

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

ECOLE SUPERIEURE DE COMMERCE

-KOLEA-

**A Dissertation submitted in partial fulfilment of the requirements for
Master's degree in Financial Sciences and Accounting**

Major: CORPORATE FINANCE

TOPIC:

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

Submitted by:

Meriem BOUSSAID

Supervised by:

DR. Billel BENILLES

DR. Abdelkrim KRIMI

2019/2020

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Dedication

I dedicate this work to

To my dear parents who have always been there for me, supported me and never had enough of being such loving and caring parents, May God bless you with peace in this life and paradise in the afterlife. ...

To my sister and brother who deserve all the happiness of the world...

To every pure soul I know...

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List of abbreviations

Abbreviation	Signification
AAIOFI	Accounting and auditing organization of Islamic financial industry
CRS	Constant return to scale
DEA	Data envelopment analysis
DFA	Distribution frontier approach
DMU	Decision making unit
EMH	Efficient market hypothesis
FDH	Free disposable hull
GCC	Gulf country club
GDP	Gross domestic product
IAIS	International association of insurance supervisors
ICP	Insurance core principals
IFSB	International financial standards board
KSA	Kingdom of Saudi Arabia
MENA	Middle east and north Africa
PRF	Participant risk fund
PTE	Pure technical efficiency
SE	Scale efficiency
SFA	Stochastic frontier approach
TE	Technical efficiency
TFA	Thick frontier approach
UAE	United Arab emirates
USA	United states of America
VRS	Variable return to scale

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Abstract

Despite the remarkable growth in the insurance industry over the past two decades and the significant expansion of takaful industry, few studies evaluate the performance of Takaful vs. conventional insurance firms in term of efficiency and especially in the MENA zone, thus this study examines the performance of conventional and takaful firms 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 and 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 in term of numbers. This study being the only one measuring the efficiency of conventional vs takaful insurance companies in the MENA zone, offers key implications for decision makers, regulators, and managers associated with the insurance industry in this area and gives a global vision on the progress of the competition on the market.

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

Résumé

Malgré la croissance remarquable du secteur de l'assurance au cours des deux dernières décennies et l'expansion significative de l'industrie du takaful, peu d'études évaluent la performance des compagnies d'assurance takaful par rapport aux compagnies d'assurance conventionnelles en termes d'efficacité et en particulier dans la zone MENA. Cette étude examine donc la performance des compagnies conventionnelles et takaful dans la région du Moyen-Orient et de l'Afrique du Nord (MENA) en utilisant la méthode d'analyse de l'enveloppement des données (DEA) pour définir le meilleur acteur en termes d'efficacité. Les résultats empiriques obtenus pour 15 compagnies d'assurance conventionnelles et 15 compagnies takaful pour la période 2016-2018 ont montré que les compagnies d'assurance conventionnelles ont été significativement plus efficaces en 2016 et qu'après, les scores d'efficacité des compagnies takaful continuent d'augmenter pour atteindre un niveau très proche de celui de leurs homologues. En conséquence, nous avons noté une légère différence en termes d'efficacité en 2017 et 2018 et malgré l'effort notable des compagnies d'assurance islamiques et la différence non significative, les compagnies conventionnelles sont toujours plus efficaces d'après les chiffres. Cette étude étant la seule à mesurer l'efficacité des compagnies d'assurance conventionnelles par rapport aux compagnies takaful dans la zone MENA, elle offre des implications clés pour les décideurs, les régulateurs et les gestionnaires associés au secteur des assurances dans cette région et donne une vision globale sur l'évolution de la concurrence sur le marché.

Mots clés : efficacité, assurance conventionnelle, takaful, DEA, région MENA.

General

Introduction

GENERAL INTRODUCTION

Like any economic activity, insurance industry plays a very fundamental and vital role in the development of socio-economic sectors of an economy by creating a less risky environment. It does minimize the risk of economic activities, as well as, channelize the financial resources. A productive and efficient insurance sector also contributes to economic development of a country by changing savings into investment projects through financial intermediation. Insurance products are currently offered as two types of insurance: conventional insurance and Takaful insurance.

Conventional insurance companies offer many services for the wellbeing of individuals and businesses like repaying loss to property, life or business etc. In simple words, insurance companies encourage the individuals and entrepreneurs to go for high return activities which certainly possess a big risk. In the absence of such a service, most of the investors hesitate to undertake such business activities.

Islamic insurance also known as Takaful, is an alternative model to conventional insurance; which is forbidden in Islam, it's having some elements which are against Islamic laws such as Riba (usury), Gharar (ambiguity), and Maisir (gambling). In contrast to conventional insurance, Takaful is established on the base of mutual assistance, responsibility, mutual protection and assurance, incorporated into the concept of tabarru (donation).

Takaful firms have made a significant growth in recent years, and are showing a positive growth rate. This situation has created a certain competition between these two types of insurance companies and raises 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. The sole purpose of our study is to measure the performance of conventional insurance and Takaful industry and compare them in terms of efficiency. Our research area is the Middle East and north Africa MENA during the period 2016-2018.

MENA is referred to the Middle East and North Africa area which includes 19 countries and 16 others are sometimes included. 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.

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The comparison between conventional and takaful insurance has been the subject of several studies, we cite the work of Tarifa Almulhim (2019) where she did an analysis of Takaful vs. Conventional insurance firms in KSA and that of Saad, N. M, Majid, M. S. A, Yusof, R. M, Duasa, J. & Rahman, A. A. (2006) where they measured efficiency of insurance and Takaful companies in Malaysia using data envelopment analysis (DEA). These studies used DEA method to measure the efficiency since it is a mathematical programming that can be applied to assess the efficiency of decision making units and which is based on benchmarks technics. To the best of our knowledge, there are few studies comparing these two types of insurance and none has been done in the MENA region.

With all that being said, we raise the following problematic:

Is there a difference in term of efficiency between conventional insurance companies and takaful insurance companies in MENA zone?

To answer this question we set the following sub-questions:

1. What are the main differences between conventional and Islamic insurance basics?
2. What are the concepts of efficiency? And how can we measure the efficiency of insurance companies with DEA method?
3. Is there any difference in term of efficiency between conventional insurance companies and takaful insurance companies in the MENA region?

To be able to answer the main problematic and the sub-questions, we will test the following hypothesis:

H1: there exist some ultimate differences in term of basics between conventional insurance companies and takaful insurance companies.

H2: the efficiency of insurance companies can be measured.

H3: conventional insurance companies are more efficient than takaful insurance companies in the MENA zone.

Due to the importance of insurance in the development of economics and the attribute of being an independent financial institution, it is of dire importance to make a study on this industry. The interest of this topic is to give an eye on two major insurance systems: conventional and Islamic insurance systems, their principals, basics, origins and performances on the MENA market. Moreover, the efficiency measurements will help

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us understand and evaluate the performance and competitiveness of the industry, how the industry responds to these challenges and which one of the players is expected to survive and grow in the future. Furthermore this study will manner to define deeply the concept of economic efficiency and the methods existing to measure it. We will mainly spot the light on the data envelopment analysis, which is the one we are using to measure and analyze the efficiency of our sample.

We have chosen to conduct this study for the following reasons:

- the importance of the insurance sector and moreover the emergence of the takaful industry in the world and precisely in the MENA zone leads us to give more attention to this field and to explore more deeply the points of divergence of these two direct competitors to bring out best on the market for the benefit of the insurers and the insureds.
- To our knowledge, no study on measuring the insurance efficiency has included the country of MENA as a whole region.

