



A Comparative Analysis on the Efficiency of Insurance companies Using DEA method: Conventional vs Takaful companies in MENA Zone.

تحليل مقارنة حول كفاءة شركات التأمين باستخدام طريقة تحليل مغلف البيانات: الشركات

التقليدية مقابل شركات التكافل في منطقة الشرق الأوسط وشمال إفريقيا.

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Received :. 05/ 03 / 2020

Accepted : 12/05/ 2020

Published :31/12/2020

ABSTRACT

This study examines the performance of conventional and takaful companies in the Middle East and North Africa region (MENA) using Data envelopment analysis method (DEA) to define the better actor in term of efficiency. The empirical results obtained for 15 conventional insurance companies and 15 takaful companies for the period 2016-2018, showed that conventional insurance companies has been significantly more efficient in 2016 and which after, the efficiency scores of takaful companies continue to increase to come to very close level to its counterpart. As a result, we marked a slight difference in term of efficiency in 2017 and 2018 and despite the noticeable effort of Islamic insurance companies and the non-significant difference, still conventional companies are more efficient.

Key words: efficiency, conventional insurance, takaful insurance, DEA, MENA region.

JEL Classification : D62, G22, C80.

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الملخص

تبحث هذه الدراسة في أداء الشركات التقليدية وشركات التكافل في منطقة الشرق الأوسط وشمال أفريقيا (MENA) باستخدام طريقة تحليل مغلف البيانات (DEA) لتحديد الفاعل الأفضل من حيث الكفاءة. أظهرت النتائج التجريبية التي تم الحصول عليها لـ 15 شركة تأمين تقليدي و 15 شركة تكافل للفترة 2016-2018، أن شركات التأمين التقليدية كانت أكثر كفاءة بشكل ملحوظ في عام 2016، وبعد ذلك، استمرت درجات كفاءة شركات التكافل في الزيادة لتقترب إلى مستوى نظيره ونتيجة لذلك، لاحظنا اختلافاً طفيفاً في مدى الكفاءة في عامي 2017 و 2018 وعلى الرغم من الجهود الملحوظة لشركات التأمين الإسلامية والفرق غير الملحوظ، لا تزال الشركات التقليدية أكثر كفاءة.

الكلمات المفتاحية: الكفاءة، التأمين التقليدي، التأمين التكافلي، طريقة تحليل مغلف البيانات، منطقة الشرق الأوسط وشمال أفريقيا.

تصنيفات JEL: D62, G22, C80.

Introduction

Given the primary role of insurance companies in creating a less risky environment in which investors can operate and the guarantee that these companies provide to encourage investors and protect individuals, a continuous improvement in term of performance is necessary. On the other hand, there is no better driver for a company to improve than to exist in a competitive market and it is the case for the insurance market nowadays.

Conventional insurance companies today are faced with an alternative operating according to the rules of Islam, known as takaful. From a Sharia'ah perspective, conventional insurance has certain elements that are contrary to Islamic law, such as Riba (usury), Gharar (ambiguity) and Maisir (gambling). Unlike conventional insurance, takaful is established based on mutual assistance, responsibility, mutual protection and insurance, which are incorporated in the concept of tabarru (donation).

Takaful firms have made a significant growth in recent years, and are showing a growth rate. This situation has created a certain competition between these two types of insurance companies and raised the question of performance and its measurement to make a reasonable comparison in terms of the results achieved and the means employed. This is the core reason, which motivates us to make an efficiency analysis of conventional insurance, and Takaful since efficiency is a measurable component of performance.

This study is considered with the concept of economic efficiency, which refers to the ideal distribution of resources to serve every element or individual in the ideal manner while minimizing costs. It has two components: technical efficiency and allocative efficiency, and can be measured with several methods among them the efficiency frontier approaches, we are using in this work the data envelopment analysis DEA method.

Several previous studies show that the Data Envelopment Analysis (DEA) method is the most appropriate method for measuring efficiency. It is by using this method that we will examine and analyze the efficiency of 30 insurance companies (15 are conventional ones and 15 are takaful) operating in the MENA insurance market during the period 2016-2018.

According to the "Islamic Financial Services Industry Stability 2019", the Takaful industry's contribution to the MENA insurance market is 31%, which confirms the growth of this industry and thus the importance of this comparison for the present and future of the MENA's insurance market and the aim of this study is to compare these two types of insurance companies in terms of technical efficiency.

This paper is organized as follows: the first section comes as a literature review on the use of DEA in insurance sector, followed by section two that includes data description and methodological elements and the third section represents the results and conclusion.

