The Efficiency of Islamic Life Insurance in Indonesia: A Two-stages DEA

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The Islamic insurance industry in Indonesia is one of the industries that is experiencing very rapid development every year. This can be seen from the growth of assets and market share that continues to increase, especially in the Islamic life insurance industry. The rapid development of the Islamic life insurance industry has led to a stronger level of competition between companies. To be able to compete in the insurance industry nationally, Islamic life insurance must be able to compete with conventional insurance by improving performance optimally. The purpose of this study is to analyze the efficiency of Islamic life insurance companies and business units in Indonesia for the period 2014-2019 and the factors that influence them. This study used 3 companies and 10 Islamic life insurance business units that issued their financial statements in the 2014-2019 period. The method used in this research is the Data Envelopment Analysis (DEA) method and Tobit. The estimation results show that all companies and business units of Islamic life insurance in Indonesia have not reached the level of performance efficiency and there are still inefficiencies in the use of inputs and outputs. Factors that positively affect efficiency are joint venture dummy, while liquidity ratio and expense to net premium ratio negatively affect the performance efficiency of Islamic life insurance companies and business units in Indonesia.

Keywords: Islamic insurance; Takaful efficiency; DEA; Two-stage

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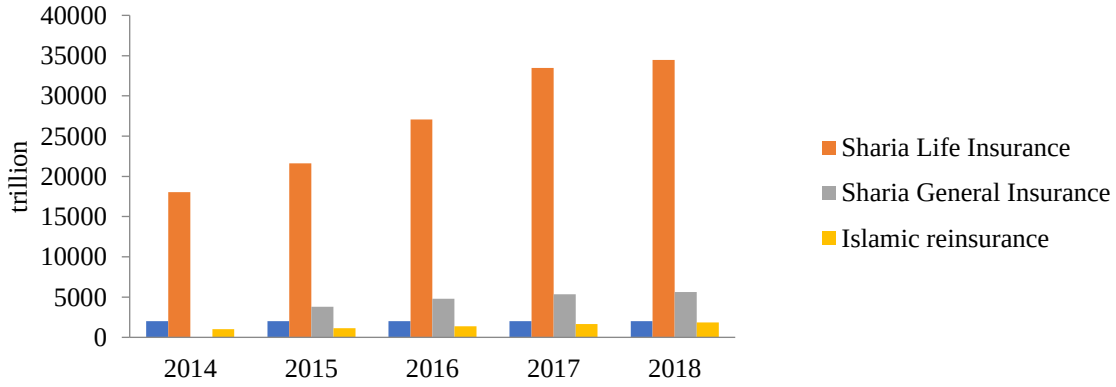
INTRODUCTION

Insurance is an institution that covers or guarantees risks, both financial and non-financial risks. The insurance industry plays an important role in a country's economy. According to Malik (2011), insurance acts as a financial intermediary institution that is consolidated into the financial industry with a wider scope. Insurance is able to channel financial resources owned by the community in the long term to be invested in various sectors so as to improve the national economy. In addition, insurance is also able to accept and manage community risk by providing protection from various losses (Danarti 2011).

The development of the insurance industry in Indonesia has encouraged the government to issue regulations around insurance, one of which is Law Number 2 of 1992 concerning Insurance. According to the law, there are three types of insurance, namely general insurance, life insurance and reinsurance, which have very intense competition. In 1994, the *holding company* PT Syarikat Takaful Indonesia (STI) formed the first sharia insurance under the name Asuransi Takaful (Daniar 2015).

According to the National Sharia Council (DSN), sharia insurance is an effort to protect and help each other among a number of people, where this is done through investment in the form of assets (*tabarru'*) that provide a pattern of return to face a certain risk through a risk *sharing* system. *The* legal basis of Islamic insurance is contained in the DSN0MUI fatwa No: 021/DSN-MUI/2001 concerning Islamic Insurance Guidelines. In addition, Islamic insurance also has a legal basis contained in QS. Al-Maidah (5): 2 which means: "…. help *you in (doing) virtue and piety, and do not help you in sin and offense, and fear Allah. Verily, Allah is very severe in His punishment*".

Competition in the Islamic insurance industry is now growing rapidly with the presence of new players, both from Islamic general insurance, Islamic life insurance and Islamic reinsurance. The growth of the Islamic insurance industry is increasing every year along with the growth of public understanding of the importance of insurance in an effort to minimize future risks. This is evidenced by the level of Islamic financial literacy reaching 8.11% and Islamic financial inclusion reaching 11.6% (OJK 2016). In addition, the growth of Islamic insurance is also evidenced by the growth of assets that reached 25% from 2012 to 2017 (OJK 2018). In 2018, Islamic insurance assets grew by 3.2% *year to date* and 6.1% *year on year* (OJK 2018).



Source: OJK 2018 (processed)

Figure 1 Development of Islamic insurance assets in 2014-2018

Figure 1 explains the development of Islamic insurance assets in Indonesia in 2014-2018 consisting of Islamic life insurance, Islamic general insurance and Islamic reinsurance. Overall, the growth of Islamic insurance assets has increased. The highest increase in assets occurred in Islamic life insurance companies. The increase in assets can increase the level of solvency of *tabarru'* funds or the ability of insurance companies to fulfill their obligations in the form of claim payments (Munawir 2010).

In the Asian region, Indonesia and Malaysia dominate the second highest Islamic insurance market share of 30% after Saudi Arabia with a market share of 48% (EY 2014). In addition, Indonesia also provides a gross contribution that continues to increase by 14% each year (OJK 2017). The growth in gross contribution is in line with the growth in the number of Islamic

insurance companies engaged in *full fledge* and Islamic insurance units in Indonesia. This is further explained in Table 1 as follows:

Table 1 The number of companies and sharia insurance business units in Indonesia for the period 2014-2018

DMU	2014	2015	2016	2017	2018
Life Insurance Sharia Business Unit	18	19	21	23	23
General Insurance Sharia Business Unit	23	24	24	25	24
Sharia Reinsurance Business Unit	3	3	2	2	2
Life Insurance Company	3	5	6	7	7
General Insurance Company	2	3	4	5	5
Reinsurance Company	0	0	1	1	1
Total	49	54	58	63	62

Source: Financial Services Authority (OJK 2018).

Table 1 explains that the number of Islamic insurance companies in the form of business units or *full fledge* Islamic insurance companies has generally increased during the 2014-2018 period, especially in the Islamic life insurance industry. Islamic life insurance is a risk management service provided to overcome losses related to a person's life based on sharia principles (Mapuna 2019). The growth in the number of Islamic life insurance companies that operate according to sharia principles will strengthen competition in the national insurance industry. To surpass the performance of insurance companies with conventional systems, Islamic life insurance companies must be able to perform good and efficient performance.

