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Efficiency Analysis of Life Insurance Companies in Indonesia and Malaysia

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ABSTRACT

This study focuses on measuring the performance of life insurance companies in Indonesia and Malaysia. Input oriented Data Envelopment Analysis (DEA) uses panel data to extract the efficiency score of 5 life insurance companies from Indonesia and 5 life insurance companies from Malaysia for the year of 2015-2019. DEA-based Malmquist Total Factor Productivity (TFP) Index used to measure the efficiency change along the study period. This study utilizes asset and operating expenses as input variables, as for output variables, this study utilizes premium and investment income. Based on an efficiency score computed by DEA, most of the life insurance companies in both countries perform efficiently during the study period. However, life insurance companies in Indonesia still perform more efficiently than Malaysian life insurance companies. The results of the Malmquist TFP Index for life insurance companies in both countries show that there is 2.5% improvement in technical efficiency change, 1.5% deterioration in technology efficiency change, 0.6% improvement in pure efficiency change, 1.9% improvement on scale efficiency change, and 0.9% increase in TFP change. It shows that the main reason for TFP increased is due to improvement of technical efficiency change.

1. Introduction

The aims of insurance are to prevent risk-averse individuals from bearing the full brunt of nature's actions that adversely affect them Sukminski (2014) Hence, people decide to buy the insurance and regularly pay the insurance premium to protect themselves from an unforeseen event that may occur in the future. Insurance is divided into two types, life insurance and general insurance.

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Life insurance companies known as one of non-bank financial institution that play an important role as alternative sources of funding and become the protection of business risks. In 2019, it is reported that life insurance companies contributed 1.1705% of Indonesia's Gross Domestic Product (GDP). As in Malaysia, life insurance companies contributed 2.4457% of its GDP. Focusing on the life insurance sector will minimize the likelihood of the data contaminated the effects of non-life insurance sectors. The performance of life insurance company will determine the welfare of the society and economy in the respective country where they operate.

Indonesia and Malaysia have lots of similarities such as both of them are member of Association of Southeast Asian Nation (ASEAN). Indonesia and Malaysia also have similarities in terms of syariah insurance as both of them dominate the syariah insurance market in the Southeast Asia market (Ardianto and Sukmaningrum, 2020). Both Indonesia and Malaysia are developing countries, where most of the population has a low-income level, low quality of health, and social security. Saad and Idris (2011) stated that in developing countries that lack of protection have higher risk of losing, but lower risk to get recover from the loss. In 2019, it reported that only 40.4% of children under 5 years old have been fully vaccinated in Indonesia, specifically in Aceh and Papua (OECD, 2019). Similarly to Indonesia, it was found that 22.8% of Malaysian children from low-income group have obesity (Shabar et al., 2019). Hence, the needs of life insurance as risk transfer mechanism in developing country is higher. Life insurance company expected to run as efficient as possible to give a good service to the society. Despite the important role of life insurance company in economic activities and society, some life insurance players still not aware about their company efficiency and how to improve it.

There are many studies conducted to measure the performance of life insurance company in Indonesia or Malaysia itself, but there is none of them comparing it. The gap of knowledge from previous study which prompted this research to be carried out. Indonesia and Malaysia are both emerging country and both of them have many similarities in terms of culture and history. Knowing whether there is significant different from the efficiency score can be a valuable lesson for life insurance company in both countries. Then, from the finding's life insurance company from both countries can improve in the part that they lack of to perform better in the future.

Multiple input and output data would be used to calculate efficiency; hence Data Envelopment Analysis (DEA) technics is the most suitable method to generate the efficiency score. Malmquist Productivity Index also would be used to measure relative productive changes. This study would use data from each company financial report from 2015 – 2019 (5 years) to be extracted.