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1. Literature review

DEA method has been widely used in assessing the efficiency of conventional insurance especially in the USA and developed countries. Cummins and Zi (1998) perform a DEA and mathematical programming to examine the efficiency of US insurance companies from 1988 to 1992 and deduce that the DEA is a better approach to evaluate insurance industry efficiency. Eling and Luhnen (2010) use DEA to perform a comprehensive efficiency assessment of the global insurance industry. Kaffash and Marra (2017) examine 620 papers published in journals indexed in the Web of Science database during 1985–2016 and employ DEA approaches with focus on financial services (e.g. insurance). Diacon, Starkey, and Obrien (2002) assess the pure technical, scale efficiencies of 450 insurance firms across 15 European countries, and conclude the average technical efficiency declined during 1996–1999. Cummins and Xie (2008a) examine efficiency, productivity and scale economies in the US PC insurance industry over the period 1993–2006. They find that the majority of firms below median size in the industry are operating with increasing returns to scale, and the majority of firms above median size are operating with decreasing returns to scale. However, a significant number of firms in each size decile have achieved constant returns to scale.

Even though a large number of studies was conducted to measure the efficiency of conventional insurance, few of them paid attention to takaful industry. Saad, Majid, Yusof, Duasa, and Rahman (2006) uses Data Envelopment Analysis (DEA) with Malmquist Index in order to investigate the life insurance industry in Malaysia and to compare its performance with Takaful operators from year 2002 to 2005. They found that scale efficiency has made big contribution rather than pure efficiency to the total factor productivity in the insurance industry in Malaysia. On the other

hand, they found that Takaful has performed below than the industry average in pure efficiency, but the Takaful scale efficiency is at the industry average. As a result, they conclude that, Takaful is competitive in Malaysian insurance industry.

Akhtar (2018) examines the performance of Saudi Arabia's Takaful and conventional insurance companies during 2010–2015 by conducting a DEA and recommend that Takaful and large conventional insurance firms must follow the industry's best practices to improve their efficiency and productivity levels. However, Akhtar considers the production process as a single stage and ignores the intermediate stage, which poses limitations when identifying the sources of inefficiency. Further, Akhtar's (2018) study ignores the fact that the production process of Saudi Arabia's insurance industry, like any insurance sector in the world, is a standard structure comprising two stages, operations and profitability.

Ismail, Alhabshi, and Bacha (2011) examine the efficiency of Takaful and conventional insurance firms in Malaysia from 2004 to 2009 and conclude that the efficiency score of Tankful firms is low. Accordingly, they recommend that Takaful companies should decrease their organizational and management expenses to improve their efficiency scores.

On another occasion, Ismail et al (2011) conducts a study on technical efficiency to measure the performance of conventional insurance industry and Takaful industry using DEA. In order to examine the technical efficiency of both industries, Ismail et al (2011) uses constant return to scale and variable return to scale assumptions. By examining the technical efficiency, they also make a comparison for pure technical efficiency and scale efficiency. In the end, Ismail et al (2011) evidences that conventional insurance industry is more efficient than Takaful industry in constant return to scale and variable return to scale assumptions. Besides that, Takaful industry has lower pure technical efficiency and scale efficiency than that of conventional insurance, and this is in line with the previous study done by Saad et al (2006).

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Furthermore, Kassim (2008) conducts a study regarding Takaful in Malaysia using qualitative techniques. According to Kassim (2008), it is difficult to compare the performance of Takaful industry and that of the conventional insurance industry as both industries have different products and have different ways in recording their profit. Furthermore, he also concludes that, it is hard to look at the level of capital and solvency margin in comparing the performance of both industries because they have different nature of contracts.

Hidayat and. al (2015) carried out a study on the comparative analysis of financial performance of the Takaful and conventional insurance companies in Bahrain for the period of 2006 to 2011. This study found that conventional insurance companies in Bahrain performed better than Takaful companies in term of profitability and efficiency during 2006-2011.

Khan and al. (2014) analyzed the Takaful and conventional insurance companies of Pakistan in terms of efficiency and productivity for the period 2006 -2010. The results indicated that the insurance firms were more technically efficient exhibiting 89% efficiency for the given period. Similarly, the results also pinpointing the scale efficiency of 74%, which means a significant expansion in insurance sector of Pakistan is observed during the period of 2006 to 2010. This study also analyzed the Takaful and conventional insurance sectors in terms of Economies of scales. It is concluded that the Takaful firms are fighting efficiently with conventional insurance firms regardless of being new in the field. Results indicate that the Takaful firms are supplementary efficient in comparison to conventional counterparts. Malmquist productivity index reported significant enhancement in scale efficiency. It is recommended that Takaful firms should increase their efficiency and win the competition by

improving their services, product quality and marketability of their products.

