Print ISSN: 2288-4637 / Online ISSN 2288-4645
doi:10.13106/jafeb.2021.vol8.no7.0111

An Efficiency Analysis of Takaful Insurance Industry: A Comparative Study

Ali COSKUN[1], Houshang HABIBNIYA[2], Yavuz KECELI[3]

Received: March 20, 2021 Revised: May 22, 2021 Accepted: June 01, 2021

Abstract

Takaful, which is an Islamic insurance instrument, manages risks in business, according to Shariah (Islamic law) principles and offers risk protection and savings assets. The study analyzes the comparative efficiency of takaful insurance companies by implementing empirical research. The study also provides a comprehensive literature review on the efficiency analysis of the takaful industry. The empirical part presents a wide range of efficiency comparisons of 41 takaful insurance companies in 16 countries between 2009 and 2014. The data enveloping analysis technique is utilized using the rDEA package in the R environment to compute the efficiency score. In the study, the technical efficiency, overall technical efficiency, and pure technical efficiency are calculated and compared per year and per country. The findings of the study suggest that the overall average efficiency scores of takaful companies are considerably high. The study results also indicate that the excess in the consumption of inputs decreases while the deficit in achieved outputs has been declining in the covered period. The study suggests the managers of the takaful companies can use the target efficiency scores, which are calculated by using the DEA analysis, as an ideal reference benchmark for planning their inputs and outputs.

Keywords: DEA, Insurance, Islamic Finance, Takaful, Performance

JEL Classification Code: G22, L25

1. Introduction

Today's business world without an insurance system is unsustainable because firms and individuals may not have the capability to hold all kinds of risks that they may face during business operations. The social and economic contributions of the insurance industry may be attributed to its role by providing quantitative and qualitative benefits to both firms and individuals and mitigating various types of economic risks such as like fire, loss of property, occupational health, industrial loss prevention, cargo, death, automobile accidents, and medical treatment.

Takaful, which is an Islamic insurance policy, manages risks in business according to Islamic laws (Shariah) principles, where both risks and funds are shared between the insured and insurer. The word takaful means "mutual guarantee" or "guaranteeing each other" and has been derived from its Arabic root word kafala, a verb which means a guarantee, bail, warrant, or an act of securing one's need (Ali, Odierno & Ismail, 2008; Stagg-Macey, 2007). The notion of the risk-sharing principle in the takaful system, in general, can be attributed to its main principle of mutual cooperation, taawun (brotherhood), and solidarity. In other words, as it is asserted by several scholars that, the acceptance of the takaful is based on cooperation among policyholders for the common good and its risk-sharing scheme under the principle of taawun through the creation of the tabarru fund (Wahab, Lewis, & Hassan, 2007; Rahman, Yusof, & Bakar, 2008). Notwithstanding, the takaful insurance, which is viewed as an Islamic finance product, is a cooperative insurance mechanism where the insurer helps policyholders to provide loss protection services for each other.

[1]First Author and Corresponding Author. Professor, Department of Accounting, College of Business Administration, American University of the Middle East, Kuwait [Postal Address: Egaila Block 6, Ahmedi, 54200, Kuwait] Email: ali.coskun@aum.edu.kw
[2]Associate Professor, Department of Accounting, College of Business Administration, American University of the Middle East, Kuwait. Email: houshang.habibniya@aum.edu.kw
[3]Assistant Professor, College of Business, Alfred University, United States. Email: keceli@alfred.edu

The boundary between conventional insurance and takaful lies in the underlying concepts and contracts employed. First, segregation between participants and shareholders' funds as the company's role in takaful is only to manage participants' funds on their behalf. The participants in takaful are the owners. Second, in takaful, the customers (policyholders) pay their contributions (premiums) as a donation (Tabarru), which is also treated as saving (Mudarabah -profit and loss sharing). The takaful operator is just an agent who has been authorized to operate or manage the Takaful fund on behalf of the participants; therefore, this eliminates the principle of uncertainty (Gharar) from the Takaful contract (Mazahir, Ab Rahman, & Ramzy, 2018).

In contrast, the paid premiums in conventional insurance create an obligation against the insurer on a sale and purchase relation. In other words, the policyholders have no right to determine contributions or benefits. The insurance company has full control over the amount allocated to the insured. These two principles are considered essential elements from the Shariah point of view (Swartz & Coetzer, 2010) 'Tabarru' are collectively contributed from a group of people who choose to be covered under takaful. This is the most important factor, which distinguishes takaful from conventional insurance. It is an agreement among a group of members or participants who are willing to mutually guarantee one another against potential future losses to their respective assets (Rahman et al., 2008).

Takaful, which is following Islamic values concerning socio-economic principles for the benefit of individuals and society as a whole, is not a new or modern phenomenon. Its fundamentals were laid and practiced in various forms for centuries, ever since the days of Islam. Many Muslim investors wish to comply with the principle of Islamic laws that prohibits the payment or acceptance of interest (riba) for lending and accepting of money, respectively. As a result, there has been a strong demand for Islamic finance and rapid growth for Sharia-compliant financial services and transactions worldwide. Not only is religiosity the main reason for selecting Islamic financial products by Muslim customers, but also the costs and benefits to the customers are also significant for their preferences (Buljubašić, 2013).