2. Literature Review

Life insurance company provide 3 principal services: financial intermediation, risk-pooling and risk-bearing, "real" financial service Cummins et al (2010). Premium can be used to represent the output of risk-pooling and risk-bearing function of life insurance company (Athawale, 2016). Investment income can be the measurement of financial intermediation function of life insurance company (Chakraborty et al., 2012)

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Leverty et al (2004) used premium as their output variables to measure China's insurance company performance. They measured both life insurance and general insurance company performance. The time interval taken for the study is 1999 – 2002 for life insurance company. They used Data Envelopment Analysis (DEA) estimation as

well in the data analysis part. In conclusion, they found that life insurance company in China perform efficiently and able to make quick and significant productivity gains.

Using investment income as the output indicator, it can measure the insurer ability to produce return from capital market or other instruments (Chakraborty et al., 2012). The author used investment income as their output variable. Data Envelopment Analysis (DEA) and Malmquist productivity index approach applied by the author to measure life insurance company performance in India. Chakraborty et al (2012) chooses 14 companies as the sample of their study. The time interval taken is from 2005 to 2009. In the end of their study, they found that company that has both life insurance and non-life insurance perform more efficient than company that only has life insurance.

Viverita (2019) using investment income as one of the outputs to measure Indonesia's private insurance company efficiency because she believes that investment income also benefits the company. Viverita (2019) use Data Envelopment Analysis (DEA) method to analyze whether there are efficiency changes before and after new government regulation regarding the implementation of Badan Penyelenggara Jaminan Sosial (BPJS). The author observed 18 private insurance company during 2009 – 2016 for observation. As the result, there are no significant change in company's efficiency score before and after the implementation of government regulation.

Insurance company input divided into administrative (home office) labor, agent labor, materials and business services, and financial capital (Cummins et al., 2010). However, administrative labor, agent labor, materials and business service can be put together under operating expenses.

Athawale (2016) and Sinha (2015) used operating and commission expenses as their input variables. Commission was related to labor expenses as they were given to the agent or broker that have the responsibility to market insurer's product. Operating expenses represented the cost that company should spend to maintain their operations.

Athawale (2016) used operating expenses as their input variable to measure private life insurance performance in India because they believed it includes labor-related expenses, capital expenses, and material expenses. Athawale (2016) measured company's performance during 2001 – 2014 using Data Envelopment Analysis (DEA). They observed 10 life insurance company that operates in India. At the end of the study, they found out that there is improvement in life insurance company efficiency.

Similarly, to Athawale (2016), Sinha (2015) used operating expenses and commission as their input variables to measure 15 life insurance companies' performance from 2001 until 2012. Sinha (2015) also used Data Envelopment Analysis (DEA) model to judge life insurance company efficiency in India. As the conclusion, Sinha (2015) found that there is significant fluctuation in mean technical efficiency during the period of observation.

Jaloudi (2019) used debt and owner's equity as one of their input variables to measure the efficiency of life insurance companies in Jordan from 2000 until 2016. The study used 22 life insurance companies as the sample to evaluate the technical efficiency and examine the internal and external determinants that affect the technical efficiency of life insurance companies in Jordan. Jaloudi (2019) used Data Envelopment Analysis (DEA) to determine technical efficiency scores. The author also used slack-based and logit models to evaluate technical

efficiency determinants. In the end of the study, Jaloudi (2019) found that owner's equity and debt or known as asset is the most important internal determinant of life insurance company's efficiency. The author also found there was slight development of technical efficiency of life insurance companies in Jordan during the study period and there was variation in level of efficiency in each year. Jaloudi (2019) concluded that life insurance companies should increase their size by merger to increase assets in order to perform more efficiently.

From previous study, it said that efficiency of a firms could be obtained by optimizing input to produce output (Naushad et al., 2020). In conclusion, life insurance company would perform more efficient if they could manage their expenses wisely to provide services. Naushad et al (2020) used operating expenses as one of the inputs in their study. Output variables that they used were premium and investment income. They conducted a study to measure the efficiency of life insurance company in Saudi Arabia. They used Data Envelopment Analysis (DEA) technique to measure 30 life insurance companies' performance from 2015 to 2018. At the end of the study, they found that among 30 life insurance companies listed on the Saudi stock exchange, only 3 companies remained efficient during the study, whereas the other experienced upwards and downwards.

