Sharia insurance efficiency in Indonesia and Malaysia using the stochastic frontier approach analysis

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Abstract

Purpose: This study aims to analyze the efficiency level of Indonesian sharia insurance and Malaysian *takaful* with a parametric stochastic frontier approach where the input is total assets and expenses, and the output of this research is claims and premiums.

Methodology: This study uses quantitative methods with secondary data in the form of *shariah* insurance Malaysia and Indonesia annual reports 2016-2020. The data analysis uses a regression test with the help of *stochastic frontier approach* (SFA)

Findings: Based on the results of processing using *stochastic frontier analysis (*SFA), Indonesian Sharia insurance's overall production efficiency level is known to be 0.6306 or 63.06%, Malaysian *takaful* on average is known to be 0.6160 or 61.60 %. Partially, Indonesian *sharia* insurance total assets, insurance expenses, and claims positively and significantly affect the number of premiums. *Takaful* Malaysia's total assets of Malaysian *takaful* partially have an insignificant negative effect on the premium amount. Malaysia's *takaful* expenses and claims partially have an insignificant positive effect on the premium amount.

Originality: This study analyzes the efficiency and looks at the effect of the variables of Indonesian sharia insurance and Malaysian *takaful* with a parametric stochastic frontier approach.

Practical implications: This research shows that the management of Indonesian *sharia* insurance and Malaysia's *takaful* is still inefficient, so each government needs to regulate the operations in this industry.

Keywords: efficiency, SFA, *Sharia* Insurance Indonesia, *Takaful* Malaysia, total assets, claims, insurance expenses, premiums.

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Introduction

The non-bank financial industry is an alternative to fund and protect business risks besides banking companies. Insurance is a business service with high public demand in several types of INKB (non-bank financial industries). In Indonesia, there were 137 companies in 2018, and it rose to 138 companies in 2019. The development of conventional insurance is also followed by the number of sharia insurance in Indonesia. Based on statistical data 2019 from the OJK (Financial services national authority) sharia of IKNB, the average number of sharia insurance that is full sharia for five years starting from 2014-2018 has increased by 10%, and sharia business units have increased by 48%. It shows that there are many sharia insurance companies in the form of sharia business units which are the parent of conventional insurance. Some sharia insurance and sharia business units, which have increased over the last five years, show positive growth in sharia insurance assets. It plays an important role in minimizing the risks in insurance to provide appropriate services to the community.

Based on statistical data in 2018 from OJK (Financial services national authority), the average growth of sharia insurance assets during 2014-2018 increased by 17.33%. Total sharia life insurance assets increased by 3% from IDR 33.484 billion in 2017 and IDR 34.474 billion in 2018, Sharia general insurance increased 5% from IDR 5,370 billion in 2017 and IDR 5.621 billion in 2018, sharia reinsurance increased 12% from IDR 1 .666 billion in 2017 and Rp. 1.864 billion in 2018.

The prospects for the development of sharia insurance can continue to increase due to some reasons. First, most Indonesian people are Muslims who tend to respect solutions from their religion. Second, the Indonesian economy is significantly dependent on the micro, small, and medium enterprise (MSME) sector, following the risk management approach through the concept of helping in sharia insurance. Third, the implementation of Good Corporate Governance (GCG) can encourage clean business processes, providing a conducive impact for this industry and helping to avoid practices that contain elements of uncertainty and gambling will be in line with the practice's careful endeavor. (Ramadhani, 2015).

According to the Islamic Finance Development Indicator (IFDI) (2019), Islamic finance in several countries is controlled by Saudi Arabia, Iran, Bangladesh, Malaysia, and Indonesia. For *takaful* itself, Malaysia excels in Southeast Asia. *Takaful* Malaysia was established in 1984. Starting from the establishment of *takaful*, the Malaysian government (Bank Negara Malaysia) gave full support to the development of *takaful*, one of which was in the form of *takaful* legality. In 2016, there were 11 *takaful* operating and more than 88,000 *takaful* agents offering family and general *takaful*. In May 2019, the number increased to 15 *takaful* (Bank Negara Malaysia, 2019). Based on the Global Islamic Financial Report (2017), the rise of Malaysian *takaful* providers increases the growth of total *takaful* assets. The average growth of total *takaful* assets, both general and family, increased by 9.6%, with the highest total assets during 2011-2016 of RM 26.9 billion. The growth of *takaful* families is 10%, with the highest RM 22,3 billion during 2011-2016. The average total asset growth reached 6.9% for general takaful, with the highest RM 3.4 billion during 2011-2016. *Takaful* growth is higher than conventional insurance, which is only 5.3%.

Saad (2012) used data envelope analysis (DEA) to study the efficiency of general non-life companies in Malaysia between 2007 and 2009 based on a panel of 28 companies. Overall, the study found takaful companies less efficient than conventional companies. Ismail et al. (2011) investigated the cost efficiency and investment performance of takaful and conventional insurers in Malaysia using DEA. They found a significant difference in cost efficiency, with lower scores for takaful operators than conventional insurers. Kader et al. (2010) examined the cost efficiency of takaful firms operating in 10 countries using DEA and a second stage regression to determine the factors that affected cost efficiency. They found that more members of board of directors, larger firm size, and specialized product lines improve efficiency.