Therefore, the number of Islamic financial institutions has been increased worldwide rapidly since the inception of the system in 1975, and today the number of Islamic financial institutions has reached 300 in more than 75 countries. They are concentrated in the Middle East and Southeast Asia, but they also appear in European countries and the United States. The total worth of the Islamic finance industry's three main sectors of banking, capital markets, and takaful are estimated at USD 2.19 trillion in 2018, as is shown in Table 1. Even though the gross contributions of the global takaful industry increased by a 6.1% increase from USD 26.1 billion in 2016 to USD 27.7 billion in 2017, its share in the global Islamic financial services remained unchanged at 1.3% (IFSB, 2019). This tremendous growth of the Islamic financial sector is expected to generate more growth in the Takaful sector.

The development of a modern takaful system was initially undertaken in Sudan in 1979, followed by Malaysia in 1984. Nowadays, around the world, approximately 306 takaful institutions are operating in at least 45 countries, including re-takaful and takaful windows, offering takaful insurance products. The takaful market has a significant presence in 13 countries, including Gulf Cooperation Council (GCC) countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE), Iran, Malaysia, and Brunei. Takaful markets in countries such as Indonesia, Pakistan, Jordan, and Bangladesh are still emerging. IFSB (2019) indicated that the global takaful insurance industry had generated positive

Table 1: Breakdown of the Global Islamic Financial Service Institutions by Sector and Region (USD billion, 2018)

Region	Banking Assets	Sukuk Outstanding	Islamic Funds Assets	Takaful Contributions	Total	Share %
Asia	266.1	323.2	24.2	4.1	617.6	28.2%
GCC	704.8	187.9	22.7	11.7	927.1	42.3%
MENA (ex-GCC)	540.2	0.3	0.1	10.3	550.9	25.1%
Africa (ex-North)	13.2	2.5	1.5	0.01	17.2	0.8%
Others	47.1	16.5	13.1	–	76.7	3.5%
Total amount	1.571.3	530.4	61.5	27.7	2,190	100%
Share in the sector	71.7%	24.2%	2.8%	1.3%	100%	

Note: Data of Sukuk outstanding and Islamic funds are at the end of 2018, bank assets are as of June 2018, takaful as at the end of 2017.
Source: IFSB (2019). Islamic Financial Services Industry Stability Report 2019, Islamic Financial Services Board, retrieved from https://www.ifsb.org/download.php?id=5231&lang=English&pg=/sec03.php.

returns (profit) in all the markets in 2017. The most profitable markets in terms of ROA are Saudi Arabia (8.21%), Oman (5.76%), and Jordan (5.73%). The lowest profitable takaful markets in terms of ROA are the UAE and Bahrain. IFSB (2019) compared the expense ratio of the global takaful industry in six years period (2012-2016) and the year 2017 and found that the expense rate is declined, except a few countries in the sample, because of intensive deployment of technology implementation, innovation and cost-effective distribution channels.

This study analyzes the comparative efficiency of takaful insurance companies in 16 countries, including South Asia and the GCC region, between 2009 and 2014. The efficiency and performance analysis issues are essential for Takaful institutions since they are facing intense competition from the well-established conventional insurance companies (Khan & Noreen, 2014). The data enveloping analysis technique is utilized to compute the efficiency score in order to make a comparison.

2. Efficiency Analysis of Takaful Insurance Companies

A review of existing literature reveals that the efficiency and performance of the insurance industry is undoubtedly a topic of great interest in the academic literature during the last two decades. Many studies examined the efficiency and productivity of the insurance sector, both in developed countries and developing economies.

The most common technique used by the researchers to measure the efficiency of the insurance companies is the Data Envelopment Analysis (DEA), which was introduced by Charnes, Cooper, and Rhodes (1978). DEA is a non-parametric technique that can be used to measure the relative efficiency of decision-making units with multiple inputs and multiple outputs (Kumar & Gulati, 2008). The technical efficiency of each decision-making unit refers to the ratio of the weighted sum of outputs to the weighted sum of inputs. DEA calculates the "efficiency frontier" based on the input-output combination of the best performing units and the efficiency scores of other units calculated based on their distance from the frontier. The non-parametric frontier analysis uses mathematical programming to measure the relationship of services provided (outputs) to assigned resources (inputs) (Coskun & Balci, 2018; Akin, Bayyurt, & Zaim, 2013; Bhatia, & Mahendru, 2015; Masud, Rana, Mia, & Saifullah, 2019; Kumar, Anand, & Batra; 2020).