Similar to Naushad et al (2020), Duasa and Rahman (2006) use commission and management expenses, both commission and management expenses known as operating expenses in this study. (Duasa and Rahman, 2006) also utilized premium and investment income as their output variables. The researchers used those input and output variables to measure the life insurance company performance in Malaysia during 2002 to 2005. They use Data Envelopment Analysis (DEA) approach to estimate the efficiency score of 13 life insurance companies. The aim of their study was to compare the performance of conventional and takaful life insurance company. In conclusion, they found that Takaful National as representative of takaful companies in Malaysia perform as efficient as conventional life insurance company.

Leverty et al (2004) used asset as financial capital for their research as they believed that company with higher capitalization has lower probability of default if the losses were higher than expected. Insurer with low probability of default would set higher price for their product as they have enough money to cover the benefit of unexpected loss. Hu et al (2009) used total assets to measure Chinese insurance company efficiency. In the end, they found that expansion or merger would lead to more productive company. It can be concluded that as company has bigger capitalization they could run more productively. Hu et al (2009) data took 35 Chinese life insurance companies from 1999 to 2004. The authors used Data Envelopment Analysis (DEA) approach to estimate the efficiency.

Kasman (2007) and Saad and Idris (2011) found that company size has positive impact towards efficiency. Company size depend on the asset they have so the more asset a company has, the bigger the company is. Kasman (2007) used asset as their input variable and benefits as their output variable to measure Turkish life insurance company performance. The authors used Data Envelopment Analysis (DEA), Chance-Constrained Data Envelopment Analysis (CCDEA), and Stochastic Frontier Analysis (SFA) to estimate the data from 1999 to 2005. There are 28 companies taken for the study. At the end of the study, it is found that from the three methods there was significant inefficiency in Turkish life insurance industry.

Most of the research conducted to compare life insurance companies efficiency that operates in the same countries. There is little research that compares between countries, especially between ASEAN countries. This paper

would compare the efficiency of life insurance companies in Indonesia and Malaysia using Data Envelopment Analysis (DEA) approach.

3. Data and Methodology

To explore the efficiency scores of Indonesia and Malaysia life insurance companies, Data Envelopment Analysis (DEA) and DEA-based Malmquist Total Factor Productivity (TFP) would be used in this research. DEA is a non-parametric mathematical programming that is used to assess production efficiency of a decision-making unit (DMU). In this study, the DEA approach would be estimated using DEAP version 2.1 (Coelle, 1996). DEA approaches generate the efficiency score of each DMU and compare it to the best practice. It is easier to measure DMUs efficiency if there is only one input and one output variable, but in reality, there is more than one input and output variable, hence DEA models allow multiple input and output variables to be measured at the same time without any assumption on data distribution (Ji and Lee, 2010). The DEA model can be divided into input-oriented models and output-oriented models. In the input-oriented models, it minimizes input while satisfying at least given output, however for output-oriented models, it maximizes output without acquiring new input (Ji and Lee, 2010). Input-oriented models are used more often because it is easier to control input instead of output. If the efficiency score generated by DEA equals 1, it shows that the input is 100% utilized to produce output (Mendes and Santos, 2013). The DEA model written as follows:

$$\max \ Ef_k = \frac{\sum_{r=1}^{s} \mu_{rk} y_{rk}}{\sum_{i=1}^{m} v_{ik} x_{ik}} \quad (1)$$

Constraints;

$$\mu_{rk} \geq 0, r = 1, \ldots, s \quad (2)$$

$$v_{ik} \geq 0, i = 1, \ldots, m \quad (3)$$

$$Ef_k = \frac{\sum_{r=1}^{s} \mu_{rk} y_{rk}}{\sum_{i=1}^{m} v_{ik} x_{ik}} \leq 1, k = 1, \ldots, n \quad (4)$$