One of the assessments of a company's performance is seen from its efficiency. Efficiency is the most important aspect in measuring the performance of a financial institution. Efficiency measurement is used to evaluate the performance of Islamic insurance companies and can determine the amount of competitiveness in the industry (Antonio *et al.* 2013). Efficiency can be measured by two approaches, namely input-oriented approach and output-oriented approach (Coelli *et al.* 2005). The output-oriented approach occurs when the entity will maximize the amount of profit, while the input-oriented approach is used when the entity wants to reduce the proportion of inputs used to produce output at the same level.

Measurement of the efficiency of insurance companies needs to be done to evaluate the company's performance in the activity of combining inputs to produce optimum output as an effort to avoid bankruptcy. The inability of a company to pay debts or obligations at maturity will be a factor causing bankruptcy. Likewise, companies that have good asset quality can avoid the risk of bankruptcy (Bestari and Rohman 2013). As is the case recently, there has been a bankruptcy of a State-Owned Enterprise (BUMN) company engaged in the insurance sector, namely PT Asuransi Jiwasraya. The company experienced bankruptcy due to failure to pay overdue claims to policyholders at the end of 2019, the value of which reached IDR 802 billion (Sugianto 2019). This could happen because the company experienced a deficit due to a mismatch between assets and liabilities in the 2018 financial statements of PT Asuransi Jiwasraya (Saleh 2019). Therefore, this study analyzes the efficiency of Islamic life insurance companies and business units in Indonesia as an effort to avoid bankruptcy.

LITERATURE REVIEW

Efficiency Concept

Efficiency is defined as a measure of effectiveness without wasting time, effort and with minimum skill. The term efficiency is different from effectiveness, both of which are used to describe the performance of an entity. However, efficiency is focused on using minimum inputs to produce optimum outputs (Jaouadi and Zorgui 2014). Efficiency theory is closely

It is related to consumption theory and production theory in microeconomics. The meaning of efficiency in production theory is a state of the company when it is able to generate maximum profit in the production activities carried out and can be a measuring tool that functions as an assessor of producer choices. In consumption theory, efficiency occurs when consumers are able to maximize their satisfaction and utility. Efficiency will be optimal if the company can maximize output by using fixed inputs or by minimizing the use of inputs to achieve maximum profit. The same level of output (Karim 2007).

According to Coelli (2005) efficiency can be measured by two approaches, namely an output-oriented approach and an input-oriented approach. The

output-oriented approach is where an entity will maximize its profits. The proportion of output to be produced is increased while still using the same level of input. While the input-oriented approach is where an entity will reduce the level of the proportion of inputs with the aim of producing outputs at the same level. In this approach, an entity will minimize costs by reducing its production costs.

According to Farrel (1957), firm efficiency consists of two components, namely technical efficiency and allocative efficiency. Technical efficiency is a relationship in the use of inputs to produce outputs at the *best practice* in the *Decision Making Unit* (DMU). Allocative efficiency is the company's ability to use inputs in the optimal proportion. The combination of technical efficiency and allocative efficiency will result in economic efficiency.

Efficiency in Islamic View

Production in Islamic economics is the activity of exploiting economic resources provided by Allah SWT so that they become *maslahah* to meet human needs (Turmudi 2017). In this theory, *capital* and technology in the short term are assumed to be fixed because all inputs used contain costs, so the principle of production is how production can run so that it can reach the most maximum and efficient level. Islam forbids exaggeration in everything including in maximizing output. It is feared that this will fall into the category of *injustice*. A company is not allowed to seek maximum output from minimal inputs. The company should carefully calculate the inputs and outputs of a company, so as not to be excessive. The prohibition of excess is found in the word of Allah SWT:

Meaning: *"And it is He who has made gardens with gardens and without gardens, date palms, plants of various fruits, olives and pomegranates that are similar (in shape and color) and not the same (in taste). Eat of their fruits (of all kinds) when they bear fruit, and pay only on the day of harvest, but do not overdo it. Verily, Allah dislikes the extravagant."* (Q.S. Al-An'am: 141)

Islamic economic system in organizing factors of production, distribution and utilization of goods and services is based on the Qur'an and Sunnah to achieve *maslahah* (Suhrawardi 2000). To achieve benefits, Islam limits economic actors in running their business, but it does not become an obstacle to profit. There is no pure definition of efficiency, be it in terms of profit or cost. Islam requires *kaffah* in carrying out every activity, but by not violating the limits set by Allah SWT so that the results are always optimal and no one is harmed or wronged (Tuffahati *et al.* 2016).

Efficiency Measurement

An organization/company can measure its performance based on the activities that have been carried out. According to Hadi *et al.* (2012) there are 5 (five) benefits of measuring the performance of an organization/company. These benefits include improving the quality of decision making, increasing internal accountability, increasing public accountability, supporting strategic planning and goal setting and enabling effective use of resources. Efficiency measurement can be done by assessing the competitiveness of inputs and outputs as well as expenses and *returns* (Safique *et. al* 2015).

According to Al-Amri (2015), and As-Salafiyah (2023) efficiency in conducting its assessment can be seen from three kinds of efficiency, namely:

1. *Technical Efficiency*. Technical efficiency (TE) is an efficiency assessment that describes how efficient the technology used is in achieving a certain level of output with the inputs used. Technical efficiency can be divided into pure technical efficiency and scale efficiency. Pure technical efficiency (PTE) is an efficiency assessment that describes the effectiveness of inputs in producing certain outputs optimally, while scale efficiency (SE) is an efficiency assessment that describes the company's ability to achieve optimal operational activities.

$$\underline{\textit{Technical Efficiency}} = \textit{Pure Technical Efficiency}$$
$$\textit{Scale Efficiency}$$

2. *Allocative Efficiency*. Allocative efficiency in measuring it refers to how efficient management is in choosing the combination of inputs used with the costs incurred. In other words, if inputs produce outputs that consumers do not want, this means that the inputs are not used efficiently.
3. *Cost Efficiency*. Cost efficiency is a combination of technical efficiency and allocative efficiency. A production is said to

be efficient if the company can use minimal inputs to produce certain outputs.

In addition, there are three approaches used to measure and determine the relationship between input and output variables of a financial institution (Muharam *et al.* 2007). The three approaches are:

1. *The Assets Approach*

The asset approach describes the primary function of a financial institution as a lender. In this study, the measured output is defined in terms of assets.

2. *The Production Approach*

The production approach describes a financial institution as a producer, and defines output as the sum of labor, capital expenditure on fixed assets and other materials.

3. *The Intermediate Approach*

The intermediation approach describes a financial institution as an intermediary between a surplus unit and a deficit unit. In this condition, the units used are usually labor costs, capital, interest payments to depositors. While the output is usually loan credit and investment income.

In measuring efficiency performance, two approaches can be used, namely parametric and non-parametric approaches. The parametric approach is an efficiency measurement in which the model sets certain conditions about the population parameters that become the object of research, while the non-parametric approach is a measurement in which the model does not set conditions about the population parameters that become the parent of the research sample (Hidayah 2016). Analysis using a parametric approach can be calculated using three methods, namely the *Stochastic Frontier Approach* (SFA), *Distribution Free Approach (*DFA) and *Thick Frontier Approach* (TFA) (Berger & Humpery 1997). Meanwhile, if using a non-parametric approach, it can be done with the *Data Envelopment Analysis* (DEA) *and Free Disposable Hull* (FDH) methods.