2. Methodology and data description

2.1. The sample determination

This study will analyze data for 30 insurance companies selected from MENA insurance market (only 12 countries are included due to the lack of data), in which 15 companies are conventional and 15 are takaful companies listed in table 1 and table 2.

For the homogeneity of the sample, a basic assumption for a reliable analysis, this study did not include intermediary institutions, such as banks and other financial institutions that their main business is not in insurance. With that being said, we also made sure after the selection of the sample that the size of the companies selected is non-significantly dissimilar.

Table 1: The selection of conventional insurance companies

	Conventional companies	Country
1	Al Ahlia insurance	Oman
2	ADNIC	UAE
3	La Société Assurances Magharebia	Tunisia
4	Carte assurance	Tunisia
5	Atlanta assurance	Morocco
6	Orient insurance	UAE
7	Qatar insurance company	Qatar
8	Arabe Jordan insurance company	Jordan
9	Bahrain national insurance company	Bahrain
10	Salim assurance	Tunisia
11	Al khazna insurance company	UAE
12	La CIAR	Algeria
13	LIA insurance	Lebanon
14	AcıbademSağlıkve Hayat SigortaAnonimŞirketi	Turkey
15	Oman Qatar insurance company	Oman

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Table 2: The selection of takaful insurance companies

	Takaful companies	Countries
1	Solidarity insurance	Bahrain
2	La Société At-Takafulia	Tunisia
3	Qatar Islamic insurance company	Qatar
4	Zitouna takaful	Tunisia
5	Neova insurance	Turkey
6	Wethaq insurance	Kuwait
7	AL Ahli insurance company	KSA
8	Warba insurance company	Kuwait
9	Al Rajhi insurance company	KSA
10	National takaful company (Watania)	UAE
11	Islamic insurance company	Jordan
12	Al Madina insurance company	Oman
13	Dar Al takaful	UAE
14	Pak Qatar general takaful	Qatar
15	Salama assurance Algeria	Algeria

2.2.The approach choice

The **value-added approach** is the most appropriate method for studying the efficiency of insurance companies. The value-added approach considers that all categories of assets and liabilities have certain output characteristics rather than distinguishing inputs from outputs in a mutually exclusive manner. Categories with significant value added, as judged by the allocation of operating costs, are used as important outputs. Others are treated as inputs, intermediate products or unimportant outputs, depending on the characteristics of the specific activity under consideration.

For insurance companies; risk pooling, risk bearing and Intermediation services are considered two main services that insurance industry provides to customers and on this basis the choice of the variables will be done while remaining very selective for the outputs since they will represent the concrete added value created by the two main services mentioned above.

2.3. Return to scale assumptions

This study will measure the efficiency of insurance companies under both returns to scale assumptions, since CRS assumes that there is no significant relationship between the scale of operations and efficiency, thus small insurance firms can be as efficient as large insurers in converting the specified inputs into the specified outputs, in other words, they can be comparable. While DEA under VRS assumption is run to check for scale inefficiency. The scale inefficiency should be understood as disproportional change in output compared with any change in inputs.

2.4. The models used

As it was mentioned before, CCR model assumes a constant return to scale to calculate the technical efficiency scores while the BCC model integrates a variable return to scale to obtain pure technical efficiency scores and since we are using both returns to scale, we will adopt both CCR and BCC models.

2.5. Orientation choice

The reasoning of the value-added approach is based fundamentally on the choice and nature of the outputs taken, because they represent the concrete added value¹ created by the insurance company. Simultaneously the adoption of this approach makes it an obligation to output-orient the study since we are focusing mainly on the value added generated (the outputs) by the company, that's why our study will be based on output maximization model, known as output-oriented approach. As we mentioned before in this approach, the maximum output is determined while holding inputs constant.

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2.6. Variables determination

A critical issue in the efficiency analysis is the definition of the variables to be considered as inputs and outputs to conduct the analysis. A variety of sets of variables are considered in the existing literature to analyze the efficiency of insurance firms, depending on the approach chosen, its logic and end. Before presenting the combination used, we mention that the data used are collected from annual reports published by the insurance companies listed above, for the three years period 2016-2018 and conversion to the USD was made using the end year rate of each period. Considering the use of the value-added approach and its orientation and reasoning explained earlier, an insurance company is providing two main services:¹