Definition:
Ef_k = technical efficiency of specific decision-making unit (DMU) under analysis with input *m* and output *s*
k = represent the number of DMU (there are n DMUs)
r = number of outputs from 1 until s (there are s outputs)
i = number of inputs from 1 until m (there are m outputs)
μ_{rk} = the weight for r^{th} output for DMU under observation
v_{ik} = the weight for i^{th} input for DMU under observation
y_{rk} = represent the output value of r^{th} output for k^{th} DMU
x_{ik} = represent the input value of i^{th} input for k^{th} DMU

The equation (1) used to measure the weighted multiple outputs and weighted multiple inputs. The equation (2) and (3) are the constraints to make sure that the weighted is not negative. The equation (4) used to make sure that the efficiency will not exceed 100%.

DEA-based Malmquist Total Productivity Factor (TPF) Index used to measure productivity changes along with time variations. Malmquist TPF can be decomposed into technical efficiency change (the catch-up effect) and

technology change (the frontier shift effect). The TPF Index approach proposed by Fare et al. (1994) between period *t* and *t*+1 is given:

$$M_t(x^t, y^t, x^{t+1}, y^{t+1}) = \frac{{D_1}^{t+1}(x^{t+1}, y^{t+1})}{{D_1}^{t}(x^t, y^t)} \left[\frac{{D_1}^{t}(x^{t+1}, y^{t+1})}{{D_1}^{t+1}(x^{t+1}, y^{t+1})} \frac{{D_1}^{t}(x^t, y^t)}{{D_1}^{t+1}(x^t, y^t)}\right]^{\frac{1}{2}} = EFFCH \; x \; TECHCH \quad (5)$$

$$M_t(x^t, y^t, x^{t+1}, y^{t+1}) = TFPCH \quad (6)$$

$$EFFCH = PECH \; x \; SECH = \frac{{D_1}^{t+1}(x^{t+1}, y^{t+1})}{{D_1}^{t}(x^t, y^t)} \quad (7)$$

$$TECHCH = \left[\frac{{D_1}^{t}(x^{t+1}, y^{t+1})}{{D_1}^{t+1}(x^{t+1}, y^{t+1})} \frac{{D_1}^{t}(x^t, y^t)}{{D_1}^{t+1}(x^t, y^t)}\right]^{\frac{1}{2}} \quad (8)$$

"TFPCH" is the representative of "TPF changes", "EFFCH" is "technical efficiency change", and "TECHCH" is "technology efficiency change". The equation (5) shows the productivity of production point (x_{t+1}, y_{t+1}) relative to the production point of the previous year (x_t, y_t). When the value is greater than one, it will indicate that there is positive TPF growth from time *t* to *t*+1. However, equation (7) or EFFCH is used to measure how far the observed production from maximum potential production (how far the observed DMU to the frontier) is between time *t* and *t*+1 (Saad & Idris, 2011). Simply, EFFCH measures how well the production input can be converted to output. If EFFCH = 1, it means that the distance of DMU to the frontier is the same at time *t*+1 and time *t*. If EFFCH > 1, it means that DMU moves closer towards frontier at time *t*+1 than time *t*, and the opposite for EFFCH < 1.

EFFCH can be further decomposed into pure technical efficiency change (PECH) and scale efficiency change (SECH) (Lee et al., 2011). EFFCH is the efficiency change calculated under constant return to scale (CRS) and PECH is the efficiency change calculated under variable return to scale (VRS). As for SECH it is the ratio of CRS efficiency change (EFFCH) to VRS efficiency change (PECH).

TECHCH or technology efficiency change capture the shift on technology (movement of the frontier function) between x^t and x^{t+1} [3]. If TECHCH = 1, it shows that there is no movement in the technology frontier; TECHCH > 1, it indicates that there is technological progress; TECHCH < 1, it reflects that there is technological regress.