The literature reveals that a few studies analyzed the efficiency of the takaful insurance companies (Kader, Adams, Hardwick, & Kwon, 2014; Al-Amri, 2015; Miniaoui & Chaibi, 2014) and most of the studies analyzed the efficiency of the takaful companies with the conventional insurance companies together (Benyoussef & Hemrit, 2019; Akhtar, 2018; Abbas, Khan, Abbasi, & Mahmood, 2018; Bao, Ramlan, Mohamad, & Yassin, 2018; Rusydiana & Nugroho, 2017; Faruk & Rahaman, 2015; Khan & Noreen, 2014; Saad, 2012; Al-Amri, Gattoufi, & Al-Muharrami, 2012; Ismail, Alhabshi, & Bacha, 2011; Saad, Majid, Yusof, Duasa, & Rahman, 2006; Naushad, Faridi, & Faisal, 2020) by using DEA methodology. The summary of studies that used DEA to analyze the efficiency of takaful insurance is shown in Table 2. The input and output variables used in these studies and the scope of the analysis are also indicated in the table.

The studies in Table 2 reveal that efficiency analysis of takaful insurance companies has been done either as a comparison of the different regions or countries or as a comparison of companies in a country. As seen in the table, most of the studies in only one country, and there is a lack of cross-country studies. Most of the literature in Table 2 is on Malaysia and GCC region, and there are six studies on the efficiency of takaful companies in Malaysia, two studies are on Saudi Arabia, two studies on Pakistan, and one study is on Indonesia. In the studies in one country, the number of Takaful companies has represented minor percentages.

Bao et al. (2018), Saad (2012), Ismail et al. (2011), and Saad et al. (2006) analyzed the efficiency of the insurance companies in Malaysia. Bao et al. (2018) evaluated the performance of eight takaful and 18 conventional insurance companies in Malaysia by using a quantitative method of DEA output-orientation CCR model for the period 2014–2015. They determined the efficient and inefficient companies and measured the average efficiency scores for two years. Ismail et al. (2011) studied the relationship between efficiency and organizational structure for eight takaful and 18 conventional insurance companies in Malaysia over the period 2004–2009. They used the DEA methodology and separately analyzed both scale efficiency and technical efficiency. They compared the takaful and conventional insurance firms, and they found that both scale and technical efficiencies of takaful companies are significantly lower than the conventional insurance firms because of the influence of organization form on efficiency. Saad et al. (2006) investigated the efficiency of the one takaful and 12 conventional insurance firms in Malaysia during the period 2002 to 2005. Saad (2012) measured the efficiency of six takaful and 22 conventional insurance firms in Malaysia during the period 2007 to 2009. She implemented the DEA technique and measured efficiency using the Malmquist index and found that the total factor productivity of takaful and conventional insurance companies in Malaysia is mainly due to change in both scale efficiency and pure efficiency.

Benyoussef and Hemrit (2019) and Akhtar (2018) studied the efficiency of insurance companies in Saudi Arabia.

Table 2: Summary of the Literature on the Efficiency Analysis of Takaful Insurance Companies

Authors	Years	DMUs	Inputs	Outputs
Akhtar (2018)	2010–2015	Six takaful and 24 conventional insurance firms in Saudi Arabia	Equity, net claim incurred general and administrative expenses	Net premium earned, investment income, investment and management fee income
Benyoussef & Hemrit (2019)	2014	Four takaful and 19 conventional insurance firms in Saudi Arabia	Gross premiums, capital	Investments, Claims
Rusydiana & Nugroho (2017)	2012–2016	Three takaful and five conventional insurance firms in Indonesia	Cost of commissive, operational cost, total equity	Premium, investment revenue
Abbas et al. (2018)	2010–2015	Five takaful and 32 conventional insurance firms in Pakistan	Labor, total fixed assets, total equity capital	Invested assets, investment incomes, net premiums
Khan & Noreen (2014)	2006–2010	Five takaful and 12 conventional insurance company in Pakistan	Total fixed assets, business services, equity capital, labor	Invested assets, net premium
Al-Amri et al. (2012)	2005–2007	Thirty-nine insurance companies in GCC.	Management expenses, net claims	Premium earned, net investment income
Ismail et al. (2011)	2004–2009	Seven takaful and 11 conventional insurance firms in Malaysia	Labor cost investment assets management expenses	Gross premium contribution, investment income
Saad et al. (2006)	2002–2005	One takaful and 12 conventional insurance firms in Malaysia	Commission, management expenses	Premium, net investment income
Saad (2012)	2007–2009	Six takaful and 22 conventional insurance firms in Malaysia	Commission, management expenses	Premium, net investment income
Bao et al. (2018)	2014–2015	Eight takaful and 18 conventional insurance firms in Malaysia	Operating expenses, equity capital, commissions	Net premiums, net investment income, net incurred claims
Faruk & Rahaman (2015)	2009–2011	Ten conventional insurance firms in Bangladesh and five Takaful firms in Malaysia	Commission, management expenses	Premium, net investment income
Miniaoui & Chaibi (2014)	2006–2009	Eight takaful companies in GCC and four takaful companies in Malaysia	General and administrative expenses total assets	Gross contribution
Kader et al. (2014)	2004–2006	Twenty-six takaful companies in ten countries	Price of labor, capital, total operating expenses	Gross contributions (gross premiums)
Al-Amri (2015)	2004–2009	Twenty-two takaful companies in GCC.	Number of employees, technical provision, shareholders' equity	Premium income total investment
Naushad, Faridi, & Faisal (2020).	2015–2018	Thirty Insurance Companies in Saudi Arabia	General and administration expenses, policy and acquisition costs	Net premium earned investment income and other incomes