Based on OJK (2019), the Islamic insurance industry shows a reasonably rapid performance. It requires a measurement of the level of efficiency. Abidin & Endri (2009) mentioned that one of the most important aspects of a company's success is efficiency. Efficiency is not just about keeping costs as low as possible but also involves managing the relationship between inputs and outputs, namely how to manage production factors (inputs) to provide optimal results (output). This paper analyzed the efficiency of Indonesian and Malaysian *takaful*. We use two input-output measures for insurance, including claims and premiums output variables, while input variables total assets, insurance premiums. We then use stochastic frontier analysis (SFA) with the production approach to evaluate efficiency scores for the firms in our sample.

Literature Review

The theory of efficiency is closely related to consumption theory and production theory in microeconomics. Efficiency in consumption theory is where the consumer can maximize the utility or satisfaction that will be fulfilled. In production theory, a company can generate maximum profit on production done. In conventional literature, production theory will describe the company's treatment of buying and using inputs for production and originating outputs of products produced.

The production theory will see its ability to maximize profits and optimize its efficiency. Efficiency will be optimal if the company can maximize output by using fixed input or minimizing the use of input to achieve the same output level (Karim, 2007).

According to Coelli et al. (2005), the efficiency level can be measured through either the input/cost-oriented approach or the output-oriented approach. The input-oriented approach signifies that a certain amount of input may be reduced proportionally to produce the same output level. Unlike the input-oriented approach that focuses on cost minimization, the output-oriented approach emphasizes profit maximization. It means that a certain percentage of output may be increased proportionally using the same input level. One of the commonly used efficiency is through the frontier approach. The frontier efficiency approach can be divided into the metric and non-paramedian frontier. Where the parametric frontier approach can be measured by parametric statistic tests such as Stochastic Free Approach (SFA), Think Frontier Approach (TFA), and Distribution Free Approach (DFA). In contrast, the approach through non-parametric is to use Data Envelopment Analysis (DEA) method (Gitman, 2013). Frontier efficiency can also be used in regulatory analysis to measure the effect of mergers and acquisitions. Capital regulation, deregulation of deposit rates, and geographical shift retrofit on the branches and holdings of the acquisition companies. Compared to other indicators, the main advantages of this indicator are quantitative measurements by eliminating the effects of market prices and other exogenous factors that influence the performance to be observed (Ascarya, 2008).

According to Coelli et al. (2003), SFA has more advantages than other methods. First, it involves disturbance terms that represent disturbances, measurement errors, and exogenous surprises out of control. Second, environmental variables are easier to treat because they can be separated and differentiated by random noise. Third, it allows hypothesis testing to use statistics. Fourth, it is easier to identify outliers. Fifth, the cost frontier and distance function can measure business efficiency with much output. To circumvent this technical flaw, we use the model employed by Battese & Coelli (1995), which estimates the efficiency and frontier in one stage. The basic stochastic frontier models come from Aigner, Lovell & Schmidt (1977). We use the production/output-oriented form since our dependent variables measure some output from insurance activities. Efficiency measurement using the SFA approach can be done through an output-oriented approach for measuring technical efficiency and an input-oriented approach for measuring cost efficiency. Technical efficiency is measured by the production frontier, while cost efficiency is measured based on the cost frontier (Kumbhakar & Knox,2000). Battese & Coelli (1995) explained that the results of the measurement of the SFA method that emerged were in the form of scores between 0-1.

Dewi & Murni (2016) stated that using DEA, Indonesian sharia life insurance has a high-level efficiency. Tuffahati, Mardian, & Suprapto (2016) the efficiency of general sharia insurance and sharia life insurance with the DEA approach has not yet reached optimal efficiency. Indrarini et al. (2019) The efficiency of sharia insurance with the DEA approach show that Al-Amin and *Takaful* sharia insurance have a higher efficiency level than Amanah Gita Sharia Insurance. On the other hand, Ningsih & Suprayogi (2017) found that it has not shown efficiency during 2013-2015. Benarda, Sumarwan, & Hosen (2016) the efficiency of sharia life insurance in Indonesia during the period 2011-2014 with the DEA method shows that the average results of the DEA analysis of sharia life insurance are not efficient. Sabiti, Effendi, Novianti (2017). The efficiency level of Islamic insurance companies in Indonesia with the DEA method shows that life insurance and insurance sharia companies in Indonesia have not yet reached the level of efficiency.

Saad (2012) the efficiency of Malaysian general insurance with the DEA approach is efficient with scale and pure. Kader et al. (2010) cost efficiency of *takaful* companies with the DEA approach shows that company size and product specialization positively affect *takaful* cost efficiency while the policy environment is not significant in increasing cost efficiency. Faruk & Rahaman (2015) The efficiency of Bangladeshi and Malaysian life insurance using DEA shows that Bangladeshi life insurance is more efficient than Malaysian life insurance. Alhassan & Biekpe (2016) South Africa's general insurance cost and profit efficiency is 80.08% and 45.71%, where cost

efficiency is higher than profit efficiency. Al-Amri (2015) The UAE and Qatar *takaful* insurance efficiency has a high level of technical efficiency, while Saudi Arabia and the UAE have a high level of cost-efficiency. Abbas et al. (2018) the efficiency of Pakistani *takaful* and conventional insurance with DEA shows that *takaful* and insurance operating have the same level of efficiency Baharin & Isa (2013) cost efficiency *takaful* and Malaysian conventional insurance with the SFA approach there are significant differences. *Takaful* cost efficiency is lower than conventional insurance.

