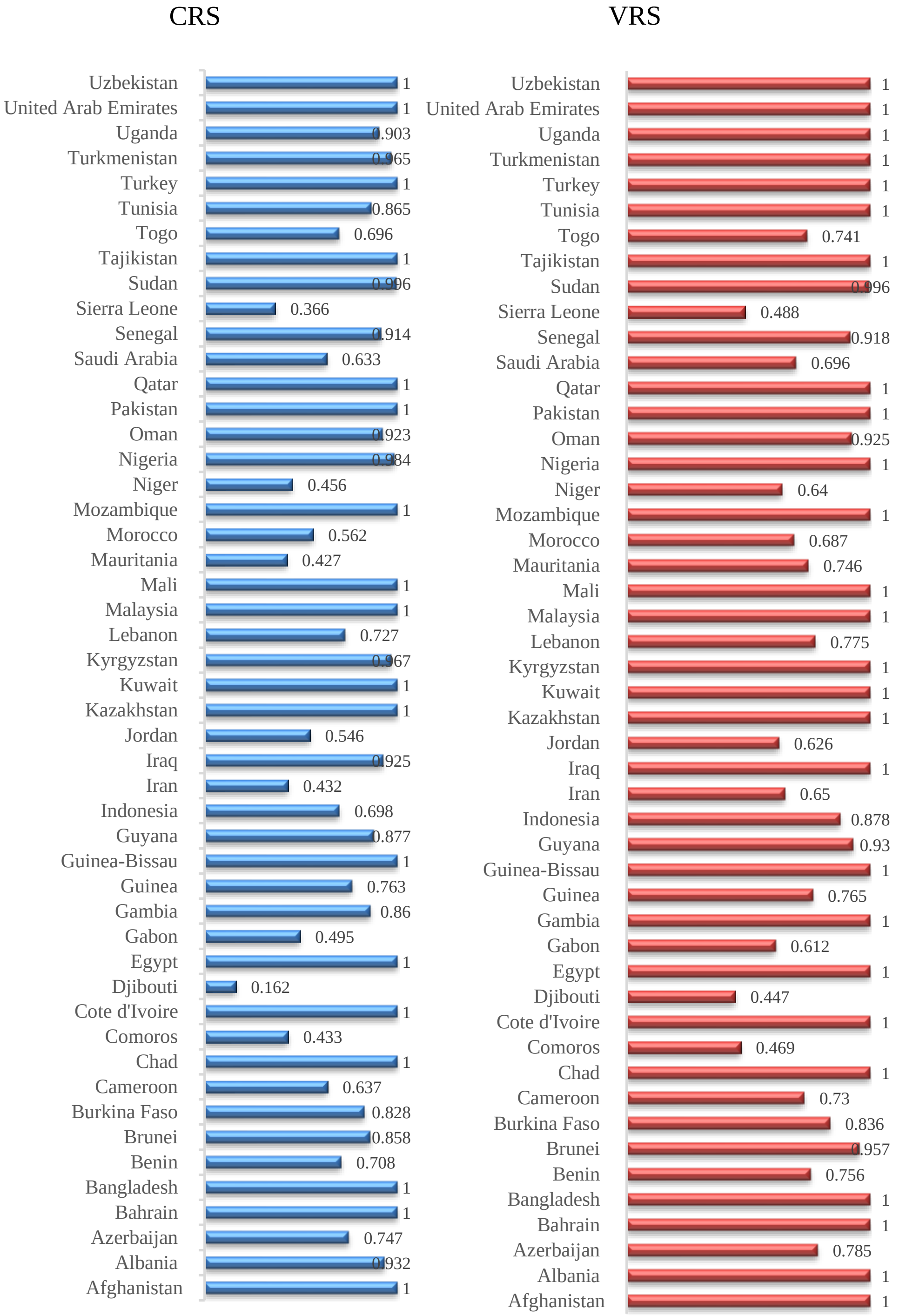

Figure 1 Efficiency Scores of OIC Member Countries

CONCLUSION

This study tries to analyze the productivity growth of OIC member countries either from changes in technical efficiency, changes in technological efficiency or both and analyze how to develop capital resources and capital resources owned in each country. Furthermore, in achieving the mentioned objectives, this study uses a non-parametric method, namely the

Malmquist TFP index for a sample of 49 OIC member countries. The results obtained from the Malmquist index score (*TFP Change*) show that 43% of the overall sample experienced an increase in productivity. This is indicated by a score of more than 1. While the rest shows a decrease in productivity levels. According to the technological change index (TECHCH), Tunisia is the country with the highest technological improvement at 4.1 percent. The country with the highest increase in technical efficiency is Saudi Arabia with 6.8 percent. For the analysis of OIC countries by region, it can be seen that countries included in the GCC, Sub-Saharan Africa, and *Asian countries* generally tend to experience a decrease in productivity. Meanwhile, AMU and *Middle East Countries* on average experienced an increase in productivity. A significant increase in TFP growth indicates a positive improvement. There are two ways that can be done to increase TFP growth, namely solving inefficiency problems through reallocation of resources to become more competitive and technological improvements. In this case, OIC countries can undertake human resource development, i.e. continuous technological improvement through the creation of innovations. A comparison of performance among OIC countries helps identify policies for further improvement. Furthermore, identifying countries that are lagging behind with respect to technology adoption and human resources becomes a benchmark for enhancing cooperation among OIC member countries. In addition, in the efficiency analysis, it can be seen that the average value of CRS efficiency of OIC member countries as a whole is relatively high at 82%. This indicates that the economic performance of the 49 OIC countries has been quite good towards achieving the SDGs. Although, in the VRS approach, the resulting efficiency value is higher at 87%. In general, the countries that fall into the group with the highest efficiency value (relative efficiency value = 1) are Afghanistan, Bahrain, Bangladesh, Chad, Cote d'Ivoire, Egypt, Guinea-Bissau, Kazakhstan, Kuwait, Malaysia, Mali, Mozambique, Pakistan, Qatar, Tajikistan, Turkey, UAE, and Uzbekistan. Then added with eight other OIC countries on the VRS approach. For the countries in this group, maintaining their efficiency gains is an important agenda. Improved performance, of course, would be better. Meanwhile, the OIC member countries with the lowest efficiency scores in both the CRS and VRS approaches are Sierra Leone, Comoros, and Djibouti. For these three countries, efforts to improve efficiency scores should be prioritized, both in terms of improving the effectiveness of inputs and outputs, for example by increasing capital resources and the quality of human resources. It is recommended that country-level studies on efficiency and productivity be conducted to intensively examine the determinants of inefficiency and productivity decline and implement appropriate interventions that can improve efficiency and productivity.