- **Risk-pooling and risk-bearing:** Through a pooling mechanism, the insurance company provides a risk reduction service for insurable business and consumer contingencies. The insurer to insureds who suffer losses redistributes a large portion of the premiums collected. The added value of the insurance consists mainly of underwriting fees, actuarial fees and fees related to risk pooling activities. Thus, other stakeholders such as support the reduced risk: shareholders for stock companies, former policyholders for mutual organizations and other players who hold the debt of the insurance company. In this way, it will increase economic security and enable value creation.
- **Intermediation:** Insurers collect funds from annuities and insurance policies and invest them until they are withdrawn by policyholders or used to reward claims. Insurers invest the funds collected primarily in

¹ The added value might not have a tangible sense also generated by the same services mentioned before, for example risk transfer can be considered as an added value generated by the main activity of the insurance company and technically the value added emerged is represented by the net premiums.

marketable assets. The added value of the intermediation process is the interest margin between the rate of return earned on the assets and the rate provided to policyholders.

With that being said, we sign that most outputs of insurance companies are intangible and as we mentioned before the added value created by the two services mentioned above is being represented by technical elements respectively net premiums and net investment income which are the outputs chosen to conduct this study.

For inputs most of the previous studies have mentioned that there are 3 main sections of inputs: labor, capital and business services, and to satisfy this, we led 3 inputs for the three sections and we considered physical, human and financial resources as inputs for this study, the next tables show and justify the variables taken for this analysis:

Table 3: Presentation of inputs

Variables	Description	Justification	Reference
Fixed assets	They are Assets which are purchased for long-term use and are not likely to be converted quickly into cash, such as land, buildings, and equipment.	They represent the resources that are exploited to generate the insurance's output, in other words the means and physical materials needed to accomplish the activity.	Berger & Humphrey, (1992).

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capital	Capital= equity+ cash Equity is the corporation's owners' residual claim on assets after debts have been paid. Equity is equal to a firm's total assets minus its total liabilities. Cash and cash equivalents are the total value of cash on hand that includes items that are similar to cash; cash and cash equivalents must be current assets.	Equity has for role to ensure claims payment and regulatory requirement when losses exceed expectation while cash represents a resource for investment that can generate the investment income.	Hughes &Mester, 1998; Cummins & Weiss, 2000; Eling&Luhnen, 2009.
Operational expenses	These are operational costs, services (maintenance, telecommunications, printing, etc.) + Employees cost +commissions paid to intermediaries.	It involves the human resources and others physical means and services necessary for the activity.	Berger &Humphrey, (1992).

Source: Elaborated by us on the basis of the literature review

Table 4: Presentation of outputs

Variables	Description	Justification	Reference
Net premiums	Net premiums are the sum of premiums written by an insurance company over time, minus premiums ceded to reinsurance, plus any reinsurance assumed.	Premiums are cash received and accordingly enhance the value of an insurer. Premiums also have profit built in meaning a permanent addition to insurer value. Moreover, premiums lead to the insurer being able to reap future benefits from the policy moreover it is the proxy of the risk pooling and risk bearing output.	Berger et al. (1997) and Cummins and Weiss (2000).
Net investment income	It is received from investment assets (before taxes) such as bonds, stocks, mutual funds, loans and other investments minus related expenses.	Investment income is cash earned by the company and thus add to its value also it is the proxy of the intermediation output.	Worthington and Hurley (2002).

Source: Elaborated by us on the basis of the literature review

The number of variables taken fulfills an important DEA condition, which is the number of observations, must be greater than or equal to twice the product of the number of outputs multiplied by the number of inputs.

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2.7.Descriptive study of inputs and outputs

Before addressing the results, we find it necessary to present some descriptive statistics on the variables used to measure the efficiency of insurance companies for the period 2016-2018, the following tables will illustrate the descriptive statistics:

Table 5: Descriptive analysis for conventional and takaful insurance companies

variable	period	minimum	maximum	mean	Standard deviation
Net Premiums	2016	3699557	8695115056	450235972	1612043574
	2017	151063	9463736301	478354511	1756656009
	2018	34184434,03	58188939,21	992686377,37	16973748,4
Net investment income	2016	19887	353142669	30295796	81293644,13
	2017	26095	247945231	14022072	44923162,46
	2018	2767421,27	4489795,51	11547916,10	1217902,508
Fixed assets	2016	26358	825683761	42665600	152820048,3
	2017	191800	771811822	38152841	142226443,3
	2018	196615,39	14672237,59	105180997,91	10235810,62
capital	2016	5221752	42236817883	1724835939	7697007815
	2017	1380711	39476200951	2619885570	9025830038
	2018	50405752,56	108430434,43	2129313086,10	41029646,02
Operational expenses	2016	422512	860874682	68825048	165503016,7
	2017	21653	176337934	26500286	43722843,92
	2018	10307199,47	15680319,38	23632113,27	3799369,531

Source: Elaborated by us via Microsoft Excel.