Research Methods

This research is quantitative as the method employed examines certain populations or samples. The sampling technique is done randomly. Data collection is distributed by accessing the respective websites of Indonesian and Malaysian Islamic insurance. The population in this study were all Islamic insurance companies in Indonesia and Malaysia. The sampling technique used in this study is purposive sampling with the criteria of Indonesian sharia insurance companies registered with the Financial Services Authority (OJK) and Malaysian *takaful* registered with Bank Negara Malaysia (BNM) and having complete annual financial reports from 2016 to 2020. Collection data shariah insurance Indonesia with website the Financial Services Authority (OJK) for Takaful Malaysia by accessing each company's financial report.

The data in this study were analyzed using a parametric approach with the SFA method. This study measured efficiency by using an output-oriented approach or frontier production function. Production efficiency was formulated as the relationship between the amount of production output and the number of inputs. Production efficiency could occur if the company produces optimum production, resulting in a combination of several inputs. The input variables for this research are total assets, total expenses, and output variables claims and premium. The measurement of variables in this study is described in table 1.

Table 1. Research Variables and Operational Definitions

	Indicator	Operational definition	Data source
Input	Total Assets	Total current and non-current assets	Balance
	Total Expenses	The total cost of paying employee salaries, purchasing or renting office equipment, paying for telephone, water, electricity, etc	Company Fund Profit and Loss Statement
Output	Claim	Payment of participant's loss submission to the company	Report on the underwriting surplus (deficit) of t*abarru'* funds
	Premium	Fund which the policyholder deposits to the insurance company.	Balance

Under the predetermined sample criteria, 10 Indonesian sharia insurance and 11 Malaysian *takaful* meet the criteria, which can be explained in table 2.

Table 2. List of Research Samples

Malaysian *Takaful*	Indonesian Sharia Insurance
AIA Public *Takaful* Bhd	PT Asuransi Allianz Life Indonesia
AmMetLife *Takaful* Berhad	PT Asuransi BRI Life
Etiqa Family *Takaful* Berhad	PT Asuransi Jiwa Central Asia Raya
FWD *Takaful* Berhad	PT Asuransi Jiwa Manulife Indonesia
Great Eastern *Takaful* Berhad	PT Asuransi Sinar Mas
Hong Leong MSIG *Takaful* Berhad	PT Tokio Marine Life Insurance
Prudential BSN *Takaful* Berhad	PT BNI Life Insurance
Sun Life Malaysia *Takaful* Berhad	PT Prudential Life Assurance
Syarikat *Takaful* Malaysia Keluarga Berhad (Company)	PT Sun Life Financial Indonesia
Takaful Ikhlas Family Berhad	PT Chubb Life Insurance Indonesia
Zurich *Takaful* Malaysia Berhad	

Analysis Techniques of

Stochastic frontier approach

Frontier 4.1 software is used to estimate the cost function using the data panel method on the parametric Stochastic Frontier Approach (SFA). According to Rahmawati (2015) Standard function of the stochastic cost frontier is as follow:

$$ln\, Ci = f(ln\, Xji, lnYji)$$

where Ci is total cost of sharia insurance n; Xji is input j on sharia insurance n; Yji are output k on sharia insurance n; and *ei* are galat. *ei* consist of 2:

$$ei = ui + vi$$

where *ui* is error factor controllable; and *vi* are random error factor uncontrollable. Assumed that v normally distributed N(0, σ2v) and u half-normal, |N(0, σ2v)| where uit = (ui exp(-h(t-T))3 and *h* are parameter estimated. *Cost efficiency* derived from a cost function, just like with the log as follows:

$$ln\, C = f\,(w, y) + e$$

By using the stochastic cost frontier equation, the cost equation can be written as follows:

$$ln\, C = f\,(w, y) + ln\, u + ln\, v$$

where C is the total cost or cost efficiency; w is the number of inputs; y is the number of outputs; and u and v are errors. So, the cost efficiency can be written as follows:

$$\text{CFFn} = \frac{C_{min}}{C_n} = \frac{\exp[\,fc\,(w^n, y^n) + \ln(UC_{\min})]}{\exp[\,fc\,(w^n, y^n) + \ln(UC_n)]} = \frac{UC_{min}}{UC_n}$$

The efficiency value calculated using the SFA method is in the form of a percentage. The amount of the percentage that shows the efficient intention is the percentage with a weight of 100%. The closer to 100%, the more efficient it is in using the input to produce maximum output.

Results and Discussion

The descriptive statistics in table 3 show the value of each variable according to the type of country Indonesia (I) and Malaysia (M). Assets are the total assets owned by the company for operational activities. In 2016, the minimum value of Indonesian sharia insurance was IDR 10,260,007, owned by PT Chubb Life Insurance. The minimum value for Malaysian *takaful* was RM 16,568,299 by AmMetLife *Takaful* Berhad, while the maximum value of Indonesian sharia insurance was IDR 16,110,117, owned by PT Prudential Life Assurance in 2017. For Malaysian *Takaful,* the maximum value obtained was RM 23,261,649, owned by Etiqa Family *Takaful* Berhad in 2020. The average total of sharia insurance assets of Indonesia was IDR 1,294,930, smaller than the standard deviation value of IDR 1,552,978, which means that the data variation was relatively high and heterogeneous. In Malaysian *takaful,* the average total assets obtained was RM 2,104,601, higher than the standard deviation value of 1,283,003. It means that the variation of Malaysian *takaful* data was relatively low and homogeneous.