For this work, we used a descriptive method to conduct the theoretical notions related to the two types of insurance and also the efficiency concepts and its measurement. On the other hand, we used the DEA method to measure the efficiency of insurance companies and an analysis method to examine and explain the results obtained. 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. .

To properly conduct this study, our research will be developed around three chapters:

The first chapter will illustrate the basics of the two types of insurance companies in section one and section two as well as their similarities and differences in section three. The second chapter will take place to define the notion of efficiency and its measurement in the first place. The second section is dedicated to a presentation of the Data Envelopment Analysis (DEA) method and finally, we will be presenting a review of the literature on the application of the DEA method. The last chapter will be the subject of the empirical part, we will start by a presentation of the MENA insurance

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market in the first section and the second section will be dedicated to the methodological elements used and finally the results of the application of DEA method.

Chapter 1:
General Overview on
conventional and
takaful insurance

Introduction

Since his existence, man has sought to protect himself, his family and then his property and assets from the risks and hazards of life. Insurance is part of this common search for protection; it is a modern and scientific organization of solidarity that allows compensation for damage that may be suffered by some members of a community, through modest contributions.

Conventional insurance companies offer many services for the wellbeing of individuals and businesses like repaying loss to property, life or business etc. In simple words, insurance company encourages the individuals and entrepreneurs to go for high return activities which certainly possess a big risk. In the absence of such a service, most of the investors hesitate to undertake such business activities.

Over time, the concept of insurance has changed since it is now being commercialized and has been transformed into a profit-oriented business. To revive the legacy of the real concept of insurance, the Takaful (Islamic insurance) scheme was introduced in the second half of the 20th century differentiating itself from conventional insurance practices.

Takaful is strictly based on Islamic law known as Sharia'ah principles; it is essentially a concept of mutual help. Insurance business under conventional system is based on Riba (usury), Gharar (ambiguity), and Maisir (gambling), which are prohibited in Islamic society under Islamic principles. So there is need to clear the difference between the conventional insurance and the Islamic insurance Takaful and that was the purpose of this chapter.

This chapter will be represented as follow:

- Section 01: general concepts on conventional insurance.
- Section 02: general concepts on takaful.
- Section 03: comparison between conventional insurance and takaful insurance.

Section 01: General concepts on conventional insurance

The conventional insurance industry is one of the largest industries in the world so this section will define the concept, the history and the essential elements related to this activity.

1. Definition of insurance

Insurance may consider several definitions:

1.1. General definition

A meeting of people, who are fearing the arrival of an event that is harmful to them, contribute to enable those who will be affected by this event to deal with its consequences.¹

1.2. Legal definition

Article 2 of Ordinance No. 95-07 of 25 January 1995 relating to insurance defines insurance with reference to Article 619 of the Civil Code in Algeria as follows:

"Insurance is a contract by which the insurer undertakes, in return for premiums or other pecuniary payments, to be provided to the insured or to the third party beneficiary in whose favor the insurance is taken out, a sum of money, an annuity or other pecuniary benefit, in the event of the risk provided for in the contract being realized. »

1.3. Technical definition

According to Mr. Joseph Hémard: "Insurance is a transaction by which a party, the insured, in return for a remuneration (the premium), for himself or for a third party, in the event of the realization of a risk, is allowed to be presented by another party, the insurance company which, taking on a set of risks, compensates them in accordance with the laws of statistics".²

1.4. Economic definition

"Economic insurance is a product often marketed by companies in the form of a package of guarantees. This is a purely legal product, since it consists solely of the obligations taken on by the insurer".³

Also "Insurance is a means of covering the financial consequences of risks that cannot be eliminated by preventive measures. Like other preventive measures, the cost of

¹ François Couilbault, Eliashberg. C, Latrasse.M - Les grands principes de l'assurance - 5th édition, l'argus, paris, 2002, p43.

² Ibid. p57

³ Www. Legal.Com (26-03-2020 20:36)

insurance is proportional to the amount of the guarantees provided and is therefore necessarily included in the cost of the products or services sold or provided by the insured”¹.

2. Historical approach to insurance

Insurance was implemented as early as the first civilization; the authors consider that the insurance period begins in 1347, the year in which the first insurance contract was established in Genoa, Italy. To this end, we can distinguish throughout history two great periods in the evolution of insurance: pre-insurance and modern insurance.

2.1. Pre-insurance

This period goes from 4500 B.C. to 1347 A.D. It manifests itself through mutual assistance organized around the family and the community, in case of damage the consequences of the latter will be shared among the members of the entire community at which one it belongs to. There are many examples of this solidarity and mutual aid:²

2.2. In antiquity

The stonecutters of Lower Egypt: The latter had set up mutual aid boxes which enabled them to stand together against certain dangers; thus the victim of an accident benefited from the intervention of all the other stonemasons through mutual aid societies; The code of Hammurabi, King of Babylon: The Babylonians had codified the organization of transport by caravan, and in particular, provided for the allocation of between traders of the cost of theft and looting.³

2.3. In the Middle Ages (the big adventure loan)

This loan favored the birth of marine insurance; it was practiced by the Greeks and Romans four centuries before Christ. Indeed, to cover and guarantee cargoes against maritime risks, merchants, with a speculative aim, granted loans to ship-owners; this is what is called "THE LOAN TO THE BIG ADVENTURE" maritime adventure. These lenders advance the price of the cargo and in case of loss of the ship they lose their loans, however, if the ship arrives safely at port they are entitled to full repayment of their loans plus interest on the entire cargo.

¹ Ibid. p58.

² HADDAD - Non-hydrocarbon export credit insurance in Algeria - Dissertation of academic magister, business management, University of Mouloud MAMMERI of Tizi-Ouzou, 24/09/2006, P.13.

³ Ibid. p15.

2.4. Modern insurance

Since its emergence, insurance has continued to develop in the time from which it has taken several forms (from marine insurance to the most complex lines of modern times and the most diverse).

2.5. Marine insurance

It is the first form of modern insurance; it is in the ports of the Mediterranean that its essential rules developed. It appeared in the 14th century and was the first Mediterranean city to develop its essential rules in Italy: the first insurance policy dates back to October 23, 1347¹ (it was written at Genoa for the Santa Clara ship trip from Genoa to Mallorca); it is also in Genoa in 1424 that the first marine insurance company was founded. This form of insurance has spread to other countries such as:²

- France: in 1584 it was subscribed to for the Saint-Hilaire on the occasion of a transport of goods from Marseille to Tripoli;
- In England: in 1617, to secure the cargo of the ship "The three brothers";
- In Spain: which was a pioneer in this field; it was as early as 1435 that Jacques the 1st of Aragon enacts the ordinance of Barcelona which is the first legislative monument of insurance.

2.6. Fire Insurance

If marine insurance originated as a form of speculation, the insurance was created for the purpose of assistance after the London fire of 2 September 1666, which remains ingrained in the minds of Londoners. This fire caused major damage (13,000 houses and nearly 1,000 churches were destroyed). It is in the aftermath of this disaster that are created:³

- The Fire-office in 1667⁴ : starting point of an insurance organization in England against fire;
- In 1750, the French company "La Chambre Générale des Assurances" which in 1753 became "La Chambre Royale des Assurances".¹

¹ TAFIANI, Messaoud Boualem - Les assurances en Algérie, Étude pour une meilleure contribution à la stratégie – Algiers; édition ENAP. p11.