Data Envelopment Analysis (DEA) was first introduced by Charnes, Cooper, and Rhodes in 1978. This method is a mathematical linear programming technique used to evaluate the efficiency performance of a *Decision Making Unit* (DMU). In conducting its analysis, the DEA method accommodates input and output variables to produce a single value of efficiency that is used to measure technical efficiency, pure technical efficiency and scale efficiency.

In this study, in measuring the efficiency of companies and business units of Islamic life insurance, analysis with a non-parametric approach is used, namely DEA. According to Insukindro *et al.* (2007), there are three benefits obtained from the use of DEA in measuring efficiency, namely as a benchmark for obtaining relative efficiency which is useful to facilitate comparison between the same economic units, measuring various variations in efficiency between economic units to identify the factors that cause it and determine policy implications so as to increase the level of efficiency. In addition, the DEA model used in this study has 3 advantages compared to other models. These advantages include:

1. The DEA model can measure many input variables and output variables
2. No assumption of a functional relationship between the measured variables is required
3. Input and output variables have different units of measurement

In general, the DEA method has two models that are often used, namely the CCR (Charnes, Cooper and Rhodes) and BCC (Baker, Charnes and Cooper) models (Cooper 2002). The CCR model was first introduced by Charnes, Cooper and Rhodes in 1978. This model assumes *constant returns to scale* (CRS) which indicates that the addition of production factors (inputs) will not have an impact on additional production (output). In addition, the CRS model also assumes that the company has the same internal and external conditions and operates in a perfectly competitive market. The CRS condition indicates that Islamic life insurance companies operate at the most productive scale size where the company is technically efficient or purely technical (Cooper *et al.* 2006). However, the CRS model is only suitable for conditions where the DMU operates optimally.

The BCC model is one of the DEA method models first introduced by Baker, Charner and Cooper (1984). This model assumes *variable return to scale* (VRS) which indicates that the increase in input and output is not in the same proportion. The increase in proportion can be *increasing return to scale* (IRS) or *decreasing return to scale* (DRS). Islamic life insurance companies are assumed with the BCC model to not have the same internal and external conditions and do not operate in a perfectly competitive market. The efficiency value of the BCC model describes *pure technical efficiency* (PTE) and *scale efficiency* (SE). *Pure technical efficiency* (PTE) is a description of DMU's ability to utilize existing resources, while *scale efficiency* (SE) is a description of a DMU operating at the right scale of production (Sabiti *et al.* 2017).

METHODS

Type and Source of Data

The data used in this study is secondary data in the form of panel data which is a combination of *cross section* data from 13 companies and Islamic life insurance units in Indonesia and *time series* data in the form of annual financial reports for the 2014-2019 period. The data is obtained from the official website of the Financial Services Authority (OJK) in the form of Sharia Insurance Statistics and the website of each Islamic life insurance company in the form of Annual Financial Reports. This research uses several books, journals, literatures, and internet media to complement the unavailable data.

Research Sample

Sample withdrawal *purposive sampling* technique, namely the sample is selected based on certain criteria. These criteria are Islamic life insurance companies that are listed on OJK's sharia insurance statistics and issue audited annual financial reports every year. There are 30 Islamic life insurance companies and units registered in 2018. However, the sample used emphasizes the form of Islamic life insurance companies and business units that have published their financial reports from 2014 to 2019. This study uses 3 companies and 10 Islamic life insurance units in Indonesia.

Data Analysis and Processing Methods

The analysis method used in this research is quantitative analysis. Quantitative analysis is a form of analysis used to measure the level of efficiency of the company under study and the factors that influence it. The quantitative method used in this research is *Two Stage Data Envelopment Analysis* (DEA) method with output orientation BCC model. The DEA method is used to measure the efficiency value of Islamic life insurance companies and then continued with tobit regression to find out the factors that influence the efficiency value. The software used in this analysis are *Max DEA* for efficiency analysis*, Microsoft Excel* 2016 and *Eviews 6*.

Measurement of the efficiency performance of Islamic life insurance companies in Indonesia using DEA

Data Envelopment Analysis (DEA) method is one of the non-parametric analysis methods that evaluates the relative efficiency of a collection of *decision making units* (DMU) in managing inputs of the same type so as to produce outputs of the same type in the form of an unknown function. This method is used to estimate measures of technical efficiency, pure efficiency and scale efficiency. The approach used in this study is output orientation.

Analysis with DEA method resulted in the value of the company's technical efficiency in the range of 0-1 (Sabiti *et al.* 2017). Islamic life insurance companies will be considered efficient if it is close to the value of 1 and said to be inefficient if it is close to the value of 0. There are five input variables and three output variables used in this study. The inputs used are total company assets, total liabilities, commission expenses, general and administrative expenses and claim payments. While the output variables used are income, *tabarru'* funds and gross contributions of each DMU-Islamic insurance.

Analysis of factors affecting the efficiency performance of Islamic life insurance companies in Indonesia using the Tobit method

In analyzing the factors that influence the efficiency level of Islamic life insurance, we can use the tobit or logit method. Both methods have differences that lie in the essence of the *dummy*. In this study, the researcher used the tobit method because the tobit method has an advantage over the logit method, which can use *dummy* variables with numbers between 0 and 1, while the logit method can only be used with *dummies* with numbers 0 and 1. The tobit method can describe the relationship between the dependent variable (response variable) and the independent variable (*predictor variable)* which is categorical, continuous or a combination of both.

This method is used after the efficiency score is known. The efficiency score that ranges from 0-1 makes tobit a method to estimate regression coefficients in analyzing factors affecting the efficiency performance of Islamic life insurance companies in Indonesia. In this method, the independent variables used consist of four financial health ratios of the insurance industry, namely the level of solvency of *tabarru'* funds (SDT)*, the* level of solvency of company funds (SDP), the liquidity ratio (RL), the ratio of expenses to net premiums (RB), company type *dummy* (DJP) and *joint venture dummy* (DJV). While the dependent variable is the level of technical efficiency of Islamic life insurance companies and business units.