Research Framework

This section will briefly explain the overall design of the analysis procedure that will be conducted. The data will consist of input variables (asset and operating expenses) and output variables (investment income and premium). First, the data from 10 life insurance companies from Indonesia and Malaysia will be used to compute efficiency score under DEA approach. After that, the same data set will be utilized to generate relative productivity change of life insurance companies in Indonesia and Malaysia from 2015-2019 using Malmquist Productivity Index approach.

Data and selection of variables

This data set used in this study was obtained from the annual report of each life insurance companies. The period taken is from 2015 to 2019. The population of this study is life insurance companies in Indonesia and Malaysia. In 2019, there are 60 life insurance companies listed in Indonesia and more than 14 life insurance companies listed in Malaysia. However, this study will follow judgemental sampling because the sample chosen is based on the highest value of asset owned, as asset is used as one of the input variables of this study. Only 5 insurance companies from each country will be taken as the sample of this study, because only not all life insurance companies publish their annual report in their website. PT Prudential Life Assurance, PT Allianz Life Indonesia, PT Panin Dai-ichi Life, PT Asuransi Jiwa Central Asia Raya, and PT Great Eastern Life Indonesia are representing Indonesia's life insurance company. Tokio Marine Life Insurance Malaysia Bhd., Hong Leong Assurance Bhd., Gibraltar BSN Life Bhd., Sun Life Malaysia Assurance Bhd., and Great Eastern Life Assurance Malaysia Berhad will represent Malaysia life insurance company. Those 10 companies are chosen because they have highest value of total assets compared to others life insurance companies in the country they operate.

Considering data availability and existing literature, asset and operating expenses are used as the inputs; investment income and premium are used as the outputs in this study. Asset in this study refers to the accumulation value of equity capital and debt capital. As operating expenses refers to expenditure used to run the business. On the other hand, premium refers to amount of money received by the insurer from their policyholder in exchange of insurance coverage. Investment income will refer to profit gains from life insurance company's investment.

4. Results and Discussion

Table 1 and 2 above are the descriptive statistics for life insurance companies in Indonesia and Malaysia.

Table 1 - Descriptive statistics for life insurance companies in Indonesia (2015 - 2019)

	Input Variables		Output Variables	
	Asset	Operating Expenses	Premium	Investment Income
Mean	Rp 23,478,077	Rp 2,335,623	Rp 8,519,192	Rp 1,239,467
Std. Dev.	Rp 24,469,075	Rp 2,530,923	Rp 9,099,667	Rp 2,779,112
Minimum	Rp 2,405,430	Rp 220,737	Rp 936,381	-Rp 4,680,834
Maximum	Rp 71,619,133	Rp 7,918,521	Rp 26,883,390	Rp 10,818,916

Table 1 - Descriptive statistics for life insurance companies in Malaysia (2015 - 2019)

	Input Variables		Output Variables	
	Asset	Operating Expenses	Premium	Investment Income
Mean	RM 21,543,664	RM 582,131	RM 2,523,490	RM 859,592
Std. Dev.	RM 29,583,583	RM 590,313	RM 2,824,664	RM 1,186,672
Minimum	RM 1,987,393	RM 124,452	RM 235,163	RM 74,887
Maximum	RM 87.292,013	RM 1,796,622	RM 8,727,964	RM 3,460,663