REFERENCES

Afzal, M. N. I., & Manni, U. H. (2013). Knowledge-based economy (KBE) frameworks and empirical investigation of KBE input-output indicators for ASEAN. Asian Research Policy, 4, 1-9.

Avenzora, Ahmad and Moeis, Jossy P. (2008). Productivity and Efficiency Analysis of Textile Industry and Textile Products Industry in Indonesia in 2002-2004. Parallel Session IVB Industry and Manufacturing, Hotel Nikko Hotel Jakarta.

Bjurek, H. (1996). The Malmquist Total Factor Productivity Index. Scandinavian Journal of Economics, Vol.98, No.2, pp.303-313.

Caves et.al. (1982). The Economic Theory of Index Number and the Measurement of Input, Output and Productivity. Productivity. Econometrica, 50(6):1393-1414.

Charnes, A., Cooper, W. W. & Rhodes, E. (1978). Measuring the efficiency of decision making units. European Journal of Operational Research, 2, 429-444.

Coelli, T. (1996). A Guide to DEAP 2.1: A data envelopment analysis (computer) program. Armidale: University of New England.

Devi, A. (2023). Tourism In OIC Countries: A Review Based On Scopus Database. *Halal Tourism and Pilgrimage*, *3*(1).

Farrell, M.L. (1957). The Measurement of Productive Efficiency, Journal of the Royal Statistical Society, 120, p.253-281

Khan, K. U. (2018, March). PRODUCTION AND PRODUCTIVITY IN OIC: A COMPARISON. In *16th International Conference on Statistical Sciences* (p. 179).

Kim, J. & Lau, L. J. (1994). The sources of economic growth of the East Asian newly industrialized countries. Journal of the Japanese and International Economies, 8(3), 235-292.

Krugman, P. (1994). The myth of Asia's miracle. Foreign Affairs, 73(6), 62-78.

Masri, M. D. and Asbu E. Z. (2018). Productivity change of national health systems in the WHO Eastern Mediterranean region: application of DEA-based Malmquist productivity index. Global Health Research and Policy, 3(22), 1-13.

Mohamad, N. H. and Said, F. B., 2011. Comparing Macroeconomic Performance of OIC Member Countries. Countries, International Journal of Economics and Management Sciences, 1(3), pp. 90-104.

Nuraini, I., & Rusydiana, A. S. (2023). Efficiency of SDG Achievement in Muslim Countries. *Muslim Business and Economics Review*, *2*(2), 207-224.

Prakoso, D. (2020). Economic growth and government size in OIC countries: A GMM application. *Ekonomi Islam Indonesia*, *2*(2).

Pratomo, W., Rusydiana, A., Riani, R., Lubis, R., Marlina, L., Putra, P., & Nurismalatri, N. (2023). Does Renewable Energy Consumption a Driver for Economic Growth? Panel Data Analysis in Selected OIC Countries. *International Journal of Energy Economics and Policy*, *13*(6), 573-580.

Ramanathan, R. (2003). An Introduction to Data Envelopment Analysis: A tool for performance measurement. New Delhi: Sage Publications.

Rusydiana, A. S., & Nugroho, T. (2017). Measuring efficiency of life insurance instution in Indonesia: Data envelopment analysis approach. *Global Review of Islamic Economics and Business*, *5*(1), 012-024.

Sherman, H.D. and Gold. (1985). Bank Branch Operating Efficiency: Evaluation with Data Envelopment Analysis, Journal of Banking and Finance, 9, 279-315.

Taylor, R. J. (2007). Technical progress and economic growth: An empirical case study of Malaysia. Cheltenham: Edward Elgar.

Tsolas, Ioannis E. and Giokas, Dimitris I. (2012). Bank branch efficiency evaluation by means of least absolute deviations and DEA. Managerial Finance Vol 38 No. 8, 2012.

Uula, M. M., Maulida, S., & Rusydiana, A. S. (2023). Tourism Sector Development and Economic Growth in OIC Countries. *Halal Tourism and Pilgrimage*, *3*(1).

Young, A. (1994). Lessons from the East Asian NICS: A contrarian view. European Economic Review, 38(3), 964-973..

Yusof, S. A. (2007). Employment and Productivity Link: A Study on OIC Member Countries. *Journal of Economic Cooperation Among Islamic Countries*, *28*(1).