² BESSON, J-L, PARTRAT, C - Non-life insurance: modelling, Simulation - Paris: Economicaedition, 2005, p7.

³ BOUDJELLAL, Mohamed - Insurance in an Islamic system - Revue de science économique et de gestion, 2005, p60

⁴ BIGOT, G - Droit des assurances: entreprises et organismes d'assurance - 2nd édition. Paris: DELTA édition, 2000, p12.

2.7. Life Insurance

Life insurance is related to marine insurance, it was customary to insure the slave transported by sea and which represented a commercial value to be safeguarded, then the captain and the crew of the ship, then it also extended to the passengers from the 16th century onwards. This form of insurance was prohibited in all countries for sociological reasons as it was considered immoral except in England where the first life policy was found. The official appearance of life insurance dates back to 1653 under the name of Tontine in France that is a kind of saver's insurance by which the share of the eventual dying benefits the survivors either by sharing the capital accumulated or by receiving a pension life expectancy.²

2.8. Accident Insurance

It is a recent form of insurance, this insurance mainly concerned the industrial accident branch, economic and technological development and demographic expansion have contributed greatly to the development of the other branches of accident insurance, such as motor insurance and, much later, machinery insurance, Examples:³

- Hail insurance in 1826
- Livestock mortality insurance in 1855 ;
- Workmen's Compensation Insurance in 1898;
- Third party liability insurance which was gradually introduced during the 19th and 20th century, like :
- Architects and Developers Liability Insurance 1941;
- School Accident Liability Insurance 1945;
- Liability insurance for the use of any land vehicle in 1958.

3. The players in an insurance transaction

Five elements arise from an insurance transaction:

3.1. The insured

Is the person on whom the risk rests i.e. the person whose property, assets and life is guaranteed against the various risks by paying a certain amount (premium or contribution).

¹ LEZOUL, Mohamed - La situation actuelle du secteur des assurances en Algérie. In International Colloquium: Traditional Insurance Companies and Takaful Insurance Companies between Theory and Practical Experience - Setif University, April 2011, P5.

² HADDAD, Op.cit, p17.

³ TAFIANI, Boualam. Op.cit., p14.

3.2. The subscriber

Is the natural person (e.g. the head of the family on behalf of his children, the carrier on behalf of his clients, the client on behalf of the companies working on a building site, etc.) or legal entity (the bank on behalf of its borrowers, the company on behalf of its employees, a company on behalf of its subsidiaries, etc.) who contracts with the insurer by paying the premium.

3.3. The beneficiary

Is a natural or legal person who will receive the benefits promised by the insurer in the event of the realization of the risk provided for in the insurance contract.

3.4. The third party

Any person who is not party to the contract but can claim the benefit (such as the beneficiaries of a death insurance, victims in liability insurance).

3.5. The insurance company

Is the one who is obliged to pay the indemnity provided for in the event of the realization of the insured risk, it is generally a commercial company or a mutual insurance company.

The insurer must be present before, during and after the subscription of the contract:

- Before the completion of the contract: he must design products corresponding to the needs.
- When the contract is taken out: he must ensure that the insurance policy is drawn up within as soon as possible and according to the agreed standards.
- Once the guarantee has been acquired: he must not only settle the claims, but also spread to questions from policyholders, provide attestations, monitor the evolution of guarantees, propose amendments¹.

4. Elements of an insurance transaction

There are four elements of an insurance transaction:²

4.1. Risk

The word risk in insurance covers several notions:

- It refers to the insured object, such as a building, and qualified as an insured risk.
- It is used in the business of underwriting: as a share of industrial risk, personal risk, or as a share of the risk of the insured (automobile risk, etc.).

¹ François Couilbault, Eliashberg. C, Latrasse.M, Op. Cit p.56.

² Ibid.p. 59

- It corresponds to an insured event.

Not all events are insurable, in fact, only events with the following characteristics are insurable:

-1st characteristic: the event must be future (the risk must not have already occurred).

-2nd characteristic: there must be uncertainty; we talk about random event i.e. that depends on chance.

-3rd characteristic: the arrival of the event must not depend exclusively on the will of the insured.

4.2. The premium

The premium is the contribution that the insured pays to the insurer in exchange for coverage that is granted it is payable at the start of the insurance transaction or the year insurance, hence its name premium (which we find in the locution of premium first or in the word "primer" which means first) where the insurance undertaking is a corporation or mutual form in which the insurer is at the same time a member-policyholder, the premiums calls "contribution". The subscriber's contribution is usually determined on a flat-rate basis, and is then a fixed contribution which cannot, in principle, be modified during the validity of the contract without the consent of the policyholder, regardless of the insurer's performance (except for indexation agreed) mutual companies and certain companies with a mutual form the system of the variable contribution, with payment of a contribution which may give rise either to the additional payment of a reminder of contribution, or to a refund called a "rebate" in the opposite case. Regardless of the form of the insurance organization, whether for-profit or not, contributions must be sufficient to cope:

- The cost of the disasters that occurred during the year.
- All the costs (acquisition, management, collection) incurred by the organization insurer.

4.3. The insurer's benefit

The insurer's commitment in the event of the risk materializing is to pay a benefit. It is, in a general way, money intended for:

- either to the subscriber and insured, for example in fire insurance
- either to a third party, for example in liability insurance
- or to the beneficiary, e.g. life insurance (in the event of death)

In practice, a distinction must be made between two types of service:

- Benefits which are determined after the occurrence of a claim, according to its importance (e.g. fire in a building).
- Lump-sum benefits that are determined at the time of contract subscription, before the occurrence of a claim (e.g. life insurance).

4.4. The compensation to the mutuality's own

Each Subscriber makes his or her contribution without having to pay, whether he or she or another person makes the contribution will benefit, but aware that it is through its payments and those of other policyholders that the insurer will be able to compensate those who have been affected. All the persons insured against the same risk and who contribute mutually for to deal with its consequences, constitutes mutuality.

Insurance is therefore the organization of solidarity between people insured against the occurrence of the same event. This solidarity is very strong:

- If the risk worsens (for example, if there are more car accidents, or if each accident costs more money) the whole mutuality will have to pay a higher contribution.
- If the risk decreases (for example, if there are fewer deaths in life insurance), everyone's contribution will decrease.
- If policyholders "cheat" by failing to declare the seriousness of their risks or exaggerating them the importance of a claim, the entire mutuality will suffer.

Thus, the idea of mutuality compensation implies that all members of the mutual society should be treated equally. This implies the need to provide for sanctions in the event of "cheating" and also justifies the extension of strict rules for underwriting and payment of claims.

5. The Risk Division

When the risk to be insured proves to be very significant, the cost of which, in the event of a claim, could not be offset by the premiums collected, the insurer proceeds with its division. To do this, insurance companies use two techniques to divide (or spread) the risk: co-insurance and reinsurance. These two techniques are indispensable and can be implemented at the same time:¹

5.1. Co-insurance

Co-insurance consists of a proportional sharing of the same risk between several players. Each accepts a certain percentage of the risk, receives in exchange the same percentage of the premium, and in the event of a claim, will be required to pay the same

¹ Article n°3 of Order No. 95-07 of 25 January 1995 relating to insurance.

proportion of the benefits due. The management and execution of the insurance contract are entrusted to one of the insurers called lead insurer and duly mandated by the other participating insurers in the risk coverage.