The second variable is the insurance expense which is the entire cost incurred by the company. At the same time, the burden in Malaysian *takaful* is the management cost which consists of wages, entertainment salaries, etc. Table 3 shows that the minimum value for Indonesian sharia insurance expense was IDR 6,281,107, owned by PT Tokio Marine Life Insurance in 2018 for Malaysian *takaful* the minimum value was RM 0, owned by FWD *Takaful* Berhad company, Hong Leong MSIG *Takaful* Berhad, Syarikat *Takaful* Malaysia Keluarga Berhad, Sun Life Malaysia *Takaful* Berhad, Zurich *Takaful* Malaysia Berhad. In 2020, the maximum value of Indonesian sharia

insurance was IDR 14,337,093, owned by PT Prudential Life Assurance, and Malaysia was RM 20,452,540 from Prudential BSN *takaful* Berhad. The average number of Indonesian sharia insurance was 1,050,529, smaller than the standard deviation value of 1.991.814, which means the data variation was relatively high and heterogeneous. In Malaysian *takaful* the average amount of burden obtained was RM 5,136,474, lower than the standard deviation value of 7.489.031. It means that the variation of Malaysian *takaful* data was relatively high and heterogeneous.

Premium payments or *tabarru'* funds are paid by customers to the *company*. The minimum value of Indonesian sharia insurance was IDR 4,564,348 from PT Tokio Marine Life Insurance in 2018, and the minimum value of Malaysian *takaful* was RM 0, owned by FWD *Takaful* Berhad, Hong Leong MSIG *Takaful* Berhad, Syarikat *Takaful* Malaysia Keluarga Berhad, Sun Life Malaysia *Takaful* Berhad, and Zurich *Takaful* Malaysia Berhad. The maximum value of Indonesian sharia insurance was IDR 13,323,284 at PT Prudential Life Assurance in 2020, and for Malaysian *takaful*, the maximum value was RM 22,157,390 at Prudential BSN *Takaful* Berhad 2020. The average acquisition of Indonesian sharia insurance premiums of IDR 9,864,094 was greater than the standard deviation value of 2.431.342. The variation in the data was relatively low and homogeneous. In Malaysian *takaful*, the average *takaful* premium obtained was RM 8,715,098, which was smaller than the standard deviation value of RM 9,757,514. It means that the variation of Malaysian *takaful* data was relatively high and heterogeneous.

Claims are company expenses to handle risks that occur to customers following the dependents paid to the company. The minimum value of Indonesian sharia insurance claims was IDR 2,302,585 at PT Chubb Life Insurance in 2017, and the minimum value of Malaysian *takaful* was RM 17,400,505 at AmMetLife *Takaful* Berhad in 2017. The maximum value of Indonesian sharia insurance was IDR 13,794,453 at PT Prudential Life Assurance in 2020, and the maximum value of Malaysian *takaful* was RM 21278,269 at the Etiqa Family *Takaful* Berhad in 2019. Judging from the average number of claims paid by Indonesian Islamic insurance companies of 9,619,679, more significant than the standard deviation value of 2.535.821, the variation in the data was relatively low and homogeneous. In Malaysian *takaful*, the average claim paid by *takaful* was RM 1,946,397, greater than the standard deviation value of RM 988,703. It means that the variation of Malaysian *takaful* data was relatively low and homogeneous.

Table 3. Description Statistics Shariah Insurance Indonesia (IDR) & Takaful Malaysia (RM)

Variables	N	Mean	Minimum	Maximum	Std.Deviasi
Asset	(I) 50	1,294,930	10,260,007	16,110,117	1,552,978
	(M) 55	2,104,601	16,568,299	23,261,649	1,283,003
Expenses	(I) 50	1,050,529	6,281,107	14,337,093	1,991,814
	(M) 55	5,136,474	0,000,000	20,452,540	7,489,031
Premium	(I) 50	9,864,094	4,564,348	13,323,284	2,431,342
	(M) 55	8,715,098	0,000,000	22,157,390	9,757,514
Claim	(I) 50	9,619,679	2,302,585	13,794,453	2,535,821
	(M) 55	1,946,397	17,400,505	21,278,269	988,703

Efficiency Analysis

Indonesian sharia insurance

Based on the results using *stochastic frontier analysis* (SFA), Indonesian Sharia insurance's overall production efficiency level is known to be 0.6306 or 63.06%. The highest sharia insurance in 2016 was PT Chubb Life Insurance Indonesia at 69.54%, while the lowest was PT Sun Life Financial Indonesia at 13.58%. In 2017, the highest efficiency was PT Prudential Life Assurance at 89.16%, and the lowest efficiency was PT Asuransi Jiwa Central Asia Raya at 27.31%. In 2018, the highest efficiency was PT Tokio Marine Life Insurance Indonesia at 86.66%, and the lowest efficiency was PT Asuransi BRI Life at 51.23%. In 2019, the highest efficiency was PT Asuransi Jiwa Manulife Indonesia at 83.59%, and the lowest efficiency was PT Chubb Life Insurance Indonesia at 59.41%.

In 2020 the highest efficiency was at PT Asuransi Jiwa Manulife Indonesia 92.03%, and the lowest efficiency was PT Asuransi BRI Life at 56.44%. Figure 1 summarizes the above description of the efficiency level of each company during 2016-2020.