During the study period, Great Eastern Malaysia had the highest number of all input and output variables among other companies that operating in Malaysia. Great Eastern Malaysia obtained the highest value of RM 8,727,964 million and RM 3,460,663 million for premium and investing income respectively. As for input variables, Great Eastern Malaysia obtained the highest value of RM 87,292,013 million for assets and RM 1,796,622 million for operating expenses. However, Sun Life Malaysia obtained the lowest number of assets and investment income in the amount of RM 1,987,393 million and RM 74,887 million respectively, similar to Gibraltar BSN Life Berhad that obtained the lowest number of operating expenses and premium compared to other Malaysia life insurance companies throughout the years. The lowest amount of operating expenses and premium obtained by Gibraltar BSN Life Berhad were RM 124,452 million and RM 235,163 million respectively. As for Indonesian companies, Prudential Indonesia successfully obtained the highest value in all variables compared to other life insurance companies that operate in Indonesia. The highest value of asset and operating expenses obtained by Prudential Indonesia were Rp 71,619,133 million and Rp 7,918,521 million. As for the output variable, Prudential Indonesia obtain the highest value of Rp 26,883,391 million for premium and Rp 10,818,916 million for investment income. However, Great Eastern Indonesia obtained the lowest number of asset and operating expenses compared to other life insurance companies that operate in Indonesia. The lowest value for asset and operating expenses obtain by Great Easter Indonesia were Rp 2,405,430 million and Rp 220,737 million. The lowest number of premiums received by CAR Indonesia in the amount of Rp 936,381 million and the lowest number of investment income in the amount obtained -Rp 4,680,834 million by Prudential Indonesia rather than their competitors.

DEA

The Table 3 in the next page shows the efficiency score using an input-oriented approach based on DEA method. Panin Dai-ichi Life manages to obtain the top efficiency score as they consistently get a full score of efficiency which is 1. As Panin Dai-ichi Life obtained a perfect score throughout the study period, 2015-2019, it indicates that Panin Dai-ichi Life has become the benchmark of life insurance in Indonesia in terms of the efficiency. Similar to Panin Dai-ichi Life, Great Eastern Malaysia also received full marks of efficiency score throughout the

entire study period, which makes Great Eastern Malaysia the benchmark of Malaysia life insurance companies in terms of efficiency.

Among life insurance companies in Indonesia, all of them have at least once gained a full score of efficiency. Prudential Indonesia obtains a full efficiency score almost in all years, except in 2018. For Great Eastern Indonesia, they obtained a full efficiency score twice in 2016 and 2019. However, Allianz Indonesia and CAR Indonesia only received perfect scores once in 2019 and 2016 respectively. Contrast with life insurance companies in Indonesia which all of them have at least once gained a full efficiency score, beside Great Eastern Malaysia, only Gibraltar BSN Life Berhad obtained a perfect efficiency score in 2018. However, the lowest efficiency score for Malaysian life insurance companies was also obtained by Gibraltar BSN Life Berhad in 2017.

Based on the efficiency score average, Panin Dai-ichi Life becomes the most efficient life insurance company in Indonesia and Allianz Indonesia becomes the least efficient life insurance company in Indonesia. The average efficiency score of Allianz Indonesia is 0.839, denoting 16.1% inefficiency. Great Eastern Malaysia became the most efficient life insurance company in Malaysia and Gibraltar BSN Life Berhad as the least efficient life insurance company in Malaysia. Gibraltar BSN Life Berhad has an average efficiency score of 0.656, it shows a 34.4% inefficiency.

Table 3 - Efficiency score based on input-oriented Data Envelopment Analysis

Company	2015	2016	2017	2018	2019	Average
Allianz Indonesia	0.720	0.892	0.852	0.732	1.000	0.839
CAR Indonesia	0.741	1.000	0.886	0.909	0.802	0.868
Great Eastern Indonesia	0.929	1.000	0.781	0.901	1.000	0.958
Panin Dai-ichi Life	1.000	1.000	1.000	1.000	1.000	1.000
Prudential Indonesia	1.000	1.000	1.000	0.787	1.000	0.957
Gibraltar BSN Life Berhad	0.656	0.480	0.416	1.000	0.730	0.656
Great Eastern Malaysia	1.000	1.000	1.000	1.000	1.000	1.000
Hong Leong Malaysia	0.777	0.706	0.764	0.962	0.986	0.839
Sun Life Malaysia	0.631	0.562	0.587	0.896	0.689	0.673
Tokio Marine Life Malaysia	0.813	0.804	0.781	0.967	0.859	0.845
Average	0.827	0.844	0.807	0.915	0.907	