5.2. Reinsurance

Reinsurance is a transaction whereby an insurance company (the ceding company) insures itself with another company (the reinsurer or the assignee) for all or some of the risks she has taken on. In this case, it is indeed the "insurance of insurance" or "second degree insurance". In the case of reinsurance, the insurer remains solely liable to the insurance.

6. The insurance contract

The study of the insurance contract through the various provisions of Order No. 95-07, will legally define it and define the general characteristics that constitute an insurance transaction.

6.1. Definition of insurance contract

A contract is an agreement between two or more persons who commit themselves respectively to give, to do or not to do something. In a contract of sale, the seller undertakes to deliver the item, the buyer to pay the agreed price. With regard to insurance, the insurance contract is an agreement between an insurer and the insured for the guarantee of a risk: the insurer agrees to cover the risk; the underwriter undertakes to pay the agreed premium or contribution. The insurance contract is the legal link which obliges the insurer to insure the risk, the underwriter to pay the premium¹.

6.2. General characteristics of the insurance contract

The insurance contract intends to include the following features:²

- Consensual character

The insurance contract is consensual in nature, as it is deemed to have been concluded once the parties reach agreement.

- Synallagmatic character

The insurance contract is synallagmatic because it contains commitments reciprocal rights of both parties. The insurer's commitment is linked to that of the underwriter, and vice versa.

- Random character

¹ François Couilbault, Eliashberg. C, Latrasse.M, Op. Cit, p.89.

² Ibid.p90.

The random nature of the insurance contract precludes an insurer from making a decision on the basis of a risk assessment charges a claim that the insured knew was already made at the time the policy was taken out: notion of unknown past.

- **Contract of good faith**

Good faith is fundamental to insurance. It means that the insurer relies on the loyalty of the insured: he refers to his statements without being obliged, in a non-binding manner, in general, to verify all the elements declared. In concrete terms, the good faith of the subscriber is always presumed. It is up to the insurer to prove otherwise (which is very difficult). In case of doubt, the insured will be deemed to be acting in good faith.

7. Roles of Insurance

Insurance is a very important sector in the economy, one that plays a considerable role in the growth and development of countries; but it still has some limitations.

7.1. The economic role

In addition to its intervention during the realization or the occurrence of the events although insurance has other economic and social uses, as well as the unfortunate consequences that individuals face, it has other economic and social uses. Insurance is seen as an engine of economic development and there are several reasons for this, such as:¹

- **Investment guarantee:** Any investment project must be accompanied by insurance; this is because no investor would have risked the billions of dollars needed to carry out his project without the guarantee of being reimbursed in the event of a claim or risk that only insurers can offer through the mechanisms of insurance. In other words, any investment project requires the participation of the insurer without whose guarantee the entrepreneur and especially his banker would not risk the capital involved in the project;
- **Investment of contributions:** The insurer collects contributions before the insured are subject to the risks against which they are insured. To this end, insurance companies drain very considerable savings which they inject into economic activity in the form of financial investments (they are institutional investors alongside pension funds or retirement funds and investment companies). These institutional

¹ BENAHMED, Kafia. Op. Cit, p.10.

investors finance the State by investing with the Treasury (they buy treasury bills issued by the latter to finance its budget deficit) or on the stock market (they invest their funds by buying stock market securities: shares, bonds and other equity securities).

- **An instrument for protecting heritage:** The insurance covers the economic assets by compensating the victims at the value of the damage, it allows each victim to repair or rebuild the damaged property. The insurance thus allows the renewal of the production tool; the reconstruction of the goods destroyed by any disaster and contributes massively to the protection of individual and national heritage.

7.2. The social role

The purpose of insurance is to compensate those who are victims of fate through contributions paid by the insured, which is a signally social function; it therefore makes it possible to:¹

- guarantee income to widows and orphans after the premature disappearance of the head of the family;
- to give the means to rebuild one's house or to buy another home from one whose residence has been destroyed by fire;
- To pay compensation for loss of professional income to a person who has been unable to work due to an accident and to provide the sick and/or injured person with the financial means to seek treatment.

Another aspect of the social role of insurance is its impact on the survival of the person concerned the company. By making it possible to perpetuate companies that have been victims of a stroke of fate (bankruptcy of a debtor customer, fire...etc.); insurance saves jobs, know-how, living spaces and contributes to the stability of social relations of jobs.

8. Insurance and information asymmetry

Despite the development of the insurance business, there are still limits to its expansion, and once the risk is taken over by the insurer, the latter is confronted with two limits. It

¹ Ibid.p.11.

is the presence of information asymmetry¹ that leads to problems of anti-selection and moral hazard:²

8.1. Adverse selection (Anti-selection)

Anti-selection comes from an imperfect correlation between the characteristics of the participants. The risk profile of the insured (the pricing criteria used) and the intensity of their risks (claims experience). The individual's exposure to risk depends on his personal characteristics and behavior, information that the company cannot know about the client in detail, as risk exposure is different from one individual to another. This is a phenomenon whereby an offer on the market leads to the opposite of the desired results because of information asymmetry. This problem arises when the insurance company tries to increase its premiums because it pushes the best customers out, i.e. those with the lowest probability of making a claim; it describes that insurance is more advantageous for those with a higher risk. Example: for health insurance, the company can insure healthy, low-risk people and (indirectly) refuse to insure sick people.

8.2. Moral hazard

Moral hazard means that insured persons have less incentive to avoid what they are insured against. In other words, it is the possibility that an insured person will increase his or her risk-taking, compared to the situation where he or she would fully bear the negative consequences of a claim. In the case where the insured deliberately provokes the loss in order to collect compensation, this can be considered the extreme case of moral hazard. Moral hazard also refers to any change in the behavior of a contracting party contrary to the general interest or the interests of both parties to the contract, compared to the situation that prevailed before the conclusion of the contract; one of the contracting parties may be led to change his behavior; the other partner is then in a situation characterized by the appearance of a moral hazard. Example: A person who has not insured his or her home against fire will try to limit the risk of fire either by installing smoke detectors or by buying other means of protection. The problem of moral hazard leads insurance companies to set a minimum level of effort to be made by the insured in order to claim compensation, to make certain levels of prevention and the deductible mechanism compulsory (this is the share of risk left to the insured), and the

¹ We speak of asymmetry of information, during an exchange, when some of the participants have relevant information that the others do not.

² ZAJDENWEBER, Daniel - Economics and insurance management - Paris: Édition ECONOMICA, 2006, P. 43

concern of insurance companies is how to modify the incentives of their policyholders to avoid the risk.

9. International Regulatory framework of conventional insurance

Global Insurance market is regulated by some international authorities among them we cite:

9.1. the International Association of Insurance Supervisors

Established in 1994, the International Association of Insurance Supervisors (IAIS) promotes cooperation among insurance supervisors and regulators and collaboration with supervisors of other financial sectors. Its mission, as defined by its statutes, is to:¹

- Promote effective and consistent prudential supervision of insurance organizations in order to develop and maintain fair, secure and stable insurance markets for the benefit and protection of policyholders.
- Contribute to the stability of financial markets. To this end, the IAIS undertakes various actions in order to:
 - Promote exchanges of information between supervisors on regulations, markets and firms;
 - Define common supervisory principles and develop reference rules with a view to their generalization ;
 - Helping supervisors in emerging countries to put in place adequate regulation and effective supervision.