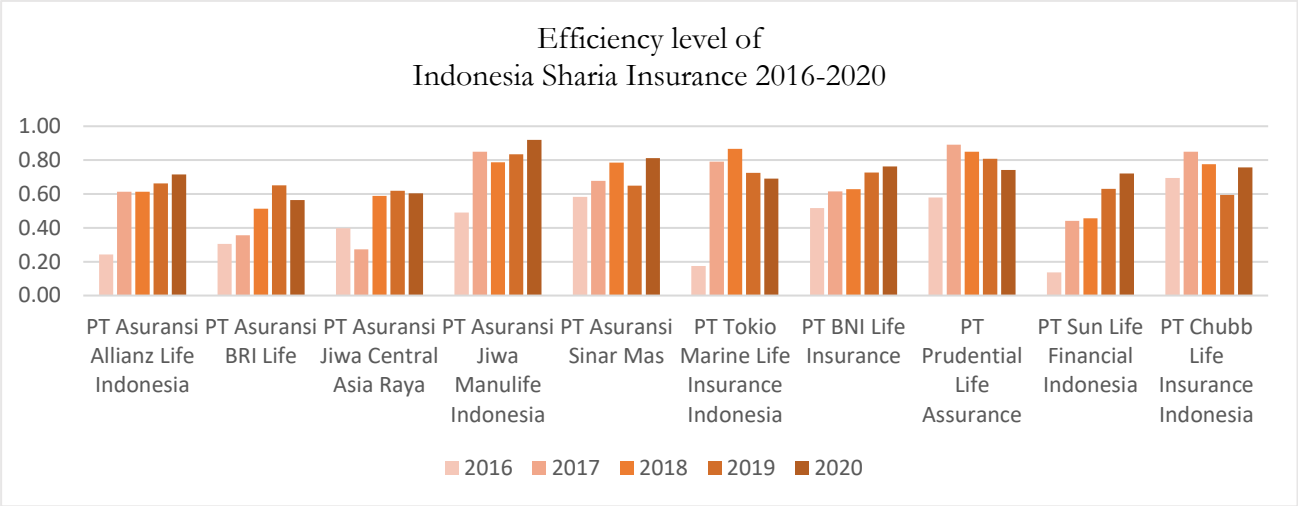

Figure 1. Graph of Indonesian Sharia Insurance Efficiency Level

Based on Figure 1, it can be concluded that the level of efficiency obtained fluctuated by the company PT Asuransi Jiwa Manulife, which had the highest score for two years, 2018-2020, and only in 2016, the company PT Asuransi Jiwa Manulife experience the lowest efficiency score. In general, efficiency is a comparison between output and input, where the company can optimally manage existing inputs to produce maximum output (Ningsih, 2017). Coelli (2005) stated that the SFA method was developed by Aigner et al. (1977). The efficiency measurement with the SFA method can be carried out using two functions, namely, the production and the cost function. This study uses the production function to measure efficiency by considering the maximum output level that can be achieved with a certain combination of *inputs*. According to Bakhsh (2006), the technical efficiency score should be higher than 0.7 to conclude that the company is efficient. Based on the results of the efficiency of the SFA, it can be grouped the level of efficiency of each Indonesian Islamic insurance company. Table 4 classifies the efficiency level of Indonesian sharia insurance.

Table 4. Classification of Efficiency Levels

Sharia Insurance	Efficiency Level	Category
PT Asuransi Jiwa Manulife Indonesia	77.68%	Efficient
PT Prudential Life Assurance	77.38%	Efficient
PT Chubb Life Insurance Indonesia	73.39%	Efficient
PT Asuransi Sinar Mas	70.16%	Efficient
PT BNI Life Insurance	65.01%	Less Efficient
PT Tokio Marine Life Insurance Indonesia	64.95%	Less Efficient
PT Asuransi Allianz Life Indonesia	56.94%	Less Efficient
PT Asuransi Jiwa Central Asia Raya	49.61%	Less Efficient
PT Asuransi BRI Life	47.78%	Less Efficient
PT Sun Life Financial Indonesia	47.71%	Less Efficient

In table 4, the efficiency level of 10 Indonesian sharia insurance companies was not optimal because none of them reached 100%. Only four companies were categorized as efficient, with a score higher than 70%. In comparison, the other six companies were categorized as less efficient, with an efficiency level of less than 70%. To achieve efficient shariah insurance, increasing in digitalization in sharia finance can be the momentum of the sharia insurance industry to sell more

efficient and effective products to the market. The same study by Benarda & Nadratuzzaman (2016), Tuffahati et al. (2016), Ningsih, & Suprayogi (2017) Sabiti et al. (2017) also found inefficient results at sharia insurance.