Tobit Model:

$$TEit = b0 + B1\ SDTit + B2\ SDPit + B3\ RLit + B4\ RBit + B5\ DJPit + B6\ DJVit + eit$$

$$PTEit = b0 + B1\ SDT\ it + B2\ SDPi\ t + B3\ RL\ it + B4\ RBit + B5\ DJPit + B6\ DJVit + eit$$

$$SEit = b0 + B1\ SDT\ it + B2\ SDPi\ t + B3\ RL\ it + B4\ RBit + B5\ DJPit + B6\ DJVit + eit$$

Description:

TEit : Technical efficiency score of the i-th Islamic life insurance company and in the t-th period.
PTEit : Pure technical efficiency score of the i-th Islamic life insurance company and in the t-th period.
SEit : Scale efficiency score of the i-th Islamic life insurance company and in the t-th period.
b0 : *Intercept*
Bn : Coefficient of the nth variable
SDTit : Solvency of the *Tabarru'* Fund of the i-th sharia life insurance and in the t-th period.
SDPit : Solvency Fund of the i-th Islamic life insurance company and in the t-th period.
RLit : Liquidity Ratio of i-th period t Islamic life insurance
RBit : Expense to net premium ratio of the i-th Islamic life insurance company and in the t-th period.
DGTit : Company type *dummy* (*full fledge* = 1, unit = 0)
DJVit : *Joint venture dummy* (joint *venture* = 1, *domestic* = 0)
eit : Error

Parameter testing of Tobit regression model estimation results.

There are two types of tests used to determine the estimation results of the Tobit regression model, namely :

1. *Likelihood Ratio test*

The Likelihood Ratio test is a type of test in the tobit model which is used to determine whether the independent variables contained in the model have a real influence on the independent variables. The hypothesis used in the *Likelihood Ratio test* is :

H0: b0 = b1 = b2 = b3 = 0

H1 : At least one coefficient is not equal to zero

If the estimation results show a *Likelihood Ratio* value greater than the real level, then reject H0. This means that the independent variable in the model affects the independent variable. Meanwhile, if the estimation results show a value smaller than the real level, then there is not enough reason to reject H0. This states that the independent variable in the model does not have a real influence on the independent variable.

2. *Wald test*

The Wald test is a type of test in the tobit model that is used to determine whether the independent variable has a significant effect or not on the independent variable. The hypothesis used in the *Wald test* is:

H0: independent variable is not significant

H1: independent variable is significant

If the estimation results show that the t-statistic probability value obtained from the independent variable is smaller than the real level, then reject H0. This means that the independent variable has a significant influence on the independent variable in the model. On the other hand, if the estimation results show a t-statistic probability value greater than the real level, then there is not enough reason to reject H0. This indicates that the independent variable does not have a significant influence on the independent variable in the variable.

Definition of Operational Variables

The operational variables were selected based on the *balance sheet approach*. This approach aims to determine the level of output obtained by a particular company or financial institution. This approach is also known as the asset/liability approach because it uses these two indicators in calculating the income of the company under study. This variable is obtained from the financial statements of all Islamic life insurance companies and business units to be studied. Some of the input variables used are total assets (Miniaoui and Chaibi, 2012; Khan and Noreen, 2014; Tuffahati *et al.,* 2016; Benarda *et al.,* 2016; Surya, 2012), total liabilities (Surya, 2012), commission expenses (Rahman, 2013; Tuffahati et al*., 2016)* general and administrative expenses (Nurhayati et al., 2019) and claim payments (Benarda et al., 2016; Sabiti *et al.,* 2017). While the output variables are income (Benarda et al., 2016; Sabiti *et al.,* 2017), *tabarru'* funds (Benarda et al., 2016; Sabiti et *al.,* 2017) and gross contributions (Al-Amri, 2015; Tuffahati *et al.,* 2016). *The* second stage using the tobit method aims to analyze the variables of *tabarru'* fund

solvency, company fund solvency, liquidity ratio, expense to net premium ratio, company type *dummy* and *joint venture dummy* on the efficiency score of Islamic life insurance companies and business units in Indonesia. The results of the estimation can later be used to formulate policies in an effort to improve the efficiency performance of Islamic life insurance in Indonesia.

Table 2. Definition of operational variables

Variables	Definition
Total Assets	The sum of all current and non-current assets such as cash, total receivables, total investments and financing and the sum of other assets.
Total Liabilities	The sum of the company's present obligations due to an activity or activities in the past that have economic benefits such as claims payable, participants' share of the *underwriting surplus of tabarru'* funds that must be paid, as well as other total debt in the form of reinsurance debt and tax debt.
Commission expenses	Costs that must be incurred by insurance companies given to agents or *brokers* because of services received such as for marketing.
General and administrative expenses	Costs used to coordinate production activities and product marketing.
Claim payment	Payments paid on the application or submission of an insurance participant's loss that is included in the insurance expense.
Revenue	The overall income earned from the company's activities such as income from managing insurance operations, sharing *underwriting surplus,* managing the investment portfolio of participant funds and investment income.
Tabarru' fund	Premium contributions paid by participants to cover any losses that arise among participants according to the provisions in the insurance policy.
Gross contribution	The gross amount that the participant is liable for the risk portion and *ujrah*
Solvency of *tabarru'* fund	The difference between the total assets of the *tabarru'* fund minus the liabilities of the *tabarru'* management.
Corporate fund solvency	The difference between the total assets of the company's funds minus the liabilities of the management of the company's funds.
Liquidity ratio	The ability of the insurance company to pay all short-term obligations
Expense to net premium ratio	The ability of an insurance company to pay all of its expenses using premium income.
Company type *dummy*	*Full fledge* Islamic insurance company =1 Islamic insurance unit = 0
Dummy joint venture	*Joint venture* company = 1 Domestic company = 0

ANALYSIS AND DISCUSSION

Efficiency Score of Sharia Life Insurance Companies and Business Units in Indonesia

An insurance company is said to be good and has efficient performance if it is able to manage inputs and produce optimal outputs in various market conditions faced. Whether or not the company's performance efficiency is achieved is due to errors in managing its inputs and outputs (Cooper *et al.* 2016).

Based on the results of data processing of financial statements of 3 companies and 10 Islamic life insurance business units for the period 2014-2019 using the DEA *(Data Envelopment Analysis)* method using the output-oriented BCC model, the efficiency level score is obtained.

Table 3 explains the efficiency level of Islamic life insurance companies in Indonesia for the period 2014-2019. The table shows that there is no Islamic life insurance company that operates efficiently. Al-Amin has the highest average efficiency of 0.99, while Amanahjiwa Giri Artha has a technical efficiency of 0.84 and Takaful Keluarga of 0.58. The results of the efficiency score indicate that Islamic life insurance companies have not been able to manage inputs to produce optimal outputs.

Table 3. Efficiency score of Islamic life insurance companies in Indonesia 2014-2019 period

DMU	2014	2015	2016	2017	2018	2019	Average
Al-Amin	0.99	1	1	1	1	1	0.99
Amanah Jiwa Giri Artha	1	0.69	0.92	0.70	0.76	0.95	0.84
Family Takaful	0.55	0.61	0.55	0.54	0.56	0.64	0.58

Source: DEA output (2020, processed**)**

Unlike the company, in Table 2 there is a sharia life insurance business unit that has a perfect efficiency score during the 2014-2019 period. The business unit is Prudential. This result shows that the Prudential business unit has been able to manage its operational activities by combining inputs to produce optimal outputs. Meanwhile, the other 9 business units have not been able to achieve a perfect efficiency score, meaning that they have not been able to manage their inputs and outputs optimally.