As a non-governmental association, the IAIS does not have the power to enact rules with which states should comply. Among the main standards established by the IAIS are the Insurance Core Principles (ICP), which define criteria for the effective regulation and supervision of insurance companies, and serve in particular as a basis for the IMF's assessments of the effectiveness of financial regulation (Financial Services Assessment Program, FSAP).

9.2. Solvency regulation

Solvency regulations are essential for the smooth functioning of the insurance market. In all industrialized countries, prudential regulations protect policyholders by providing a framework for the activity of insurers and thus guaranteeing the security of contracts.

¹ www.iaisweb.org (30-03-2020 17:57)

The main aim is to protect policyholders against the risk of insolvency of their insurers. To this end, we mention the prudential regimes adopted in the USA market.

In the USA the requirements defined by the Member States with regard to capital adequacy requirements are based on the model law of the National Association of Insurance Commissioners (NAIC) on the calculation of Risk-Based Capital (RBC). The RBC is obtained by applying factors to different types of assets, premiums, claims, expenses and provisions. There are four levels of quantitative capital requirements, each corresponding to a distinct level of supervisory intervention: Company Action Level, Regulatory Action Level, Authorized Control Level and Mandatory Control Level (with increasing supervisory intervention).¹

10. World Insurance market

Conventional insurance industry is one the biggest industries in the world in term of creation, here we represent some numbers concerning the international conventional insurance market.

10.1. Global insurance market in term of premiums:

According to the report of Allianz Research², the global volume of insurance premiums (excluding health) reached 4,180.56 billion EUR (4,781.68 billion USD) in 2018, an increase of 3.3% in one year and 3% in a decade. Life insurance records 2,258 billion EUR (2,582.68 billion USD), i.e. a growth of 2.54% compared to the turnover achieved in 2017 (2,637.7 billion USD). Non-life insurance, for its part, reaches 1 396 billion EUR (1 596.73 billion USD) at the end of 2018, an increase of 4.65% compared to the 1 334 billion EUR (1 597.95 billion USD) achieved one year earlier. The American insurance market is the leading producer of premiums with 1 115 billion EUR (1 275.33 billion USD). The Chinese market is far behind with 417 billion EUR (476.96 billion USD). With 440.648 billion USD in receipts, Japan is in third place.³

These top three countries are followed, in descending order, by the United Kingdom (USD 336.510 billion), France (USD 257.963 billion) and Germany (USD 241.485 billion). South Africa is, in terms of premiums, the first African market with 48.269

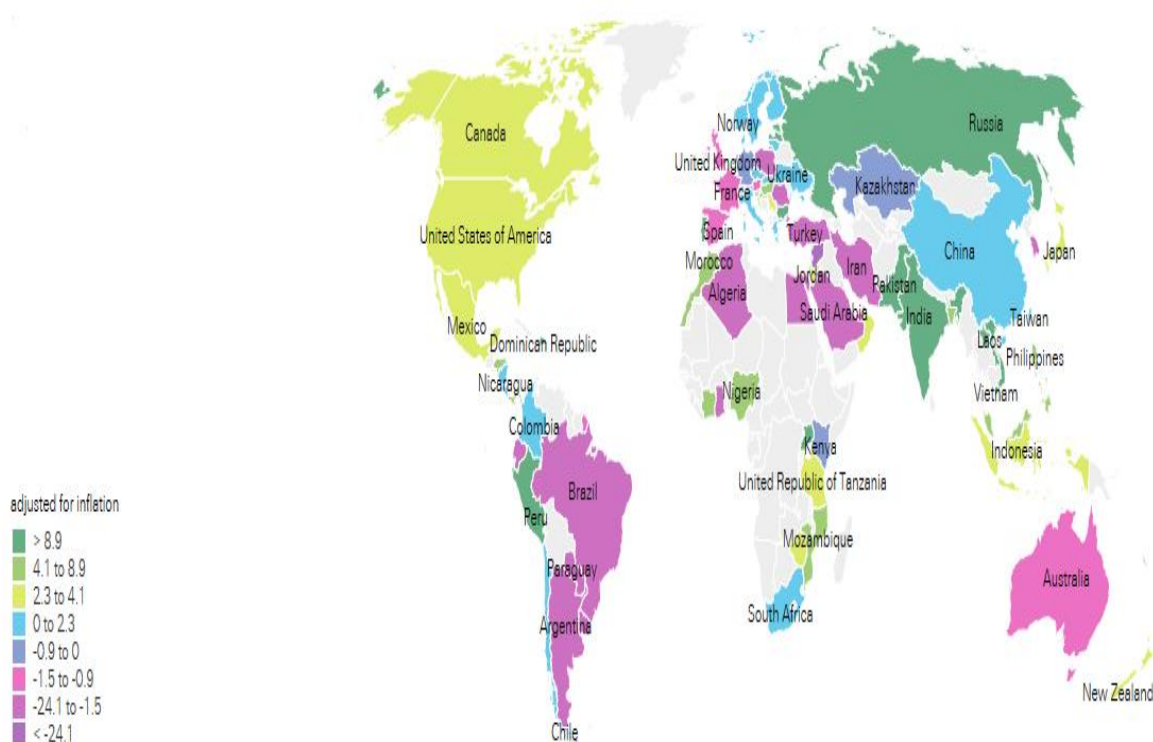
¹ www.actualitesdudroit.fr (29.05.2020 19:19).

² Allianz report - Global Insurance Market: 2018 - p.6.

³ www.atlas-mag.net (1-04-2020 20:25).

billion USD while the United Arab Emirates dominate the Middle East with 12.461 billion USD.¹ The next figure shows the global real premium growth for 2018:

Figure 1.1: Real premium growth 2018



Source: Swiss Re sigma revue, No 3/2018, p.2.

As shown above we can see that countries leading the market are mainly the countries with strong growing economies and most regions experienced negative growth mostly due to low interest rates that continued to adversely affect the supply and demand for savings products.

10.2. World insurance market: change in premium income by continent (2010-2018):

According to the following table developed by Sigma research in their 2018 reports on the global insurance market we can clearly see that the American continent is the global market leader competing the European continent with close market shares.

¹ ibid (1-04-2020 20:25)

Table 1.1: Sales evolution by continent (2010-2018)

Year	America	Asia	Europe	Oceania	Africa	World
2010	1 403 784	1 172 175	1 615 190	63 072	81 466	4 335 687
2011	1 797 703	1 278 786	1 625 442	94 958	69 274	4 566 163
2012	1 566 617	1 333 298	1 540 685	86 879	71 472	4 598 951
2013	1 561 461	1 251 992	1 620 133	89 752	70 294	4 593 632
2014	1 567 073	1 313 874	1 695 091	99 557	70 116	4 754 711
2015	1 593 791	1 351 566	1 491 430	96 951	63 942	4 597 682
2016	1 616 070	1 486 575	1 448 819	91 968	59 408	4 702 840
2017	1 864 900	1 448 800	1 486 600	92 000	65 200	4 957 500
2018	1 759 900	1 742 500	1 499 800	122 700	68 400	5 193 300
Market-share 2018	33.39%	33.55%	28.88%	2.36%	1.32%	100%

Source: Swiss Re sigma revue, No 3/2018.