Malmquist TFP Index

Table 4 in next page shows the summary of the Malmquist index of annual means by year from 2015 to 2019 for Indonesia and Malaysia life insurance companies. Technical efficiency can be affected by pure efficiency change (pech) and scale efficiency change (sech). Based on the result, in 2015/2016 and 2017/2018 there are 0.5% and 16.4% improvements in technical efficiency (effch) respectively, but in 2016/2017 and 2018/2019, it shows that there are 4.6% and 1.4% technical efficiency dropped respectively. In a certain year such as 2016/2017, the technical efficiency change was dropped because the number of pure efficiency change and scale efficiency change in that particular year also decreased. In contrast, there was an increase of pure efficiency change and scale efficiency change in 2017/2018 that caused technical efficiency change to increase. On average there are 2.5% technical efficiency improvements, 0.6% pure efficiency change and 1.9% scale efficiency change during the study period.

From 2015 until 2019, it shows that only in 2017/2018 there was a decrease in TFP changes (tfpch) and it decreased for 24.1%. The decline only occurs in 2017/2018 because TFP changes can be affected by technical efficiency change (effch) and technology efficiency change (techch), so a decrease in TFP changes in that year may be caused by a drop on technology efficiency change. In 2017/2018, there was 34.8% technology efficiency (techch) regression, and this led to the regression in the TFP changes. Overall, there is 1.5% drop on technology efficiency change and 0.9% increase on TFP change during the study period.

Table 4 - Malmquist index summary of annual means

Year	effch	techch	pech	sech	tfpch
2015/2016	1.005	1.099	1.022	0.984	1.105
2016/2017	0.954	1.150	0.991	0.963	1.097
2017/2018	1.164	0.652	1.002	1.162	0.759
2018/2019	0.986	1.143	1.009	0.977	1.127
Average	1.025	0.985	1.006	1.019	1.009

Notes: All Malmquist index averages are geometric means

Table 5 shows the Malmquist index summary of 10 life insurance companies in Indonesia and Malaysia. From 2015 to 2019, it shows that there are 2 life insurance companies in Indonesia, named Panin Dai-ichi Life and Prudential Indonesia and one life insurance company from Malaysia, named Great Eastern Malaysia, that there is not any change in technical efficiency change as they obtain a technical efficiency change score of 1. Apart from those 3 companies, the others have increased technical efficiency change throughout the study period. The highest increase for Indonesian companies is obtained by Allianz Indonesia for 8.6% and for Malaysian companies the highest is obtained by Hong Leong Malaysia with 6.1%. On average, in Indonesia and Malaysia companies, there are 2.5% increase in technical efficiency change during the study period.

From table 5, it shows that most of the companies in Indonesia and Malaysia obtain a pure efficiency change of 1, except for Allianz Indonesia who get 4.7% increase, Gibraltar BSN Life Berhad who get 0.2% increase and Tokio Marine Life Malaysia who get 0.9% increase. However, for scale efficiency change, there are 2 companies from Indonesia, named Panin Dai-ichi Life and Prudential Indonesia and one company from Malaysia, named Great Eastern Malaysia that received a score of 1. For Indonesian companies, the highest scale efficiency score was obtained by Allianz Indonesia with 1.037, indicating a 3.7% increase and for Malaysian companies, the highest scale efficiency score was obtained by Hong Leong Malaysia with 1.061, indicating a 6.1% increase.

There are two Indonesian companies that experience an increase in technology change during the study period, while the other decrease. Allianz Indonesia and CAR Indonesia experienced a 0.9% and 8.3% increase in technology change respectively. In contrast, only Great Eastern Malaysia experiences an increase in technology change. Great Eastern Malaysia obtained an increase of 0.9%. However, Hong Leong Malaysia faced the lowest decrease in technology change for 4.3%. There is a 1.5% decrease on average for technology change for all companies under study.