The previous table shows that the average amount of capital of the three years period is correspond to very large sums and its maximum amount was recorded in 2016 compared with other inputs and outputs followed by the output net premiums. On the other hand, the minimum amount is corresponding to the net investment income recorded in 2016 by the group of companies. In terms of evolution, we observe a remarkable augmentation of the two outputs throughout the years, which can be a sign of the growing activity, and we note a decrease in general for the three inputs. Based on the standard deviation values, the net investment income recorded the lowest value in 2018, and we note that inputs values are less dispersed than outputs among the three years.

Table 6: Descriptive analysis for conventional insurance companies

variable	period	minimum	maximum	mean	Standard deviation
Net Premiums	2016	26893978	58745724	236623081	22522585,55
	2017	58379459	217220791	253058355	112317783
	2018	22010188,38	58188939,21	1893085589,04	25582240,05
Net investment income	2016	601801	2351124	34807876	1236958,274
	2017	3027187	4085513	25181942	748349,6429
	2018	2171974,45	4489795,51	21695270,04	1638946,988
Fixed assets	2016	154434	201095	19983564	32994,54055
	2017	1048422	174605353	20081411	122723282,4
	2018	196615,39	930983,48	205979787,08	519276,6611
capital	2016	15612096	45473168	409786946	21114966,42
	2017	51227034	105987606	2520845693	38721571,25
	2018	47939198,81	108430434,43	4161599229,32	42773762,9
Operational	2016	2341899	4562559	39161136	1570243,744

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expenses	2017	4932954	15898714	28486381	7753963,584
	2018	6154056,18	15680319,38	31936710,75	6736085,309

Source: Elaborated by us via Microsoft Excel.

For the conventional insurance companies, we note that the average amount of capital exceeds all other variables for the three years period followed by the net premiums, which recorded the maximum sum in 2016 while recording the fixed assets the minimum one also in 2016. For the ensemble of the companies, an evolution of the activity was listed for the five variables where we conclude a significant growth for the industry.

Table 7: Descriptive analysis for takaful insurance companies

variable	period	minimum	maximum	mean	Standard deviation
Net Premiums	2016	3699557	8695115056	663848862	2225576413
	2017	151063	9463736301	703650666	2430477301
	2018	4824917,25	762889488,27	92287165,71	190372315,8
Net investment income	2016	19887	353142669	25783716	90640014,92
	2017	26095	17446787	2862202	4347815,747
	2018	133893,74	4439782,80	1400562,16	1236623,998
Fixed assets	2016	343966	825683761	65347637	210895019,5
	2017	191800	771811822	56224270	198094985
	2018	113821,05	24324265,05	4382208,74	6674256,556
capital	2016	5221752	42236817883	3039884933	10855908549
	2017	4051636	39476200951	2718925447	10169043971
	2018	2633550,18	336109245,29	97026942,88	93378656,44

Operational expenses	2016	422512	860874682	98488959	224576606,1
	2017	21653	174705192	24514192	44486921,81
	2018	17770,42	62114924,69	15327515,80	18564792,13

Source: elaborated by us via Microsoft Excel.

Likely to the previous analysis, the input capital recorded the highest amount in 2016 followed by net premiums while the minimum sum was noted in 2018 with the sum of the operational expenses. A significant growth of the industry is logged throughout the years for all the set of variables.

3. Findings of the study

As a result of the application of the DEA method using the program DEAP version 2.1, we obtained the results in form of efficiency scores running under both return to scale assumptions.

3.1. Presentation of the results

The technical efficiency (TE) scores are obtained by running the original DEA model under the CRS assumption, known as the CCR model. The pure technical efficiency (PTE) scores are obtained by running the DEA model under the assumption of variable return to scale, known as BCC model. The scale efficiency scores can be computed by means of the ratio of the overall TE to that of PTE. These next tables show the results obtained for each period:

Table 8 : Efficiency scores year 2016

N	Companies	Crste	Vrste	Scale	
1	Al ahlia insurance	1	1	1	-
2	ADNIC	0,225	0,501	0,45	Drs
3	La société assurances magharebia	0,595	0,596	0,998	Drs
4	Carte assurance	1	1	1	-