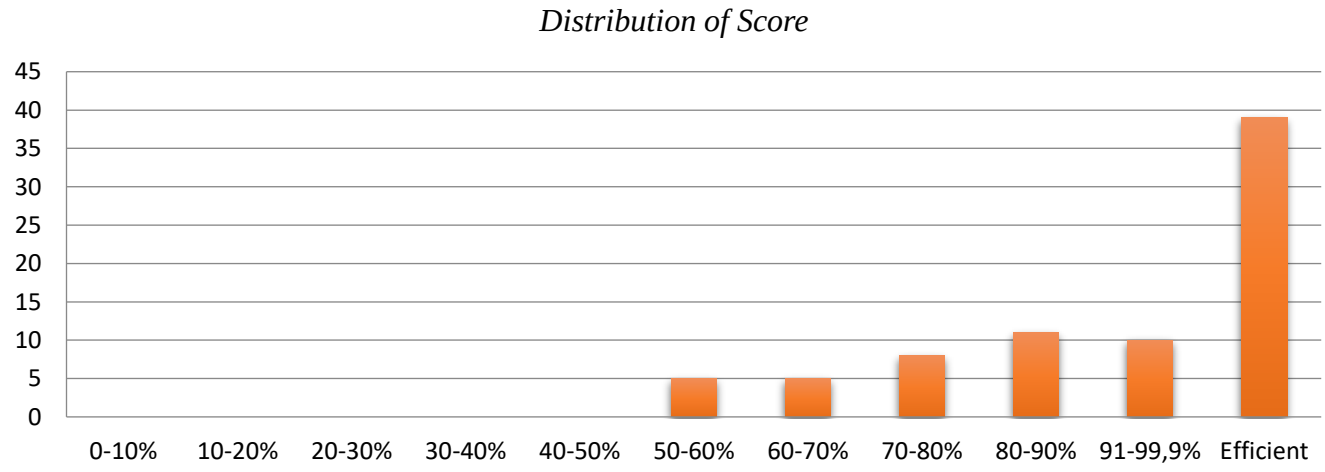
Table 4. Efficiency score of sharia life insurance business units in Indonesia for the period 2014-2019

Unit	**Efficiency Score**						**Average**
	2014	**2015**	**2016**	**2017**	**2018**	**2019**	
AIA Fiancial	1	1	1	0.98	1	1	0.99
Allianz Life	1	1	1	1	1	0.70	0.95
Avrist	1	0.70	0.68	1	0.96	0.86	0.86
Axa Financial	0.94	0.99	0.91	0.87	0.77	0.90	0.89
Central Asia Raya	1	0.55	0.75	0.86	0.75	0.68	0.77
Manulife	1	1	0.82	0.86	0.80	0.89	0.89
Panin Daichi	1	1	1	0.93	1	0.88	0.96
Prudential	1	1	1	1	1	1	1
Sun Life	1	1	0.77	1	0.87	0.88	0.92
Tokio Marine	1	1	0.81	1	1	1	0.96

Source: DEA output (2020, processed)

In relation to the previous table information, the graph below provides information on the number of efficient and inefficient business units on a certain group scale. Based on the following graph, it can be seen that the number of companies and sharia life insurance business units that are perfectly efficient (100%) is 39 DMUs. The graph below also provides information that the most business units are in a 100% efficiency condition, namely 39 DMUs, while the least are business units with efficiency levels of 50-60% and 60-70%, each of which is only 5 DMUs.

Efficiency Distribution Score of Sharia Life Insurance Companies and Business Units

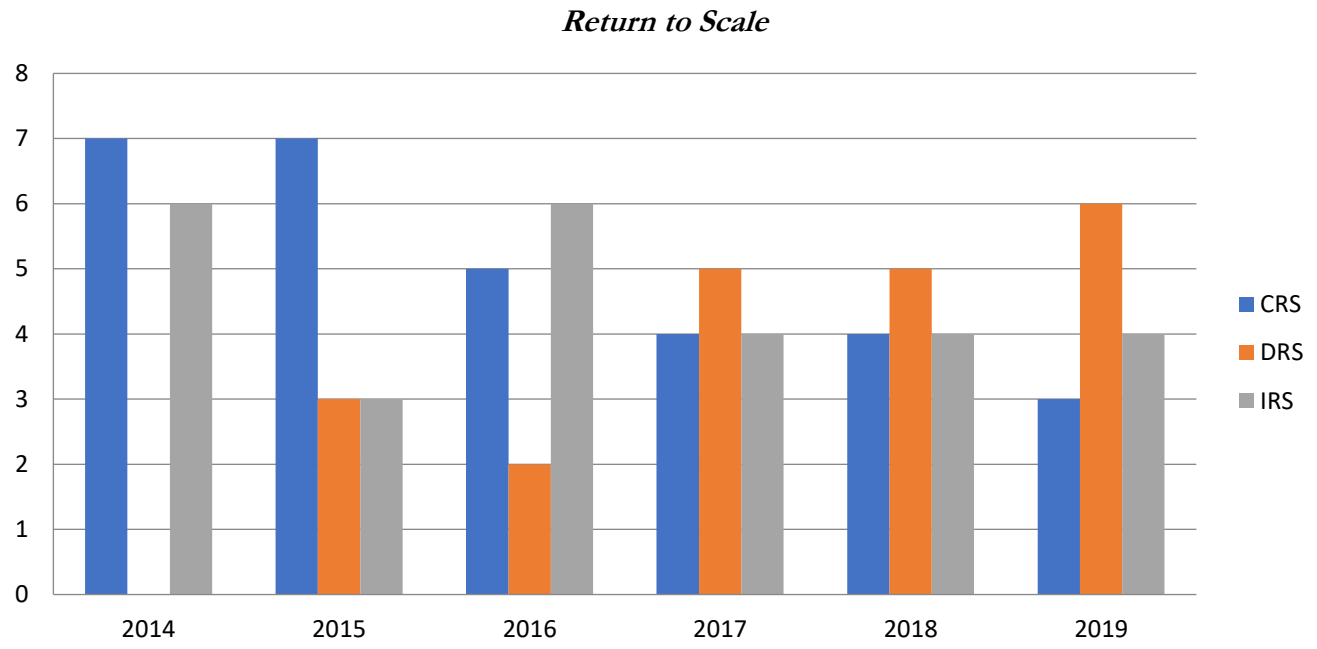


Source: DEA output (2020, processed**)**

Figure 2 *Distribution of score*

Conditions of *Return to Scale* (RTS) of Sharia Life Insurance Companies and Business Units

Besides being used to estimate the efficiency value of each company and Islamic life insurance business unit, the DEA method is also used to analyze how much effort Islamic life insurance companies make in increasing their business operational capacity to achieve optimal performance. At this stage, each DMU (*Decision Making Unit) is* in one of the *Return to Scale* (RTS) conditions, namely *Increasing to Scale (*IRS), *Constant to Scale (*CRS) and *Decreasing to Scale* (DRS). The condition grouping is based on the efficiency scale (ES) value of each company. If the company has TE, PTE and ES values with a value of one, then the company is in *Constant to Scale* (CRS) condition. Meanwhile, if the ES value is one but the TE and PTE values are less than one, the company is in *Decreasing to Scale* (DRS), while if the ES value is less than one, the company is in *Increasing to Scale* (IRS) (Sabiti *et al.* 2017).