Akhtar (2018) analyzed the efficiency of six takaful and 24 conventional insurance firms in Saudi Arabia between 2010 and 2015 and found that the average efficiency scores of firms have been increased in the mentioned period. He concluded that the larger takaful and conventional firms need to utilize their inputs more efficiently. Benyoussef and Hemrit (2019) measured the efficiency of four takaful and 19 conventional insurance firms in Saudi Arabia in 2014. They compared the efficiency of takaful and conventional firms and found that takaful companies were relatively more efficient than conventional companies in Saudi Arabia. They also concluded that conventional insurance firms need to allocate their resource since they have a lack of resources, while takaful insurance companies have a surplus.

Khan and Noreen (2014) compared the efficiency and productivity of the takaful and conventional insurance companies in Pakistan for the period 2006–2010 by using DEA. They estimated the technical, allocative, and cost efficiencies of the insurance companies and found that the insurance industry is cost-inefficient due to high allocative inefficiency. They also compared the insurance companies in terms of economies of scale. They found that takaful insurance companies were more efficient as compared to conventional ones in Pakistan. Abbas et al. (2018) analyzed the cost, allocative and technical efficiencies of five takaful and 32 conventional insurance firms in Pakistan between 2010 and 2015. They implemented a two-stage analysis and found that takaful and conventional insurance firms in Pakistan have been operating almost at equal efficiency.

Rusydiana and Nugroho (2017) measured the efficiency of three takaful and five conventional insurance firms in Indonesia in 2013–2016. They determined the efficient and inefficient firms and found the firms in IRS and DRS conditions. They concluded that the main reason for the inefficiency of the life insurance industry in Indonesia is from the output side, and they suggested to the firms to increase the value of premiums and investment income.

Miniaoui and Chaibi (2014) analyzed the technical efficiency of takaful companies in the GCC countries and Malaysia. They employed DEA to estimate the technical efficiency during the period 2006–2009, and they found that takaful companies in GCC countries are more efficient than Malaysian takaful companies since the Malaysian companies are operating in a more competitive market. They follow aggressive marketing strategies to keep satisfying customers' demands. Faruk and Rahaman (2015) compared the efficiency change and technical change of five takaful companies in Malaysia and ten conventional life insurance companies in Bangladesh.

Al-Amri (2015) analyzed the technical, pure technical, cost, and allocative efficiency of 22 takaful firms operating in the GCC countries using DEA and tried to identify the primary sources of inefficiency in takaful companies. The result of the study indicated the takaful insurance industry in GCC is highly technical and pure technical efficient, and moderately cost-efficient. Al-Amri et al. (2012) investigated the efficiency of the 39 insurance firms in the GCC region between 2005 and 2007. They haven't classified the insurance companies in terms of Shariah compliance, but they used country breakdown. They found that the insurance industry in the GCC is efficiently operating even though they continuously and rapidly growing. Kader et al. (2014) computed the cost efficiency scores of 26 non-life Takaful insurance firms operating in 10 Islamic countries by using data envelopment analysis between 2004 and 2006. They also tested the influence of firm characteristics such as board size, firm size, the regulatory environment, and product specialization on efficiency.

3. Methodology

Data is analyzed by using data envelopment analysis (DEA) with the rDEA package in the R environment. The rDEA package provides functions for DEA analysis in *R* and doing returns-to-scale tests (Simm & Besstremyannaya, 2016). First, we divided the dataset into different dataframes of input and output variables for each year (Dataframe is a term used in R programming, where a dataframe is the equivalent of a table in a database). For example, input variables for the year 2009 are saved as X2009, and output variables for the year 2009 are saved as Y2009. The code for calculating the CRS DEA scores for the year 2009 is as follows:

```
di_naive2009 ← dea (XREF = X2009, YREF = Y2009, X
                    = X2009, Y = Y2009, model = "input",
                    RTS = "constant")
di_naive2009$thetaOpt
```

where,

- Model = "input" indicates that the model is input-oriented.
- RTS = "constant" indicates that the calculations are per-formed based on a constant return to scale. RTS can get "variable" or "non-increasing" values.
- thetaOpt is a vector of DEA scores, which is in [0,1] range. (Simm & Besstremyannaya, 2016).

In this study, we considered three input variables, i.e., Net Claims Incurred (NCI), Operating Expenses (OE), and Provision (PR), and two output variables, i.e., Gross Contributions (GC) and Investment Income (INV).

The definitions of the variables are as follows (MEIR, 2015):

- Net claims incurred include "the paid claims during the year plus outstanding claims and incurred but

not reported claims at the end of the current year less the outstanding claims and incurred but not reported claims at the end of the previous year, net of all".