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5	Atlanta assurance	1	1	1	-
6	Orient insurance	1	1	1	-
7	Qatar insurance company	1	1	1	-
8	Arabe Jordan insurance company	1	1	1	-
9	Bahrain national insurance company	0,182	0,216	0,842	Drs
10	Salim assurance	0,368	0,382	0,962	Irs
11	Al khazna insurance company	0,295	0,414	0,712	Drs
12	La CIAR	0,29	0,384	0,754	Drs
13	LIA insurance	0,284	0,409	0,695	Drs
14	Acıbadem Sağlık ve Hayat Sigorta Anonim Şirketi	1	1	1	-
15	Oman Qatar insurance company	0,571	0,577	0,99	Irs
16	Solidarity insurance	0,333	0,336	0,991	Drs
17	La société at-takafulia	0,333	1	0,333	Irs
18	Qatar Islamic insurance company	0,09	0,117	0,773	Drs
19	Zitouna takaful	0,342	1	0,342	Irs
20	Neova insurance	0,541	0,922	0,587	Drs
21	Wethaq insurance	1	1	1	-
22	Al Ahli takaful company	0,152	0,178	0,856	Drs
23	Warba insurance company	0,146	0,234	0,624	Drs
24	Al rajhi insurance company	0,47	1	0,47	Drs
25	National takaful company (watania)	0,131	0,181	0,722	Irs
26	Islamic insurance company	0,363	0,455	0,797	Drs
27	Al Madina insurance company	0,143	0,251	0,57	Drs
28	Dar Al takaful	0,274	0,296	0,927	Drs

29	Pak Qatar general takaful	0,073	0,281	0,26	Drs
30	Salama assurance Algeria	0,174	0,192	0,909	Drs

Irs: increasing return to scale, Drs: decreasing return to scale.

Source: results obtained by program DEAP version 2.1

Table 9 : Efficiency scores year 2017

N	Companies	Crste	Vrste	Scale	
1	Al Ahlia insurance	0,42	0,424	0,99	Drs
2	ADNIC	0,471	0,55	0,857	Drs
3	La Société assurances Magharebia	0,716	0,728	0,983	Drs
4	Carte assurance	0,979	0,987	0,992	Drs
5	Atlanta assurance	1	1	1	-
6	Orient insurance	0,634	0,,743	0,853	Drs
7	Qatar insurance company	1	1	1	-
8	Arabe Jordan insurance company	0,706	0,761	0,928	Irs
9	Bahrain national insurance company	0,789	0,935	0,844	Drs
10	Salim assurance	0,676	0,691	0,978	Drs
11	Al khazna insurance company	1	1	1	-
12	La CIAR	0,526	0,644	0,817	Drs
13	LIA insurance	0,613	0,621	0,988	Drs
14	Acıbadem Sağlık ve Hayat Sigorta Anonim Şirketi	1	1	1	-
15	Oman Qatar insurance company	1	1	1	-
16	Solidarity insurance	0,51	0,513	0,994	Irs
17	La Société at-takafulia	1	1	1	-
18	Qatar Islamic insurance company	0,241	0,276	0,872	Drs
19	Zitouna takaful	1	1	1	-
20	Neova insurance	0,223	0,227	0,984	Irs
21	Wethaq insurance	0,444	1	0,444	Drs
22	Al Ahli takaful company	0,272	0,227	0,999	-
23	Warba insurance company	0,331	0,35	0,945	Drs
24	Al Rajhi insurance company	1	1	1	-
25	National takaful company (watania)	0,759	1	0,759	Irs

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26	Islamic insurance company	1	1	1	-
27	Al Madina insurance company	1	1	1	-
28	Dar Al takaful	0,628	0,635	0,989	Irs
29	Pak Qatar general takaful	0,156	0,296	0,579	Drs
30	Salama assurance Algeria	0,388	0,391	0,993	Drs

Irs: increasing return to scale, Drs: decreasing return to scale.

Source: results obtained by program DEAP version 2.1

Table 10 : Efficiency scores year 2018

N	Companies	Crste	Vrste	Scale	
1	Al Ahlia insurance	1	1	1	-
2	ADNIC	0,345	0,527	0,655	Drs
3	La Société assurances Magharebia	1	1	1	-
4	Carte assurance	0,738	1	0,738	Drs
5	Atlanta assurance	0,217	1	0,217	Drs
6	Orient insurance	0,49	0,993	0,494	Drs
7	Qatar insurance company	1	1	1	-
8	Arabe Jordan insurance company	0,93	1	0,93	irs
9	Bahrain national insurance company	0,425	0,508	0,836	Drs
10	Salim assurance	0,989	1	0,989	Irs
11	Al khazna insurance company	0,574	0,7	0,82	Irs
12	La CIAR	1	1	1	-
13	LIA insurance	0,214	0,289	0,74	Drs
14	Acıbadem Sağlık ve Hayat Sigorta Anonim Şirketi	1	1	1	-
15	Oman Qatar insurance company	0,348	0,349	0,996	Drs
16	Solidarity insurance	0,459	0,467	0,983	Drs
17	La Société at-takafulia	0,809	1	0,809	Irs
18	Qatar Islamic insurance company	0,192	0,237	0,809	Drs
19	Zitouna takaful	1	1	1	-
20	Neova insurance	0,616	0,624	0,986	Irs