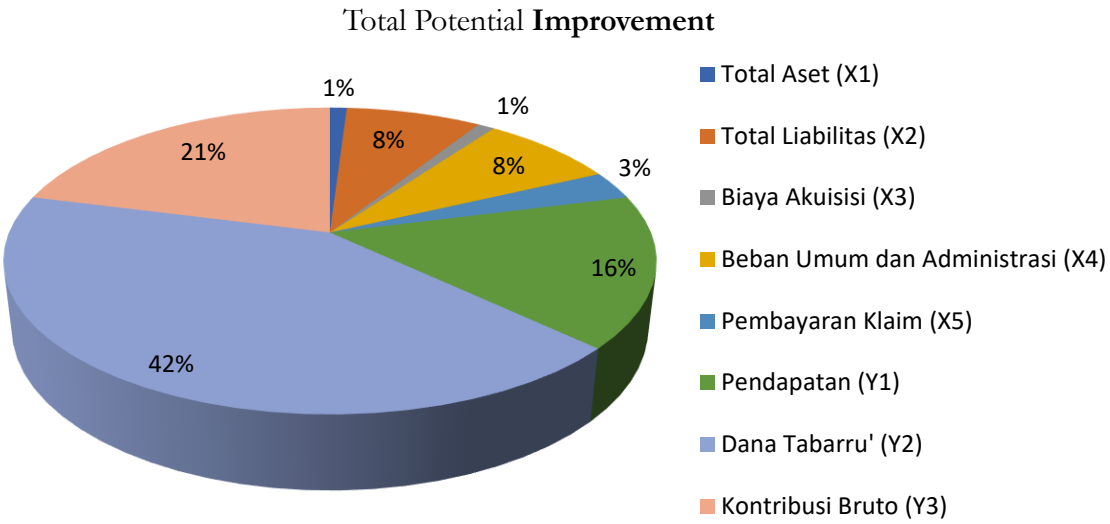
Source: DEA output (2020, processed)

Figure 3 *Return to Scale* Condition

Figure 3 explains the condition of *Return to Scale* (RTS) in Islamic life insurance companies and business units in Indonesia. Based on the figure, it can be seen that there are 30 companies and Islamic life insurance business units that are in CRS conditions, 21 companies are in DRS conditions and 27 companies are in IRS conditions. The DRS condition occurs when the increase in output produced is smaller than the input added. In this condition, the company is required to reduce inputs, because the number of inputs and outputs produced is not ideal. Meanwhile, a CRS condition occurs when there is an increase in output that is proportional to the inputs added. This condition is the ideal condition. Meanwhile, IRS occurs when the increase in output is greater than the increase in input. In this condition, it is possible to continue increasing the output capacity by maintaining the existing inputs.

Total *Improvement Potential of* Sharia Life Insurance Companies and Business Units

To find out the source of inefficiency in Islamic life insurance companies and business units in this observation, it can be seen through *total potential improvement* information that can provide an overview of the source of inefficiency. The *total potential improvement* graph states that in order for the industry to be efficient, inefficient Islamic life insurance companies and business units should reduce total liabilities by 8%, general and administrative expenses by 8% and claim payments by 3%. As for revenue, it needs to be increased by 16%, *tabarru'* funds by 42% and gross contributions by 21% in order to achieve an optimal level of efficiency.

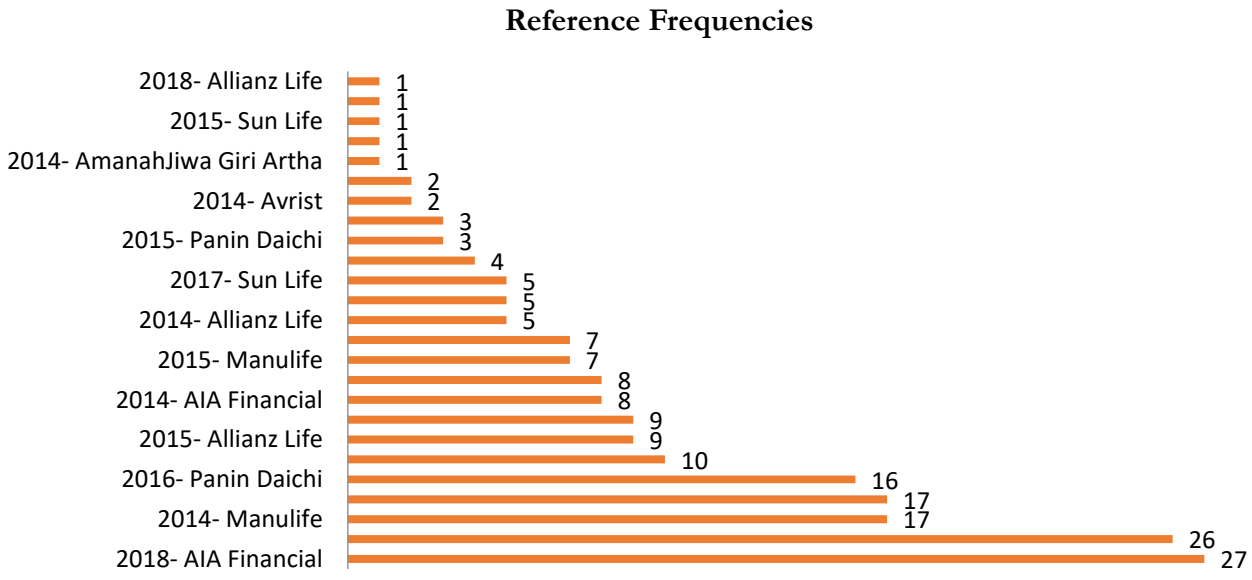


Source: DEA output (2020, processed)

Figure 4 Total *Potential Improvement*

Sharia Life Insurance Companies and Business Units that Become References

This section shows the companies and business units of Islamic life insurance that become references for other companies that are still inefficient. The results of the *frontier* analysis show that in 2018, the most referred business unit was AIA Financial, which was referred by 27 DMUs. While in 2014, the most referred business unit was Manulife which was referred by 26 DMUs.