- Operating expense is "selling and general administration expenses including the salaries expenses and other operating overheads".
- The technical provisions include "the claims outstanding, provisions for unreported claims, reserves for family takaful business, and unearned contribution reserves at the Balance Sheet date without deducting claims recoverable from reinsurers".
- Gross contribution includes "all direct, co-insurance and reinsurance inwards contribution received and receivable in the year, net of cancellations but before deduction of commissions or any reinsurance contribution ceded".
- Investment income includes "the dividend income, realized gains and losses on investments, unrealized gains and losses on investments to the extent recognized in the income statement, income from real estate and other investment related income".

In the literature, studies on the efficiency analysis of takaful insurance companies have used net claims incurred (Akhtar, 2018; Al-Amri et al., 2012), operating expenses (Akhtar, 2018; Rusydiana & Nugroho, 2017; Bao et al., 2018; Kader et al., 2014; Naushad et al., 2020) and provisions (Al-Amri, 2015) as input variables. Almost all of the studies on the efficiency analysis of takaful insurance companies agree on using the premium contributions as an output variable; some of the studies preferred using net premium contribution (Akhtar, 2018; Abbas et al., 2018; Khan & Noreen, 2014; Bao et al., 2018) while the others used the gross premium contribution (Kader et al. 2014; Al-Amri, 2015; Miniaoui & Chaibi, 2014; Bao et al., 2018; Rusydiana & Nugroho, 2017; Faruk & Rahaman, 2015; Saad, 2012; Al-Amri et al., 2012; Ismail et al., 2011; Saad et al., 2006). The second output variable, investment income, is also taken as an output variable in most of the studies (Faruk & Rahaman, 2015; Bao et al., 2018; Saad, 2012; Saad et al., 2006; Ismail et al., 2011; Al-Amri et al., 2012; Abbas et al., 2018; Rusydiana & Nugroho, 2017; Akhtar, 2018; Naushad et al., 2020).

4. Data

The data for the empirical study will be collected from the World Islamic Insurance Directory 2012, 2013, and 2015. Table 3 shows the summary of insurance companies in the dataset per country. The number of observations from the year 2014, the last year, is less than other years since the unavailability of the data in the directories used for obtaining the data.

Table 3: Total Number of Insurance Companies by Country and by Year in the Sample Data

Country	2009	2010	2011	2012	2013	2014
Bahrain	3	3	3	3	3	0
Bangladesh	1	1	1	1	1	0
Egypt	3	4	4	4	4	2
Indonesia	1	2	2	2	2	1
Iran	1	1	1	1	1	1
Jordan	2	2	2	2	2	1
Kuwait	3	3	3	3	3	1
Malaysia	1	1	1	1	1	0
Pakistan	4	4	4	4	1	0
Qatar	1	2	2	2	2	0
Saudi Arabia	4	4	4	4	3	1
Sri Lanka	1	1	1	1	0	0
Sudan	7	7	6	7	4	2
Syria	2	2	2	2	2	1
UAE	3	3	2	3	3	2
Yemen	1	1	1	1	1	0
Overall Total	38	41	39	41	33	12

5. Results and Findings

We calculated the technical efficiency scores of the insurance companies studied as Overall Technical Efficiency (OTE) and Pure Technical Efficiency (PTE). OTE, also known as Constant Return to Scale (CRS) Efficiency, is appropriate when the companies are operating under the optimum scale. PTE assumes Variable Return to Scale (VRS), which allows calculating one component of OTE to capture the management practices (Umanath & Rajasekar, 2013). On the other hand, Scale Efficiency (SE) is the ratio of OTE and PTE, where SE < 1 indicates scale inefficiency, i.e., companies not operating under the optimum scale.

The OTE, PTE, and SE scores for the takaful companies between 2009 and 2014 are summarized in Table 4.

In the Table 4, the takaful companies, minimum and average OTE, PTE and SE scores, number of fully efficient and inefficient takaful companies, and the number of the companies below the average score are given.

The numbers of the fully efficient companies are seven, seven, seven, nine, nine, and eight in 2009, 2010, 2011, 2012, 2013, and 2014, respectively, with OTE scores of 1. These efficient takaful companies made up a reference set for inefficient companies as best practices or the efficiency frontier. The remaining companies are considered technically inefficient companies because they have OTE scores lower than 1. During the observed period, the average of the efficiency scores has constantly increased, even there was a slight decrease in 2012. The average OTE score was 0.555 in 2009, and it increased to 0.595 in 2010, 0.659 in 2011, 0.613 in 2012, 0.714 in 2013 and 0.836 in 2014. Increased efficiency can be explained as the recovery of the sector after the 2018 crisis in the financial sector.

Table 5 shows the average efficiency scores OTE, PTE, and SE per country during the covered period of 2009 and 2013. Overall, during the period of the study, one takaful company in Bangladesh and one in Yemen have reached the highest efficiency in terms of OTE results. It means they have utilized their inputs in the best way to achieve the highest output. Four Egyptian takaful companies and the four Pakistani companies followed them with an average of 78.3% and 75.1% efficiencies, respectively.