Malaysian *Takaful*

The efficiency level of Malaysian *takaful* production using the Stochastic Frontier Analysis (SFA) approach was known on average at 61.60%. This efficiency score was not far from Indonesian Islamic insurance. The highest *takaful* in 2016 was FWD *Takaful* Berhad at 888 or 88.88%, while the lowest was AIA Public *Takaful* Bhd at 29.36%. In 2017, the highest efficiency was FWD *Takaful* Berhad at 88.13%, and the lowest efficiency was AmMetLife *Takaful* Berhad at 10.62%. In 2018, the highest efficiency was FWD *Takaful* Berhad at 85.49%, and the lowest efficiency was AIA Public *Takaful* Bhd at 28.61%. In 2019, the highest efficiency was FWD *Takaful* Berhad at 80.64%, and the lowest efficiency was AIA Public *Takaful* Bhd at 29.07%. In 2020, the highest efficiency was Syarikat *Takaful* Malaysia Keluarga Berhad (Company) at 81.03%, and the lowest efficiency is AIA Public *Takaful* Bhd at 0.3096 or 30.96%. Figure 1 recap the efficiency level of each takaful company during 2016-2020.

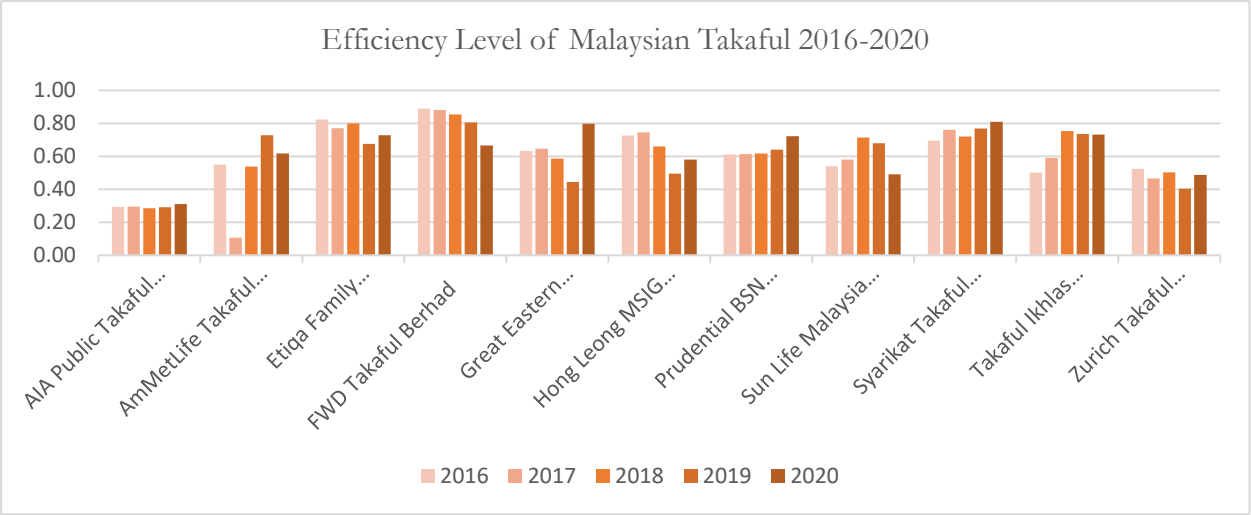

Figure 2. Graph of Malaysia's *Takaful* Efficiency Level

Based on figure 2, FWD *Takaful* Berhad got the highest efficiency score during 2016-2019, while in 2020, the highest efficiency score was Syarikat *Takaful* Malaysia Keluarga Berhad. Table 5 classifies the efficiency level of Malaysian *takaful*.

Table 5. Classification of Efficiency Levels

Takaful	Efficiency Level	Category
FWD *Takaful* Berhad	81.95%	Efficient
Etiqa Family *Takaful* Berhad	75.92%	Efficient
Syarikat *Takaful* Malaysia Keluarga Berhad (Company)	75.07%	Efficient
Takaful Ikhlas Family Berhad	66.27%	Less Efficient
Hong Leong MSIG *Takaful* Berhad	64.15%	Less Efficient
Prudential BSN *Takaful* Berhad	64.08%	Less Efficient
Great Eastern *Takaful* Berhad	62.16%	Less Efficient
Sun Life Malaysia *Takaful* Berhad	60.08%	Less Efficient
AmMetLife *Takaful* Berhad	50.77%	Less Efficient
Zurich *Takaful* Malaysia Berhad	47.65%	Less Efficient
AIA Public *Takaful* Bhd	29.50%	Less Efficient

In table 5, the efficiency level of eleven Malaysian *takaful* was not optimal because none of them has reached 100%. There were only three takafuls categorized as efficient with a score higher than 70%. In contrast, the other eight *takaful*s were categorized as less efficient, with an efficiency level score below 70%. To achieve an efficient takaful, the Malaysian companies should encourage aggressive marketing and broader distribution channels to capture more demand. Higher demand would lead to higher levels of efficiency. Studies by Saad (2012), Baharin & Isa (2013), Kader et al. (2010), and Faruk & Rahaman (2015) also found inefficient results.

The analysis of the efficiency value of Indonesian sharia insurance and Malaysian *takaful* in 2016-2020 using the SFA method has similarities

Ln (1) = β 0 + β 1LN (P 1) + β 2LN (P 2) + β 3LN (P 3) + Vi - Ui .

From these equations, a frontier model will be generated in a translog model, which is not a linear model. The data is converted into the form of a natural logarithm. In this equation, the relationship between the independent variable and the dependent variable will be seen, namely the extent to which the independent variable represented by the *input* variable affects the dependent variable represented by the *output* variable. The tests carried out on Indonesian sharia insurance and Malaysian *takaful* are displayed in table 6.