As it is illustrated in this next table the Asian and American continent have close shares and dominate the global industry with a 66% of the global market followed by Europe with 28% and the African continent is possessing the smallest share with 1% of the global market.¹

10.3. Top 10 insurance companies according to valuation

According to valuation "Brand Finance", a British company specializing in business valuation consultancy, publishes the fifth edition of its annual report "Brand Finance Insurance 100". The report ranks the world's top 100 insurers according to their market values. the next table results the top 10 insurance company mentioned in the report:²

¹ idem (08-04-2020 19:35).

² idem (08-04-2020 20 :14).

Table 1.2: Top 10 insurance companies according to valuation

Rank		Insurance company	Country	Brand value		Value evaluation
2019	2018			2019	2018	
1	1	Ping An	China	50.465	26.155	92.9%
2	2	Allianz	Germany	23.105	20.229	15.2%
3	3	China Life	China	21.836	14.393	51.7%
4	4	Axa	France	15.654	13.317	17.5%
5	5	AIA	Hong Kong	15.503	10.27	51.0%
6	6	CIPC	China	10.721	8.738	22.7%
7	7	PICC	China	9.139	7.208	26.8%
8	8	GEICO	USA	8.784	6.546	34.2%
9	9	Zurich	USA	8.219	7.169	14.7%
10	10	Allstate	USA	7.982	7.674	4.0%

Source: Swiss Re sigma revue, No 3/2018.

In the 2019 edition of the Brand Finance Insurance 100, the Qatari insurer "Qatar insurance" is ranked 75th. The two South African insurers, "Discovery" and "Old Mutual", hold respectively the 94th and 97th places.

Section 02: General concepts on Takaful

The concept of Takaful has been practiced in different forms for over 1400 years. In this section, we will define this concept and discuss its history before detailing the principles it implies and other relatable notions.

1. Definition of Takaful

The word “Takaful” is derived from the root word kafala, which etymologically means ‘guarantee’ or ‘indemnity’. Technically, Takaful is a mutual form of insurance whereby a group of participants agree to contribute a sum in order to assist each other from a defined financial loss arising from a potential future catastrophe or misfortune. The Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) defines takaful as "a system through which the participants donate part or all of their contributions which are used to pay claims for damages suffered by some of the participants. The company's role is restricted to managing the insurance operations and investing the insurance contributions.”¹

The Islamic Financial Services Board (IFSB) defines it as “the Islamic counterpart of conventional insurance, and exists in both life and family and general forms, whereby it is based on the concept of mutual solidarity, and a typical takaful undertaking will consist of a two tier structure - hybrid of a mutual and a commercial form of company.”²

In the same context, the Islamic Financial Services Act (IFSA) 2013 defines takaful as “an arrangement based on mutual assistance under which takaful participants agree to contribute to a common fund providing for mutual financial benefits payable to the takaful participants or their beneficiaries on the occurrence of pre-agreed events.”³

In Islam, takaful is grounded in the notions of mutual assistance (taawun), mutual security and indemnity (tadhamun), and mutual protection and assurance (takaful), all of which are then incorporated into the concept of tabarru’. The principle of mutual assistance is deduced from a verse of the Holy Quran which reads: “Help one another in

¹ AAOIFI, Accounting, Auditing & Governance Standards (for Islamic Financial Institutions), English version. Bahrain, Financial Accounting Standard No. 12, Appendix E, 2004, p5.

² IFSB - Guiding Principles on Governance for Takaful (Islamic Insurance) Undertaking - Kuala Lumpur, December 2012, p2.

³ Government of Malaysia - Law of Malaysia Act 759 Islamic Financial Services Act 2013, p36.

al-Birr and in al-Taqwa (virtue, righteousness and piety): but do not help one another in sin and transgression.”¹ It is also supported by a hadith that states: “Allah will always help His servant for as long as he helps others.”² The notion of mutual security and indemnity is deeply rooted in the hadith of the Prophet (pbuh) that reads: “The place of relationships and feelings of people with faith, between each other, is just like the body; when one of its parts is afflicted with pain, then the rest of the body will be affected.”³ Additionally, the spirit of mutual protection and assurance is substantiated by a hadith narrated by Imam Ahmad bin Hanbal, which reads: “By my life, which is in Allah’s power, nobody will enter Paradise if he does not protect his neighbor who is in distress.”⁴

2. Origins of takaful

The origin of Islamic insurance began before the era of the Holy Prophet Muhammad (S.A.W) which is based on “Aqilah” mutual co-operation. Later such insurance transaction was consistently polished and was even made mandatory in some cases during the period of the second Caliph, Saydina Omar (R. A .A). During the period of 14th to 17th century a Sufi Order of the Kazeeruniyya was very active especially in port cities in Malabar and in China. This order served as a kind of marine travel insurance company.

In 19 th century, a Hanafi lawyer Ibn Abidin (1784 -1836) was the first Islamic scholar who came up with the meaning, concept and legal entity of insurance contract. He was also the first person, who repeated the word insurance in the context of a legal constitution, and not in a customary practice (Klingmuller, 1969). In 1906, Muhammad Baqit Mufti of Egypt approved the idea of insurance which was explained by Ibn Abidin. In the period of twentieth century, a notable Islamic law specialist, Muhammad Abduh gave two 'fatwas' referencing that insurance transaction is like the transaction of ‘al-mudaraba’ financing technique, while the other was that a transaction which is similar to endowment or life insurance are legal.⁵

¹ Al-Ma’idah verse: 2

² Al-Naisaburi, M. (n.d) - Shahih Muslim. Beirut: Dar Ihya’ al-Turath al-Arabi, 4/2074, hadith no. 2699.

³ Al-Bukhari - Shahih al-Bukhari - Dar Thuq al-Najah, 8/10, 1422AH, hadith no. 6011.

⁴ Al-Naisaburi, M. (n.d). Op. Cit. hadith no. 46

⁵ Mher Mushtaq Hussain - conceptual and operational differences between general takaful and conventional insurance – November 2011, p.24

3. Development of takaful

The first takaful company - Islamic Insurance Company of Sudan - was founded in Sudan by the Faisal Islamic Bank in January, 1979 (Anwar, 2008). The Bank's Sharia'ah Supervisory Board approved this attempt, and in January 1979, the Islamic Insurance Company was established as a public company under the Companies Act, 1925 (Sudan)¹. This company was able to distribute profits to its shareholders at the rate of 5% in 1979, 8% in 1980 and 10% in 1981.

Following the success of the insurance company in Sudan, the Islamic Insurance Company was established as a private limited company in Malaysia. The Malaysian government constitutes a task force on the establishment of Islamic insurance in Malaysia. The task force report indicates that takaful has enormous benefits to Malaysia. Consequently, the Malaysian government promulgated the Takaful Act, 1984, which regulates takaful in Malaysia.

In 1985, the Council of Islamic Scholars in Mecca approved takaful as a Sharia'ah-approved alternative to the conventional insurance system. This led to mutual takaful companies being established in different Muslim countries, including Dubai, Bahrain, and Malaysia.²

In 2002, Lebanon (in the region of MENA) entered the Takaful market by establishing Al Aman Takaful. In Asia, the Islamic Financial Services Board (IFSB) was established. In 2003, Pakistan (in the Asian region) established Pak Kuwait Takaful Limited and this is the first Takaful Company in the country. In Europe, the significant milestones started in 2006. Hannover Re from Germany and Swiss Re from Switzerland entered the Retakaful industry. In 2007, Munich Re from Germany joined the Retakaful industry. In 2008, the Salaam Insurance Company was established in Britain. In 2011, Kenya entered the Takaful market with Takaful Insurance Africa and Saudi Arabia directed all the operators to use the cooperative insurance model. In 2012, Islamic Finance Amendment Rules 2012 allowed the operation of Takaful by conventional firms. Similarly, Pakistan allowed a Takaful window, while Malaysia launched its

¹ Fadun, Olajide Solomon - Takaful (Islamic Insurance) Practices: Challenges and Prospects – Nigeria, 2014 p19.