21	Wethaq insurance	0,232	0,236	0,977	Irs
22	Al Ahli takaful company	0,229	0,255	0,899	Irs
23	Warba insurance company	0,189	0,215	0,879	Drs
24	Al rajhi insurance company	1	1	1	-
25	National takaful company (watania)	1	1	1	-
26	Islamic insurance company	0,496	0,51	0,974	Irs
27	Al Madina insurance company	0,338	0,338	0,999	-
28	Dar Al takaful	0,573	0,587	0,977	Drs
29	Pak Qatar general takaful	0,131	0,174	0,754	drs
30	Salama assurance Algeria	0,441	0,444	0,995	drs

Irs: increasing return to scale, Drs: decreasing return to scale.

Source: Results obtained by program DEAP version 2.1

3.2.Results analysis

Based on the tables above, we start by identifying the efficient companies recorded during 2016, 2017 and 2018 that construct the efficient frontier and represent the best practice of the sample and they are considered as benchmarks.

In 2016, 8 companies were technically efficient, only one of them is a takaful, which is Wethaq insurance company. On the other hand, al Ahlia insurance company, Atlanta assurance, carte assurance, Qatar insurance company, Acıbadem Sağlık ve Hayat Sigorta Anonim Şirketi, orient insurance company and arabe Jordan insurance company are the technically efficient conventional insurance companies.

In 2017, 11 companies are technically efficient, which 5 are conventional: Atlanta assurance, Qatar insurance company and Acıbadem Sağlık ve Hayat Sigorta Anonim Şirketi remain technically efficient for two periods; al khazna and OmanQatar insurance company enter the game. For takaful, 6 companies are freshly efficient: Zitouna takaful, at-takafulia, al Madina, al Rajhi, Islamic insurance company and al Ahli takaful company.

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In 2018, Qatar insurance company and Acibadem Sağlık ve Hayat Sigorta Anonim Şirketi remain technically efficient for 3 periods respectively; la CIAR enter the efficient frontier as a new conventional company and Zitouna and al Rajhi Company are stable efficient players as takaful companies for two periods respectively.

With reference to the technical efficiency scores i.e. efficiency under the CRS assumption, the Qatari takaful company Pak Qatar general takaful had the lowest efficiency scores among the 3 years period, while analyzing with reference to the pure technical efficiency i.e. efficiency under VRS assumption, still the same company has the lowest score in 2018 while in 2016 and 2017 respectively Qatar Islamic insurance company and Neova insurance company had the lowest ones, we note that all of those three companies are takaful companies.

With analyzing in reference to VRS i.e. analyzing the pure technical efficiency, we marked 11 companies with a score equal to the unity in 2016, 12 in 2017 and 9 in 2018. These companies were not fully efficient due to a technical inefficiency, and for example we take la Société at-takafulia: In 2016, la Sociétéat-takafulia scored a technical efficiency estimated with 33% of its potential performance, however in term of pure technical efficiency, the score marked was equal to unity, thus the technical inefficiency scored with 77% were hindering the company from being technically efficient. With taking the right decisions in adjusting the combinations used, the company came to be fully efficient in 2017 before recording another technical inefficiency with a lower amount this time of only 19.1% in 2018.

3.3. Benchmarks companies

In the DEA approach, each inefficient company is compared to a group of "referents" or "peer group" companies that are efficient and close to it in terms of combinations of inputs and outputs.

The companies that represent a high occurrence as a "referent" to other companies are called benchmarks. This next table shows the benchmark companies and the number of occurrences of each one:

Table 11: Number of occurrences of insurance companies as benchmarks

2016		2017		2018	
company	Nbr	company	Nbr	company	Nbr
Al Ahlia insurance company	11	Atlanta assurance	4	Al Ahlia insurance company	2
Carte assurance	5	Qatar insurance company	14	La société magharebia	13
Atlanta assurance	11	Al khazna insurance	1	Carte assurance	1
Orient insurance company	3	Acibadem Sağlık ve Hayat Sigorta Anonim Şirketi	14	Atlanta assurance	1
Qatar insurance company	10	Oman Qatar insurance company	9	Qatar insurance company	10
Arabe Jordan insurance company	1	La société at-takafulia	10	Arabe Jordan insurance company	2
Acibadem Sağlık ve Hayat Sigorta Anonim Şirketi	10	Zitouna takaful	6	La Ciar	4
La société at-takafulia	2	Wethaq insurance company	1	Acibadem Sağlık ve Hayat Sigorta Anonim Şirketi	2
Wethaq insurance company	1	Al Rajhi takaful company	9	La société at-takafulia	5
Al Rajhi insurance company	11			Zitouna takaful	2
				Al Rajhi insurance company	11
				Watania takaful	9