Table 6. Indonesian Sharia Insurance SFA Test Results

	Coefficient	standard-error	t-ratio
Constanta	-0.2540	0.18362	-0.1383
Asset	0.8866	0.25367	0.3495
Expenses	0.1660	0.18712	0.8875
Claim	0.6011	0.12659	0.4748
sigma-squared	0.4621	0.11810	0.3912
Gamma	0.9642	0.38356	0.2513

The Indonesian sharia insurance regression equation model can be written as follows:

lnQ1 = -0.2549 + 0.8866 lnP1 + 0.1660 lnP2 + 0.6011 lnP3 + 0.4621 – 0.9642

From the regression equation above, the constant is -0.2549. It shows that if the *input* variable *is* considered constant, then Indonesian sharia insurance has a certain level of output that is 0.712 million of the total *input*. The *input* variable, namely total assets (lnP1), has a regression coefficient of 0.8866, indicating that if total assets increase by 1%, the total premium will increase by 0.8866%. The *input* variable, namely insurance expense (lnP2), has a regression coefficient of 0.1660, indicating that if the insurance expense increases by 1%, the premium amount will increase by 0.166%. Then the *input* variable, namely the total claims paid (lnP3), has a regression coefficient of 0.6011, indicating that if the claims increase by 1%, the premium will increase by 0.601%. Table 7 depicts the results of the tests carried out on Malaysian *takaful*.

Table 7. Malaysian *Takaful* SFA Test Results

	coefficient	standard-error	t-ratio
Constanta	-0.3719	0.1571	-0.2367
Asset	-0.2591	0.1252	-0.2069
Expenses	0.1821	0.9714	0.1875
Claim	0.1130	0.8008	0.1411
sigma-squared	0.6305	0.1894	0.3328
gamma	0.8375	0.1223	0.6845

The Malaysian *takaful* regression equation model can be written as follows:

lnQ1 = -0.3719 – 0.2591 lnP1 + 0.1821 lnP2 + 0.1130 lnP3 + 0.6305 – 0.8375

From the regression equation above, the constant is -0.3719. It shows that if the input variable is considered constant, then Indonesian sharia insurance has a certain level of output that is 0.4585 million of the total input. The input variable, namely total assets (lnP1), has a regression coefficient of -0.2591, indicating that if total assets increase by 1%, the total premium will decrease by 0.2591%. The input variable, namely insurance expense (lnP2), has a regression coefficient of 0.1821, indicating that if the insurance expense increases by 1%, the premium amount will increase by 0.1821%. Then the *input* variable, namely the total claims paid (lnP3), has a regression coefficient of 0.1130, indicating that if claims increase by 1%, the premium will increase by 0.1130%.

Partial Test

A partial test is used to test the strength of the relationship of each independent variable to the dependent variable individually by comparing the value of t arithmetic with the t table obtained from each variable using a significance level of 5%. The t-test on the independent variables uses a two-tailed test with = 0.05 where df = n-k, then the Indonesian sharia insurance is 50-4 = 46, the t table obtained is 2.01290. The t-test on the independent variables used a two-tailed test with = 0.05 where df = n-k. The df of Malaysian *takaful* is 55-4 = 51, then the t table obtained was 2.00758. The following table 8 shows the results of the statistical t-test for each independent variable.

Table 8. T-Statistics Test Results

Variable	Indonesian Sharia Insurance	Results	Malaysian *Takaful*	Results
Total Asset	0.3495	< 2.01290. So there is an insignificant effect of total assets on the amount of premiums.	0.2069	< 2.00758. So total assets have no significant effect on the amount of premiums.
Expenses	0.8875	< 2.01290. So there is an insignificant effect of insurance expense on the amount of premiums.	0.1875	<2.00758. So there is an insignificant effect of insurance expense on the amount of premiums.
Claim	0.4748	< 2.01290. So there is an insignificant effect of claims on the amount of premiums.	0.1411	<2.00758. So there is an insignificant effect of total claims on the amount of premiums.

Effect of Assets on Premiums

Assets are assets or assets owned by the company. According to Dewi & Sudhiarta (2017), it is stated that asset growth is highly expected for the development of the company internally and externally. The study results prove that total assets have no significant effect as indicated by the t-count value of less than the t-table, which means that the total assets do not affect the increase in premiums. The use of assets in the company is mainly used for investment in securities that have a low-risk level compared to other assets such as financing, etc. At the same time, premiums are funds given by customers to companies as evidence of their participation in sharia insurance. Assets owned by sharia insurance still follow the parent company, namely conventional insurance, so that sharia insurance assets do not have a significant increase unless there is an addition from the parent company. The results were not significant to the number of assets. It is in accordance with the amount of sharia insurance which is only 16 full sharia and 46 sharia business units. In addition, the number of sharia insurance branch offices is small, so customers feel less confident about the existence of sharia insurance. The result of this study for Malaysian *takafuls'* total assets has no

significant effect on the premium amount. The takaful operators and agents are not pursuing owners' objectives, namely policyholders. It is proven that the takaful operators have incurred many management expenses and staff costs. Meanwhile, the invested assets are not appropriately managed when the investment activity obtains more investment income. It is found that the operating activity, namely underwriting, is not gaining more premium or contribution. There is the possibility that higher agency cost was involved in the management expenses and staff cost. Eventually, higher cost stems from agency cost instead of gaining more income from underwriting and investment activity (Ismail et al., 2011).