Source: DEA output (2020, processed)

Figure 5 *Preference Frequencies*

Factors Affecting the Efficiency Value of Islamic Life Insurance Companies and Business Units in Indonesia

The tobit method is a method that will be used in analyzing the factors that affect the efficiency of Islamic life insurance in Indonesia. In this analysis, the independent variables used are *tabarru'* fund solvency, company fund solvency, liquidity ratio, expense to net premium ratio, company type *dummy* and *joint venture dummy*. While the dependent variable that will be used in this analysis is the value of technical efficiency. The value of technical efficiency is used as the dependent variable because the value of technical efficiency consists of pure technical efficiency and its efficiency scale.

Table 5 Factors affecting the efficiency value of Islamic life insurance companies and business units in Indonesia.

Variables	TE		PTE		SE	
	Coeff	Prob	Coeff	Prob	Coeff	Prob
C	0.855883	0.0000	0.897015	0.0000	0.944483	0.0000
SDT	1.67E-07	0.1233	1.42E-07	0.1659	3.33E-08	0.4962
SDP	-1.44E-08	0.6986	-4.80E-10	0.9891	-1.45E-08	0.3912
RL	**-0.005970**	0.0539	**-0.004812**	0.1000	-0.001356	0.3291
RB	**-0.070604**	0.0163	**-0.066066**	0.0177	-0.006595	0.6137
DGT	-0.020299	0.7695	-0.024258	0.7119	0.012623	0.6878
DJV	**0.127649**	0.0475	**0.098451**	0.1052	0.042748	0.1405

Source: Tobit output (2020, processed)

Description:
* : Significant at 10% real level
SDT : *Tabarru'* fund solvency
SDP : Solvency of enterprise funds
RL : Liquidity ratio
RB : Ratio of expenses to net premiums
DGT : Company type *dummy*
DJV : *Dummy join venture*

Based on Table 5, the results of the tobit analysis state that the three models used in this analysis have passed the *Wald test* and *Likelihood ratio* test criteria. Passing the *Wald test* criteria is indicated by all constant variables that have a probability value of 0.0000. While passing the *Likelihood ratio* test criteria is indicated by the *Likelihood ratio* value which is greater than the real level of 10%. The estimation results of the liquidity ratio variable in TE and PTE have a negative and significant effect at the 10% real level, assuming *cateris paribus*. Liquidity ratio is a variable that explains the ability of a company to meet short-term obligations. Based on the results of this analysis, it can be concluded that Islamic life insurance companies and units have not been able to meet their short-term obligations, where the greater the value of the liquidity ratio, the more the company's performance will improve.

On the other hand, based on the estimation results in Table 5, the ratio of expenses to net premium income has a negative effect on the TE model with a real level of 10%, *cateris paribus*. This means that the ratio of expenses to net premium income has a negative influence on the value of technical efficiency of Islamic life insurance companies and business units in Indonesia. The ratio of expenses to net premium income consists of claim expenses, commission expenses and operating expenses borne by net premium income, where the higher the ratio of expenses to net premium income, the lower the input in the form of assets that have a negative impact on the company's operational performance.

The last independent variable in the tobit analysis that is significant is the *join venture dummy* variable. This variable is a variable that states how influential the type of ownership of the company's funds is on the efficiency value of the company's own performance. Based on Table 5, it can be seen that the *join venture dummy* in TE and PTE models is positive and significant at 10% real level. This result indicates that the difference in the efficiency score of Islamic life insurance companies and business units has a positive value, meaning that companies whose capital sources come from domestic and overseas (*join venture*) have a higher efficiency score than companies whose capital sources only come from domestic. This is because with the *joint venture/foreign investment, the* parent company has more economic power to get mutual benefits. These results are in accordance with the hypothesis in the study which states that the *join venture dummy has a* positive effect on the efficiency value of Islamic life insurance companies and business units in Indonesia.

DISCUSSION

Based on the research results above, the variable that has a significant positive effect on the performance efficiency of Islamic life insurance companies and business units in Indonesia is the *joint venture dummy*. Referring to Law No. 25 of 2007, *joint venture* can be

categorized as a form of foreign investment activity where the company is established by two or more business entities to conduct business together for a certain period of time. These results are supported by an empirical study conducted by Kader *et.al* (2014) which shows that increasing efficiency in Islamic insurance can be achieved by optimizing input allocation, especially capital. Capital will help improve the solvency of corporate funds and ensure better economic returns for shareholders and policyholders (Kader *et.al* 2014). Capital activities with risk-based *joint ventures* with prudential principles can increase the efficiency and competitiveness of Islamic insurance companies (Lee *et.al* 2019).

Another factor that causes efficiency or inefficiency in Islamic life insurance companies and business units is the type of company *dummy*. In this study, the type of company dummy has a negative effect on performance efficiency, where the Islamic life insurance business unit has a higher efficiency level than the company. The size of the company affects the level of performance efficiency. The smaller the size of the company, the higher the possibility of the company to develop by utilizing inputs to produce optimal output (Rahman *et.al* 2014).

Law No. 40/2014 on Insurance mandates that there is an obligation to *spin-off the* sharia unit of an insurance or reinsurance company to become a sharia insurance company or sharia reinsurance company. Insurance companies that have sharia units with the value of *tabarru*' funds and participant investment funds have reached at least 50% of the total value of insurance funds, *tabarru' funds,* and participant investment funds in the parent company, the *spin-off* obligation applies since Law 40 of 2014 was enacted. As for companies that have not m fulfilled these requirements, they are still required to *spin-off* but with a given tempo of 10 years, to be precise until 2024. However, when viewed from the results of this study, the sharia life insurance business unit has a higher level of efficiency than the company. Therefore, this regulation will be a big challenge for Islamic life insurance companies to be able to achieve the perfect level of efficiency when they *spin-off* from their parent companies

CONCLUSION

This study aims to analyze the efficiency level of Islamic life insurance companies and business units in Indonesia. Islamic life insurance companies in Indonesia have an efficiency level of 0.80, while the Islamic life insurance business unit can achieve a technical efficiency score of 0.92. Both efficiency levels have an average efficiency score in the Islamic life insurance industry in general of 0.86. These results state that Islamic life insurance companies and business units in Indonesia do not have an efficient performance in combining their inputs to optimally manage their outputs.

Based on the 6 independent variables used to determine the factors affecting the efficiency level of Islamic life insurance companies and business units, the variables and joint venture dummy have a significant positive effect on the performance efficiency of Islamic life insurance companies and business units. However, it is different from the liquidity ratio variable and the ratio of expenses to net premium income which have a significant negative effect on the efficiency value of Islamic life insurance. Meanwhile, the solvency ratio of tabarru' funds and company type dummy have a positive effect with the assumption of ceteris paribus and the variable solvency ratio of company funds has a negative effect with the assumption of ceteris paribus.