Source: Results obtained by program DEAP version 2.1

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Based on the table above, 3 companies have been able to appear as benchmarks for the whole three years period, which two of them are conventional companies: Qatar insurance company and Acıbadem Sağlık ve Hayat Sigorta Anonim Şirketi, and the other one is takaful Al Rajhi insurance company and this specific one was expected to be efficient enough to appear on the efficient frontier in reference to so many previous studies, where it was included and came out with the same result.

Regardless to those three companies, al Ahlia insurance and Atlanta assurance appeared as benchmarks for 11 companies in 2016; Qatar insurance and Acıbadem Sağlık ve Hayat Sigorta Anonim Şirketi for 14 companies in 2017 and la société magharebia for 13 companies in 2018.

3.4. The decomposition of the efficiency

Using the Mann-Whitney test, a non-parametric test of rank comparison, we will be verifying whether there are any significant differences in the scores calculated in the tables above depending on the nature of the insurance company (conventional vs Islamic), the next table will show the results obtained by the tests:

Table 12: The efficiency decomposition of conventional and takaful companies from

	Technical efficiency				Pure technical efficiency				Scale efficiency			
	Rank sum		z/p		Rank sum		z/p		Rank sum		z/p	
	Cnv	Tkf	Z	P	Cnv	Tkf	Z	P	Cnv	Tkf	Z	P
2016	299.5	165.5	-2.806	0.005**	281	184	-2.063	0.0391**	296.5	168.5	-2.680	0.0074**
2017	267.5	197.5	-1.479	0.1391	230.5	204.5	-0.928	0.3534	228.5	236.5	0.169	0.8658
2018	264.5	200.5	-1.340	0.1803	287	178	-2.358	0.0184**	219.5	245.5	0.544	0.5861

* Significant at the 10% threshold ** significant at the 5% threshold; *** significant at the 1% threshold. Cvn: conventional, Tkf: takaful.

Source: Developed from statistical processing using STAT 11 software.

Based on the results obtained, a significant difference was noted in 2016 in term of technical efficiency since the conventional insurance companies have scored a higher rank than the takaful ones, which also was the case for the two following periods 2017 and 2018 where we marked a non-significant difference between the performances of the two types of companies. Over these two periods, the rank of takaful companies continues to increase contrary to that of conventional ones and since the difference is not significant then we can judge the progress of takaful companies in terms of efficiency to come to a close level to the conventional ones.

In term of pure technical efficiency, conventional insurance companies remain to be more efficient than takaful ones, and we scored a significant difference in 2016 and 2018. However it wasn't the case in 2017 where there was also a remarkable increase in both ranks but still conventional insurance companies are more efficient even though the noticeable effort of takaful and the non-significant difference in the level of performance.

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We came out with the same results in term of average scores, where conventional insurance companies remain more efficient in term of pure technical efficiency significantly in 2016 and 2018 with average score 0.65 and 0.82 compared to 0.3 and 0.53 of its counterpart while in 2017 conventional companies scored an average of 0.94 beside 0.9 as an average score for takaful companies. And with that being said, we can also notice the evolution of the takaful average score of efficiency and confirm the results mentioned above.

Conclusion

This work investigates the measurement of the efficiency of takaful VS conventional insurance companies in the MENA zone from 2016 to 2018 as the development of Islamic insurance is strongly growing while creating a competitive market and a direct alternative to conventional insurance.

The differences between Islamic and conventional insurance were found mainly in governance and concepts, in the ownership, management and financing of the company, this would definitely influence the performance of both types of companies and result-altered levels of efficiency.

The results of the application of the DEA on the 30 MENA companies sample showed that conventional insurance companies are more efficient than takaful insurance companies for the three years period 2016-2018.

A significant difference was marked in 2016, before noting an increasing level in takaful performance, to come to a very close level to conventional ones. Still they dominate the game even though the difference in term of efficiency was not significant in the last period but it is worth mentioning that the competition is increasingly strong considering the efforts in term of performance improvements takaful are making and the very close efficiency level between the two types of insurance.

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