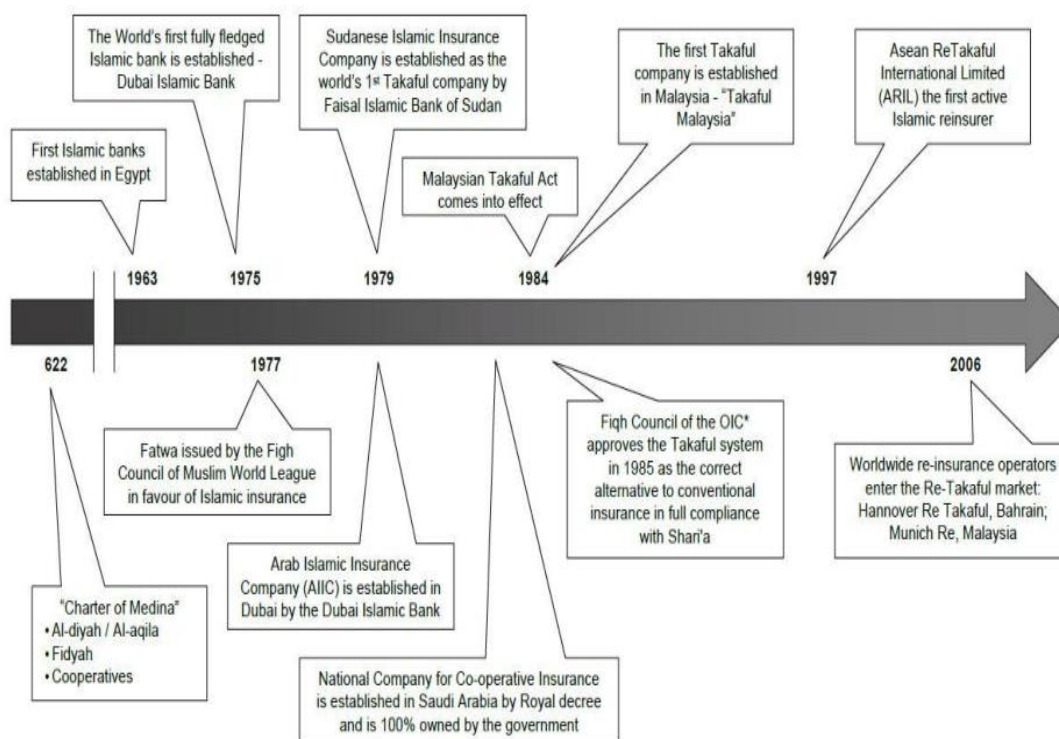
² Ibid.p20.

Takaful operating framework. In 2013, Cobalt from Britain launched the platform for writing large commercial risks (Sharia'ah compliant) in the London market.¹

In Nigeria, African Alliance Insurance Company Limited, the oldest specialist life assurance, introduced takaful into the market in 2003. Subsequently, Niger Insurance Plc and Cornerstone Insurance Plc also introduced takaful products in Nigeria. Takaful Operational Guideline (2013) establishes Sharia'ah Supervisory Board for operations of takaful in Nigeria. This is appropriate as the establishment of a Sharia'ah Supervisory Board is a prerequisite for takaful operation. The next figure concludes the most remarkable events in takaful history:

¹ Syed Ahmed Salman, Hafiz Majdi Ab. Rashid, Sheila Nu NuHtay -Takaful (Islamic Insurance): When We Started and Where We are now - International Journal of Economics, Finance and Management Sciences, 2015.p25.

Figure 1.2: Takaful Development over time.



Source: Fadun, Olajide Solomon .Op .Cit. p19

4. End purpose of takaful

Modern takaful practice is similar to insurance in practice whereby the contribution amount is calculated and is fixed for a standard normal person at a certain age for a certain amount of Benefit. Through participation in takaful schemes, participants are given the chance to assist one another. The takaful operator is required to accumulate as much tabarru' Funds as possible to help those in need .When somebody enters into a takaful Scheme, he is not supposed to have any intention of making money. His intention should be to share his wealth via contributing money or giving his money as tabarru' towards a fund that is used to help somebody else who requires assistance. He should look beyond worldly rewards in the knowledge that when his time comes to face death, the takaful operator who manages the fund shall also ease the burden of his family in the same way as he acted towards others in similar circumstances. The goal is to please God and achieve prosperity in this life and the hereafter. Takaful is viewed by Islamic scholars as the acceptable alternative - being guided by Sharia'ah principles.

The social relationships between the scheme members are also significant. Islam promotes cooperation and sharing.¹

5. Elements of a Takaful system

There are five elements that must exist to establish a proper takaful system:²

- Niya, which means utmost sincerity of intention to follow the guidance and adhering to the rule and purposes of takaful.
- Integrating sharia'ah conditions like risk-sharing under taawun principles, coincidence of ownership, participation in management by policyholders, avoiding Riba and prohibiting investments, and including mudaraba principles or wakala for management practices.
- Incorporating moral values and ethics by operating in good faith - with honesty, full-disclosure, truthfulness and fairness in all dealings.
- No unacceptable element that contravenes sharia'ah.
- Strict adherence to Islamic rules for commercial contracts, including:
 - Parties must have legal capacity and be mentally fit;
 - Existence of insurable interest;
 - Principle of indemnity prevails;
 - Payment of premium is a consideration (offer and acceptance);
 - Mutual consent, including voluntary purification;
 - Specific time period of policy (period of insurance) and agreements (conditions).

6. Key features of Takaful

The main features of takaful include³:

- The policyholders are participants and contributors of the takaful fund.
- The main purpose of the contribution is not for profit.
- Takaful is not mainly for risk taking; but to reflect the nature of pooling the risk and collective risk management.
- The takaful operator is not the owner of the fund; but, a manager of the fund.

¹ Swartz and Pieter Coetzer - Takaful: An Islamic insurance instrument - Nico .2013.P.11

² Fadun, Olajide Solomon. Op. Cit, p17

³ Ibid. p.18

- The surplus accrued from takaful operations belongs to policyholders solely under Wakala model; and to both policyholders and takaful operators under Mudaraba model.
- Since the surplus goes back to participants in proportion to their contribution, there is an inbuilt check on over-pricing.
- Funds are invested in Sharia'ah compliant instruments or assets. For instance, such fund cannot be invested in: interest yielding assets; gambling institutions; firms producing liquor, cigarette and tobacco; and entertainment firms.

7. Principles governing takaful

Takaful is governed by the same principles that conduct the Islamic finance, while retaining its own specificities of Operation:

- **Separation of Funds**

Participant funds shall be segregated from the operator's fund. An interest-free loan must be granted by the operator for the benefit of the members' fund in the event of a deficit.

- **Donation**

To avoid uncertainty in the subject matter or form of the contract Juris consults require an exact and precise definition of the subject matter of the contract, so it is necessary to is not allowed to sell the fish in the water. The form of the contract must meet well-defined criteria. A voluntary donation from the members replaces the insurance premium so that the contract becomes ethically lawful. The ambiguity in the object of the contract is removed.