Similar situations happen to TFP change as technology changes related to TFP change. From the table above, among Indonesian companies it shows that only Allianz Indonesia and CAR Indonesia obtained an increase on TFP change for 9.6% and 10.5% respectively, while the others face a decrease in TFP change. Both Panin Dai-ichi Life and Prudential Indonesia face a 3.9% decrease and Great Eastern Indonesia experiences the biggest decline which is 4.5%. For Malaysian companies, 3 out of 5 companies have positive total factor productivity changes. The highest increase was obtained by Hong Leong Malaysia for 1.5%, but Gibraltar BSN Life Berhad faced the lowest decrease for 0.9%. Overall, there is a 0.9% increase in TFP change in all companies under study during 2015-2019.

Table 5 – Malmquist index summary of firm means

Company	effch	techch	pech	sech	tfpch
Allianz Indonesia	1.086	1.009	1.047	1.037	1.096
CAR Indonesia	1.020	1.083	1.000	1.020	1.105
Great Eastern Indonesia	1.019	0.937	1.000	1.019	0.955
Panin Dai-ichi Life	1.000	0.961	1.000	1.000	0.961
Prudential Indonesia	1.000	0.961	1.000	1.000	0.961
Gibraltar BSN Life Berhad	1.027	0.965	1.002	1.026	0.991
Great Eastern Malaysia	1.000	1.009	1.000	1.000	1.009
Hong Leong Malaysia	1.061	0.957	1.000	1.061	1.015
Sun Life Malaysia	1.022	0.991	1.000	1.022	1.013

Tokio Marine Life Malaysia	1.014	0.982	1.009	1.005	0.996
Average	1.025	0.985	1.006	1.019	1.009

Notes:
*All Malmquist index averages are geometric means
*Technical efficiency change (effch), Technological change (techch), Pure technical efficiency change (pech), Scale efficiency change (sech), TFP change (tfpch)
* tfpch = effch × techch and effch = pech × sech

5. Conclusion

On average, most life insurance companies in Indonesia and Malaysia perform efficiently, except for Gibraltar BSN Life Berhad that gained an efficiency score below 50% during 2016 and 2017. Gibraltar BSN Life Berhad is a life insurance company that operates in Malaysia. From the result generated by DEA, it shows that life insurance companies in Indonesia perform more efficiently because all companies score at least 70%, while some Malaysian companies gain an efficiency score below 70%. Panin Dai-ichi Life becomes the most efficient life insurance company in Indonesia and Great Eastern Malaysia also becomes the most efficient life insurance in Malaysia as both of them obtain a perfect score of efficiency, which is 1, throughout the study period. The results of the Malmquist TFP Index for life insurance companies in both countries show that there is 2.5% improvement in technical efficiency change, 1.5% deterioration in technology efficiency change, 0.6% improvement in pure efficiency change, 1.9% improvement on scale efficiency change, and 0.9% increase in TFP change. From Malmquist TFP Index approach, it shows that the main reason for TFP is due to technical efficiency change.

In conclusion, despite the lower contributions of life insurance companies in Indonesia's GDP which is 1.1705% whereas Malaysia's life insurance contributes 2% of their GDP, life insurance companies perform more efficiently than Malaysian life insurance companies. This is possible because the employee's salary in Indonesia is lower than Malaysia, this leads to Indonesia life insurance company's cost much lower than Malaysia life insurance company's, but they can generate more premiums. Other than that, Indonesia's life insurance sector has faced lots of crises, this can be one of the reasons which encourages companies in Indonesia to perform more efficiently.

For future studies, researchers can measure company's efficiency based on a more recent time period. Future researchers also need to make sure that the chosen company has a financial statement that can be used for the data analysis. In the future, researchers also can consider measuring life insurance company's efficiency between countries that have similar economy condition or has similarities in any aspect.

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