Effect of Expenses on Premium

The expenses in this study are insurance expenses, which consist of paying employee salaries, purchasing or renting office equipment, paying for telephone, water, electricity, etc. This study indicates that the burden has an insignificant positive effect on the premium, as indicated by the t-count value is smaller than the t-table. This means that the number of expenses incurred by the company cannot increase the amount of premium paid by customers. In insurance, the agent's salary payment is obtained from many insured customers' participation, so salary expenses are not much. For other types of costs, namely the purchase or rental of office equipment, in this case, sharia insurance makes more expenditures so that customers can be known and trusted, but these costs are not paid. Increasing the amount of premium from customers happens because many people do not know the products of sharia insurance companies and the difference between sharia and conventional insurance. People, in general, do not know the terms in sharia and consider sharia insurance the same as conventional. Apart from this, the government's role in supporting IKNB is considerably weak. Previously, the government already had a discourse on sharia insurance which was still a mandatory unit to become full sharia insurance due to the Covid-19 outbreak, so the discourse could not be implemented because of economic conditions that had not improved.

The Malaysian financial system has undergone major structural changes in globalization, with various liberalization measures being introduced during the last decade. These factors are expected to impact the efficiency of the life insurance companies and the takaful operators (Saad et al., 2012). The Takaful operators have incurred high management expenses and staff costs. It is found that the operating activity, namely underwriting, is not gaining more premium or contribution. (Ismail, 2011). There is the possibility that a higher agency cost was involved in the management expenses and staff costs. Other insurance companies in Malaysia should not allow their client to get dissatisfied with their service.

Influence of Claims on Premiums

The claim in this study is a payment for the participant's loss submission to the company. This study indicates that claims have no significant effect on premiums. The t-count value is smaller than the t-table, which means that the increase in claims does not affect the premium amount. In sharia insurance companies widely known by the public, such as Prudential life insurance, Manulife life insurance, and Sinar Mas life insurance, the higher number of claims paid does not affect customers in paying premiums where people already believe in the credibility of the company. Therefore, the number of claims paid does not affect the company's credibility. Customer participation in the insurance.

In the context of Malaysia, the takaful industry has experienced substantial growth and transformation since its inception 25 years ago. The industry started with one Takaful operator, known as Syarikat Takaful Malaysia, in 1984. After Bank Negara Malaysia issued four new family takaful licenses, it has now increased to twelve. They are local composite takaful operators involved in general and family takaful business. All takaful operators are regulated by Takaful Act 1984 under the supervision of Bank Negara Malaysia (BNM). It is noted that Malaysia is the first country to implement regulations specific to Takaful Act 1984. In supporting the development of the takaful

industry, Bank Negara Malaysia issued a comprehensive concept paper concerning the Takaful Operational Framework (TOF) in late 2009. Rahman & Daud (2010) examined participants' behavior of medical and health Takaful in Malaysia. They found an adverse selection since most of the claims were rejected due to discoveries of some irregularities by the management. Malaysia's insurance industry has great potential to further increase by improving technical components such as optimizing the use of information and communication technology in providing good services to customers. Despite lacking policy coverage, different policies issued should be increased. The company's overall performance also confirms its glorious prospect to ensure steady and long-term growth and sharpen its competitive edge in an ever-changing and challenging business environment.

Conclusion

The purpose of this study is to analyze the efficiency level of Indonesian sharia insurance and Malaysian *takaful* with a parametric *stochastic frontier approach* where the input of this research is total assets and expenses, the output of this research is claims and premiums. The sampling technique used *purposive sampling* with predetermined criteria. Based on the sample criteria, there are 10 Indonesian sharia insurance companies and 11 Malaysian *takaful* as samples with a research period from 2016 to 2020. The dependent variable of this study is the total premium for the independent variables consisting of total assets, insurance expenses, and claims made by the company in nominal terms and converted to the natural logarithm. The data used in this study is secondary data, namely the financial statements of each Indonesian sharia insurance website registered with the OJK and each Malaysian *takaful* website registered with BNM.

Based on the efficiency level analysis of Indonesian and Malaysian SFA, descriptive statistical analysis, and partial tests using the *stochastic frontier approach*, the overall production efficiency level of Indonesian sharia insurance was 63.06%. The efficiency level of 10 Indonesian sharia insurance companies was not optimal because none had reached 100%. Only four companies were categorized as efficient with a score higher than 70%, namely PT Asuransi Jiwa Manulife Indonesia, PT Prudential Life Assurance, PT Chubb Life Insurance Indonesia, and PT Asuransi Sinar Mas. The efficiency level of Malaysian *takaful* production with the *stochastic frontier approach is* known to be 0.6160 or 61.60% on average. The efficiency level of the 11 Malaysian *takaful*s was not optimal because none of them had reached 100%. Only three *takafuls we*re categorized as efficient with a score higher than 70%, namely FWD *Takaful* Berhad, Etiqa Family *Takaful* Berhad, Syarikat *Takaful* Malaysia Keluarga Berhad.

The partial test results (t-test) prove that the Indonesian sharia insurance assets partially have a positive and insignificant effect on the premium amount. The burden of Indonesian sharia insurance partially has a positive and insignificant effect on the premium**.** Indonesia's sharia insurance claims partially have a positive and insignificant effect on the premium amount**.** The total assets of Malaysian *takaful* partially have an insignificant negative effect on the premium amount**.** Malaysia's *takaful* claims partially have an insignificant positive effect on the premium.

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