The overall technical efficiency scores indicate that the takaful companies might have saved their inputs to produce the same output. For example, the takaful company in

Table 4: Summary of Efficiency Scores

		Total Number of Companies	Number of Fully Efficient Companies	Number of Inefficient Companies	Average Score	Number of Below-Average Score Companies	Standard Deviation	Minimum Score
2009	OTE	38	7	31	0.555	22	0.275	0.200
	PTE	38	14	24	0.688	17	0.296	0.220
	SE	38	14	24	0.827	14	0.202	0.318
2010	OTE	41	7	34	0.595	23	0.253	0.206
	PTE	41	16	25	0.729	19	0.273	0.226
	SE	41	7	34	0.840	16	0.195	0.271
2011	OTE	39	10	29	0.659	23	0.250	0.236
	PTE	39	18	21	0.768	17	0.255	0.240
	SE	39	10	29	0.876	10	0.181	0.421
2012	OTE	41	9	32	0.613	25	0.258	0.262
	PTE	41	12	29	0.719	21	0.245	0.274
	SE	41	9	32	0.860	13	0.182	0.346
2013	OTE	33	9	24	0.714	15	0.245	0.283
	PTE	33	13	20	0.783	15	0.226	0.324
	SE	33	9	24	0.915	10	0.157	0.294
2014	OTE	12	8	4	0.836	3	0.279	0.314
	PTE	12	10	2	0.916	2	0.210	0.323
	SE	12	8	4	0.912	3	0.198	0.326

Table 5: Average OTE, PTE, and SE Values Over Six Years (2009–2014)

Country	Number of Companies	Mean OTE	Mean PTE	Mean SE
Bahrain	3	0.469	0.604	0.800
Bangladesh	1	1.000	1.000	1.000
Egypt	4	0.783	0.826	0.954
Indonesia	2	0.498	0.720	0.749
Iran	1	0.690	0.947	0.716
Jordan	2	0.584	0.596	0.974
Kuwait	3	0.452	0.466	0.965
Malaysia	1	0.605	0.855	0.716
Pakistan	4	0.751	0.854	0.854
Qatar	2	0.603	0.632	0.946
Saudi Arabia	4	0.525	0.915	0.577
Sri Lanka	1	0.311	0.320	0.970
Sudan	7	0.694	0.797	0.871
Syria	2	0.619	0.888	0.707
UAE	3	0.419	0.523	0.864
Yemen	1	0.914	0.916	0.998
Mean		0.620	0.741	0.854

Sri Lanka has the lowest OTE score of 31.1%. It means that this company could provide the same amount of service by only using 31.1% of its inputs; in other words, the company might have saved 68.9% of inputs to give the same amount of output.

The PTE is also very high in one takaful company in Bangladesh and one in Yemen, but also takaful companies in Saudi Arabia and Iran have exceeded 90% PTE score. The results indicate that since the takaful companies in Saudi Arabia and Iran were not operating on the right scale, their inefficiency was mainly due to scale inefficiency, not to pure technical inefficiency. Takaful companies in Sri Lanka, Kuwait, the UAE, Bahrain, and Qatar have the lowest PTE efficiency scores.

6. Conclusion

This study provides a comprehensive efficiency analysis of takaful insurance companies in different countries all over the world by covering 41 takaful insurance companies in 16 countries in the period of 2009–2014. The study included a comprehensive literature review on the efficiency analysis of takaful companies and empirical research to estimate the efficiency score using data enveloping analysis techniques that are utilized by using the rDEA package in the *R* environment. In this study, we prefer to limit our research to only the takaful companies since there are some differences in the revenue generation, reporting, and administration of the takaful companies and the conventional insurance companies.

In the study, the overall technical efficiency (OTE), pure technical efficiency (PTE), and scale efficiency (SE) scores of the takaful insurance companies were measured and analyzed using non-parametric data envelopment analysis (DEA). In data enveloping analysis, based on the literature on the efficiency analysis of insurance companies, we selected three input variables (net claims incurred, operating expenses, and provision) and two output variables (gross contributions and investment income). Based on the analysis, an average of OTE for takaful companies over six years period was found as 62%, for the same period average of the PTE score is 74%, and the average of the SE score is 85%. The results of the analysis indicate that the overall average efficiency scores of takaful companies are considerably high.

In the analysis, fully efficient and inefficient takaful companies in terms of OTE, PTE, and SE values were determined. The efficient takaful insurance companies are a reference set for inefficient companies, as best practices in terms of their utilization of inputs and generating the outputs. Even though the average efficiency scores are high, the results of the study indicate that majority of the takaful companies

operating inefficiently during the covered period. The average number of takaful companies that are operating below the average OTE efficiency scores is more than other efficiency criteria. During the observed period, the averages of the efficiency scores in all three categories have continuously increased, except in 2012, which there was a slight decline. The increase in efficiency can be explained by utilizing innovative ways of delivering the services, intensively using the internet and technology, and cost-effective marketing strategies. The increase in the efficiency scores also reveals that the takaful insurance industry has been recovering after the 2018 crises in the financial sector.