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APPENDIX

No	DMU	Score	RTS
1	2014- AIA Financial	1.00	Constant
2	2014- Allianz Life	1.00	Constant
3	2014- AmanahJiwa Giri Artha	1.00	Increasing
4	2014- Avrist	1.00	Constant
5	2014- Central Asia Raya	1.00	Increasing
6	2014- Manulife	1.00	Constant
7	2014- Panin Daichi	1.00	Constant
8	2014- Prudential	1.00	Constant
9	2014- Tokio Marine Life	1.00	Constant
10	2015- Al-Amin	1.00	Constant
11	2015- Allianz Life	1.00	Constant
12	2015- Manulife	1.00	Constant
13	2015- Panin Daichi	1.00	Constant
14	2015- Prudential	1.00	Constant
15	2015- Sun Life	1.00	Constant
16	2015- Tokio Marine Life	1.00	Constant
17	2016- AIA Financial	1.00	Constant
18	2016- Al-Amin	1.00	Constant
19	2016- Allianz Life	1.00	Constant
20	2016- Panin Daichi	1.00	Constant
21	2016- Prudential	1.00	Constant
22	2017- Al-Amin	1.00	Constant
23	2017- Allianz Life	1.00	Constant
24	2017- Avrist	1.00	Constant
25	2017- Prudential	1.00	Decreasing
26	2017- Sun Life	1.00	Constant
27	2017- Tokio Marine Life	1.00	Increasing
28	2018- AIA Financial	1.00	Constant
29	2018- Al-Amin	1.00	Constant
30	2018- Allianz Life	1.00	Decreasing
31	2018- Panin Daichi	1.00	Constant
32	2018- Prudential	1.00	Decreasing
33	2018- Tokio Marine Life	1.00	Constant
34	2019- AIA Financial	1.00	Constant
35	2019- Al-Amin	1.00	Constant
36	2019- Prudential	1.00	Decreasing
37	2019- Tokio Marine Life	1.00	Constant
38	2015- AIA Financial	1.00	Decreasing
39	2014- Sun Life	1.00	Increasing
40	2015- Axa Financial	0.99	Decreasing
41	2014- Al-Amin	0.99	Increasing
42	2017- AIA Financial	0.98	Decreasing
43	2018- Avrist	0.96	Increasing
44	2019- AmanahJiwa Giri Artha	0.95	Increasing

45	2014- Axa Financial	0.94	Increasing
46	2017- Panin Daichi	0.93	Increasing
47	2016- AmanahJiwa Giri Artha	0.92	Increasing
48	2016- Axa Financial	0.91	Decreasing
49	2019- Axa Financial	0.90	Decreasing
50	2019- Manulife	0.89	Decreasing
51	2019- Panin Daichi	0.88	Increasing
52	2019- Sun Life	0.88	Increasing
53	2017- Axa Financial	0.87	Decreasing
54	2018- Sun Life	0.87	Decreasing
55	2017- Central Asia Raya	0.86	Decreasing
56	2017- Manulife	0.86	Decreasing
57	2019- Avrist	0.86	Decreasing
58	2016- Manulife	0.82	Decreasing
59	2016- Tokio Marine Life	0.81	Increasing
60	2018- Manulife	0.80	Decreasing
61	2018- Axa Financial	0.77	Decreasing
62	2016- Sun Life	0.77	Increasing
63	2018- AmanahJiwa Giri Artha	0.76	Increasing
64	2016- Central Asia Raya	0.75	Increasing
65	2018- Central Asia Raya	0.75	Increasing
66	2019- Allianz Life	0.70	Decreasing
67	2015- Avrist	0.70	Increasing
68	2017- AmanahJiwa Giri Artha	0.70	Increasing
69	2015- AmanahJiwa Giri Artha	0.69	Increasing
70	2019- Central Asia Raya	0.68	Increasing
71	2016- Avrist	0.68	Increasing
72	2019- Family Takaful	0.64	Decreasing
73	2015- Family Takaful	0.61	Decreasing
74	2018- Takaful Family	0.56	Increasing
75	2014- Family Takaful	0.55	Increasing
76	2015- Central Asia Raya	0.55	Increasing
77	2016- Family Takaful	0.55	Increasing
78	2017- Family Takaful	0.54	Increasing

Tobit Regression Result

Dependent Variable: PTE
Method: Least Squares
Date: 10/05/20 Time: 23:58
Sample: 1 78
Included observations: 78

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.897015	0.072367	12.39528	0.0000
SDT	1.42E-07	1.02E-07	1.399833	0.1659
SDP	-4.80E-10	3.51E-08	-0.013675	0.9891
RL	-0.004812	0.002887	-1.666666	0.1000
RB	-0.066066	0.027210	-2.428001	0.0177
DGT	-0.024258	0.065433	-0.370728	0.7119
DJV	0.098451	0.059993	1.641045	0.1052

R-squared	0.311442	Mean dependent var	0.896421
Adjusted R-squared	0.253254	S.D. dependent var	0.141405
S.E. of regression	0.122194	Akaike info criterion	-1.280948
Sum squared resid	1.060135	Schwarz criterion	-1.069449
Log likelihood	56.95699	Hannan-Quinn criter.	-1.196281
F-statistic	5.352332	Durbin-Watson stat	2.083233
Prob(F-statistic)	0.000132		

Dependent Variable: TE
Method: Least Squares
Date: 10/05/20 Time: 23:56
Sample: 1 78
Included observations: 78

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.855883	0.076336	11.21207	0.0000
SDT	1.67E-07	1.07E-07	1.559487	0.1233
SDP	-1.44E-08	3.71E-08	-0.388726	0.6986
RL	-0.005970	0.003046	-1.960066	0.0539
RB	-0.070604	0.028702	-2.459899	0.0163
DGT	-0.020299	0.069021	-0.294093	0.7695
DJV	0.127649	0.063283	2.017125	0.0475

R-squared	0.351227	Mean dependent var	0.864899
Adjusted R-squared	0.296401	S.D. dependent var	0.153665
S.E. of regression	0.128895	Akaike info criterion	-1.174178
Sum squared resid	1.179590	Schwarz criterion	-0.962678
Log likelihood	52.79294	Hannan-Quinn criter.	-1.089511
F-statistic	6.406232	Durbin-Watson stat	2.028803
Prob(F-statistic)	0.000020		

Dependent Variable: ES
Method: Least Squares
Date: 10/06/20 Time: 00:02
Sample: 1 78
Included observations: 78

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.944483	0.034595	27.30136	0.0000
SDT	3.33E-08	4.86E-08	0.684041	0.4962
SDP	-1.45E-08	1.68E-08	-0.862764	0.3912
RL	-0.001356	0.001380	-0.982685	0.3291
RB	-0.006595	0.013008	-0.507000	0.6137
DGT	0.012623	0.031280	0.403539	0.6878
DJV	0.042748	0.028679	1.490571	0.1405

R-squared	0.101201	Mean dependent var	0.963526
Adjusted R-squared	0.025246	S.D. dependent var	0.059166
S.E. of regression	0.058414	Akaike info criterion	-2.757061
Sum squared resid	0.242267	Schwarz criterion	-2.545561
Log likelihood	114.5254	Hannan-Quinn criter.	-2.672394
F-statistic	1.332384	Durbin-Watson stat	2.133950
Prob(F-statistic)	0.254285		