The empirical study also contains an analysis to compare the average efficiencies of takaful companies based on the countries they are located in. Overall during the period of the study, the takaful companies in Bangladesh, Yemen, Egypt, and Pakistan showed higher performance in the overall technical efficiency scores comparing the takaful companies in other countries. They utilized their inputs more efficiently to achieve the desired output. The average technical efficiency of takaful companies in ten countries (Bahrain, Indonesia, Jordan, Kuwait, Malaysia, Qatar, Saudi Arabia, Sri Lanka, Syria, and the UAE) is below the average of OTE scores of all countries. The takaful companies with lower overall technical efficiency scores should save their inputs from producing the same output or should produce more output with the same level of input.

In general, the inefficiency of takaful companies results from an excess of claims, operating expenses and provisions, and a lack of contributions and investment income. Therefore, in this study, the reasons for inefficiency and potential improvement in inputs and outputs are also analyzed. The results of the study indicate that the excess in the consumption of inputs has been decreasing while the deficit in achieved outputs has been decreasing. The results show an improvement in efficiency in both inputs and outputs of the takaful sector in the covered period.

The target efficiency scores calculated by using the DEA analysis provide an ideal reference benchmark for the takaful companies to plan their inputs and outputs and improve their efficiency. The managers of insurance companies develop their strategies to compete with other companies in the insurance market. The strategies may include improving efficiency by introducing innovative products, opening new marketing channels to reach new customers, product diversification, focusing on value-added activities, reducing costs, utilizing technological innovations, and emphasizing quality.

References

Abbas, M., Khan, A. B., Abbasi, S., & Mahmood, Z. (2018). Determinants of cost efficiency of takaful and conventional insurance firms of Pakistan. *Review of Economics and Development Studies*, *4*(2), 331–340. https://doi.org/10.26710/reads.v4i2.418

Akhtar, M. H. (2018). Performance analysis of takaful and conventional insurance companies in Saudi Arabia. *Benchmarking: An International Journal*, *25*(2), 677–695. https://doi.org/10.1108/BIJ-01-2017-0018

Akin, A., Bayyurt, N., & Zaim, S. (2013). Managerial and technical inefficiencies of foreign and domestic banks in Turkey during the 2008 global crisis. *Emerging Markets Finance and Trade*, *49*(3), 48–63. https://doi.org/10.2753/REE1540-496X490304

Al-Amri, K. (2015). Takaful insurance efficiency in the GCC countries. *Humanomics*, *31*(3),344–353.https://doi.org/10.1108/H-05-2014-0039

Al-Amri, K., Gattoufi, S., & Al-Muharrami, S. (2012). Analyzing the technical efficiency of insurance companies in GCC. *The Journal of Risk Finance*, *13*(4), 362–380. https://doi.org/10.1108/15265941211254471

Ali, E. R. A. E., Odierno, H. S. P., & Ismail, A. (2008). *Essential Guide to Takaful: (Islamic Insurance)*. CERT Pubs. Sdn. Bhd.

Bao, N. J., Ramlan, R., Mohamad, F., & Yassin, A. M. (2018). Performance of Malaysian insurance companies using data envelopment analysis. *Indonesian Journal of Electrical Engineering and Computer Science*, *11*(3), 1147–1151. https://doi.org/10.11591/ijeecs.v11.i3.pp1147-1151

Benyoussef, S., & Hemrit, W. (2019). Measuring the relative efficiency of insurance companies in Saudi Arabia: The case study of takaful vs. cooperative industries. *Cogent Economics & Finance*, *7*(1), 1590818. https://doi.org/10.1080/23322039.2019.1590818

Bhatia, A., & Mahendru, M. (2015). Assessment of technical efficiency of public sector banks in India Using Data Envelopment Analysis. *Eurasian Journal of Business and Economics, 8*(15), 115–140. https://doi.org/10.17015/ejbe.2015.015.06

Billah, M. M. S., & Basodan, Y. A. (2017). Islamic Insurance (Takaful) Models and their accounting dichotomy. *Journal of Islamic Banking and Finance, 34*(1), 11–31.

Buljubašić, E. (2013). Islamic banking in Bosnia and Herzegovina: relationship between religion and Islamic banking adoption. Retrieved from http://eprints.ibu.edu.ba/1422/

Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision-making units. *European Journal of Operational Research*, *2*(6), 429–444. https://doi.org/10.1016/0377-2217(78)90138-8

Coskun, A., & Balci, E. (2018). An Efficiency Analysis of Interest-Free Banks: An International Comparison. *Journal of Insurance and Financial Management*, *4*(1), 78–97.

Faruk, O., & Rahaman, A. (2015). Measuring efficiency of conventional life insurance companies in Bangladesh and takaful life insurance companies in Malaysia: A non-parametric approach. *Management Studies and Economic Systems*, *2*(2), 129–144. https://doi.org/10.12816/0019398

IFSB. (2019). Islamic Financial Services Industry Stability Report 2019, Islamic Financial Services Board, retrieved from https://www.ifsb.org/download.php?id=5231&lang=English&pg=/sec03.php

Ismail, M. (2013). Determinants of financial performance: The case of general takaful and insurance companies in Malaysia. *International Review of Business Research Papers*, *9*(6), 111–130.

Ismail, N., Alhabshi, D. S. O., & Bacha, O. (2011). Organizational form and efficiency: the coexistence of family takaful and life insurance in Malaysia. *Journal of Global Business and Economics*, *3*(1), 122–137.

Kader, H. A., Adams, M., Hardwick, P., & Kwon, W. J. (2014). Cost efficiency and board composition under different takaful insurance business models. *International Review of Financial Analysis*, *32*, 60–70. https://doi.org/10.1016/j.irfa.2013.12.008

Khan, A., & Noreen, U. (2014). Efficiency measure of insurance v/s Takaful Firms using DEA approach: a case of Pakistan. *Islamic Economic Studies*, *22*(1), 139–158. https://doi.org/10.12816/0004133

Kumar, A., Anand, N., & Batra, V. (2020). Trends in Indian private sector bank efficiency: non-stochastic frontier DEA window analysis approach. *Journal of Asian Finance, Economics and Business, 7*(10), 729–740. https://doi.org/10.13106/jafeb.2020.vol7.n10.729

Kumar, S., & Gulati, R. (2008). An Examination of technical, pure technical, and scale efficiencies in Indian public sector banks using data envelopment analysis. *Eurasian Journal of Business and Economics, 1*(2), 33–69.

Masud, M. M., Rana, M. S., Mia, M. A., & Saifullah, M. K. (2019). How productive are life insurance institutions in Malaysia? a Malmquist approach. *Journal of Asian Finance, Economics and Business, 6*(1), 241–248. https://doi.org/10.13106/jafeb.2019.vol6.no1.241

Mazahir, S. M. M., Ab Rahman, A., & Ramzy, M. I. (2018). An analysis on Takaful operation under conventional regulator: a Sri Lankan experience. *KATHA-The Official Journal of the Centre for Civilisational Dialogue*, *13*(1), 54–72. https://doi.org/10.22452/KATHA.vol13no1.3

Middle East Insurance Review. (2012). *World Islamic Insurance Directory 2012*, The United Arab Emirates.

Middle East Insurance Review. (2013). *World Islamic Insurance Directory 2013*, The United Arab Emirates.

Middle East Insurance Review. (2015). *World Islamic Insurance Directory 2015*, The United Arab Emirates.

Miniaoui, H., & Chaibi, A. (2014). Technical efficiency of takaful industry:*AcomparativestudyofMalaysiaandGCCcountries.*IPAG Business School Working Paper No. 2014–055. Retrieved from http://v6.ipag.fr/wp-content/uploads/recherche/WP/IPAG_WP_2014_055.pdf

Naushad, M., Faridi, M. R., & Faisal, S. (2020). Measuring the Managerial Efficiency of Insurance Companies in Saudi Arabia: A Data Envelopment Analysis Approach. *Journal of Asian Finance, Economics and Business, 7*(6), 297–304. https://doi.org/10.13106/Jafeb.2020.vol7.no6.297

Rahman, Z. A., Yusof, R. M., & Bakar, F. A. (2008). Family takaful: Its role in social economic development and as a savings and investment instrument in Malaysia-an extension. *Jurnal Syariah*, *16*(1), 89–105.

Rusydiana, A. S., & Nugroho, T. (2017). Measuring Efficiency of Life Insurance Institution in Indonesia: Data Envelopment Analysis Approach. *Global Review of Islamic Economics and Business*, *5*(1), 012–024. https://doi.org/10.14421/grieb.2017.051-02

Saad, N. (2012). An analysis on the efficiency of takaful and insurance companies in Malaysia: a non-parametric approach. *Review of Integrative Business & Economics Research*, *1*(1), 33–56.

Saad, N. M., Majid, M. S. A., Yusof, R. M., Duasa, J., & Rahman, A. A. (2006). Measuring efficiency of insurance and Takaful companies in Malaysia using data envelopment analysis (DEA). *Review of Islamic Economics*, *10*(2), 5.

Simm, J., & Besstremyannaya, G. (2016, November 25). Package 'rDEA'. Retrieved 6 4, 2018, from https://cran.r-project.org/web/packages/rDEA/rDEA.pdf

Stagg-Macey, C. (2007). *An Overview of Islamic Insurance.* Kuala Lumpur: ICMIF Takaful.

Swartz, N. P., & Coetzer, P. (2010). Takaful: An Islamic insurance instrument. *Journal of Development and Agricultural Economics*, *2*(10), 333–339.

Umanath, M., & Rajasekar, D. D. (2013). Data envelopment analysis to estimate technical and scale efficiency of farms in Periyar-Vaigai irrigation system of Tamil Nadu, India. *Indian Journal of Science and Technology*, *6*(10), 5331–5336.

Wahab, A. R. A., Lewis, M. K., & Hassan, M. K. (2007). Islamic takaful: Business models, Shariah concerns, and proposed solutions. *Thunderbird International Business Review*, *49*(3), 371–396. https://doi.org/10.1002/tie.20148