- **Investments**

They must be socially responsible. It is not permitted to trade in weapons, drugs, alcohol, gambling, and anything else prohibited by religion.

- **The "excess premium" surplus**

This surplus is generated after payment of commissions to the operator, compensation of disaster victims, allocations to reserves and subscription to Retakaful.

This surplus is the sole property of the members' fund. The operator does not open right to this surplus. There is no specific surplus sharing rule to follow. The

distribution of the surplus in the Takaful members' fund is done according to the terms of the contract.¹

- **The Sharia Supervisory Board**

Experts in Muslim law are appointed to the Sharia Supervisory Board. They ensure that the operations carried out comply with the values of the religion. They are also trained in the technical field. There are at least three of them. This council may be attached to a national or international body. It is indispensable for Takaful Operations.

8. Key players in the takaful operation

The Takaful insurance operation is run by members, an operator, and shareholders, a sharia supervisory board, and a Retakaful operator. Bodies independent of governments accompany and guide this activity at the international level, such as AAOIFI, IFSB, etc.²

- **Members**

They are also designated by the following terms: participants, members, subscribers, beneficiaries, policyholders. These are natural or legal persons who have voluntarily agreed to be jointly and severally liable for each other in accordance with the terms of the Takaful insurance contract. They are of various denominations.

- **The operators**

They do not own the Takaful fund. They act as manager of risk. They may be natural or legal persons. They may be non-Muslims. They must, however, respect the clauses of the contract governing the Takaful operation.

- **Shareholders**

There are the shareholders in the operator's fund and the shareholders in case of investments made by the members' fund. They may be natural or legal persons. They may be of Muslim or other faiths.

- **Sharia Supervisory Board**

It is also called religious committee, scholars or sharia boards. It is a committee similar to the audit committee in a company. It oversees the conformity of

¹ Abdelbari MECHAAL - Expérience de répartition du Surplus Assurantiel - at a seminar on takaful at the University of Setif, 25-26 April 2011.

² AMIROU Rabah - Essai d'analyse de l'assurance mutuelle Takaful Etude comparative entre le marché Takaful Malaisien et le marché Takaful de la Coopération des Etats du Golf - université MOULOUD MAMMERI de Tizi-Ouzou, 2018.p44.

Takaful activity with Muslim laws. It operates according to the laws governing finance in the host country. Generally, it is composed of at least three scholars in Islamic law and economics with a good scientific background. This committee is indispensable for any Takaful operation.

- **The operator Retakaful**

The Retakaful Operator can be a legal entity or a natural person; he manages the Retakaful Company, which is a kind of mutuality of companies Takaful.

9. Regulatory Framework of Takaful

The IFSB and AAOIFI are the international standard-setting bodies for the Islamic financial services industry. They have produced many standards related to Islamic financial institutions. Among them, the standards and documents issued by IFSB for the Takaful industry are Guiding Principles on Governance for Takaful Undertakings (IFSB-8:), Guiding Principles on Conduct of Business for Institutions offering Islamic Financial Services (IFSB-9), Guiding Principles on Sharia'ah Governance Systems for Institutions offering Islamic Financial Services (IFSB-10), Standard on Solvency Requirements for Takaful Undertakings (IFSB-11), Guidance Note on the Recognition of Ratings by External Credit Assessment Institutions (ECAIS) on Takaful and Re-Takaful Undertakings (GN-5), Issues in Regulation and Supervision of Takaful in 2006 and Islamic Financial Services Industry Development: Ten-Year Framework and Strategies in 2007. AAOIFI has issued the AAOIFI Islamic insurance standard no. 26 in 2010. In addition, individual countries, for instance, Malaysia have come out with the Sharia'ah Governance Framework and other regulatory guidelines specifically for the Takaful operators.¹

10. Takaful Products

There are two main categories of Takaful products, i.e. general Takaful and family Takaful:²

10.1. General Takaful

According to IFSB, general Takaful is defined as, “schemes which are basically contracts of joint guarantee on a short-term basis (normally one year), and providing mutual compensation in the event of a specified type of loss”. The schemes are designed

¹ Syed Ahmed Salman, Hafiz Majdi Ab. Rashid, Sheila Nu NuHtay. Op. Cit.P14.

² Islamic financial services board IFSB - standard on solvency requirements for takaful (Islamic insurance) undertakings - December 2010.

to meet the needs for the protection of individuals and corporate bodies in relation to material loss or damage resulting from a catastrophe or disaster inflicted upon real estate, assets or belongings of participants. The Takaful contribution paid is pooled into the Participant Risk Fund under the principle of Tabarru' to match the risk elements of the business that are inherent in its underwriting activities. In addition, the potential loss incurred must be accidental and unintentional. This is seen in Surah al-Baqarah, 195: "And spend of your substance in the cause of Allah, and make not your own hands contribute to (your) destruction; but do good, for Allah love those who do well".

The main types of general Takaful products are motor vehicle Takaful; fire Takaful, marine Takaful and engineering Takaful. Takaful for motor vehicles, motorcycles and commercial vehicles are under motor vehicle Takaful. In the case of fire Takaful, it covers Takaful for standard fire, house owner or householder and home package. Marine cargo and marine hull or machinery are the sub products of marine Takaful and machinery breakdown and construction risk are under engineering Takaful.¹

10.2. Family Takaful

Family Takaful provides protection and long-term saving and investment opportunities. By having family Takaful products, it will release the financial burden on the family in times of misfortune and return will be accumulated from the investment account managed by the Takaful operators.

There are two principle sorts of family Takaful products, namely individual family Takaful products and group family Takaful products. Individual family products comprise of protection product, investment product, retirement product and medical product. Family Takaful protection aims to provide the financial help for the beneficiaries of participant when the participant dies or becomes permanent disabled. Moreover, this product also tries to release the financial burden from the participant if he suffers critical illness or temporary (totally or partially) disability. In the case of family Takaful investment products or investment-linked family Takaful products, it provides investment opportunities in addition to the protection given to the participants. Retirement family Takaful products provide financial assistance to the participant when he retires from work. The Takaful benefit of this product is that the participant is entitled to get the adequate financial support after retirement and to cover the medical expenses in old age. Medical family Takaful products cover the cost of hospitalization

¹ FadzliYusof, Wan Zamri Wan Ismail & Abdul Khudus Mohd Naaim Abdullah - Fundamentals of Takaful - Kuala Lumpur, Malaysia, 2011.p125.

and surgery. Group family Takaful is normally subscribed to by the employers for the benefit of employees and their family members. Similar to the individual family Takaful products, it provides financial assistance to the participants in order to cover hospitalization, surgery, and normal medical expenses. The coverage amount depends on the contribution given by the employer or employees.¹

11. Takaful models

The takaful industry has experimented with various models and contract underlying the relationship between participants and takaful operators. The following passages outline the evolution of these various takaful models and the issues surrounding their practice.

11.1. The Mudaraba Model

AAOIFI defines mudaraba as a partnership in profit whereby one party provides capital and the other party provides labor. Any profit is shared between the capital provider and manager in accordance with a profit sharing ratio agreed upfront. Any financial loss will be borne solely by the capital provider, unless the loss is due to the manager's negligence (taqsir), misconduct (ta'addi), or a breach of terms (mukhalafah al-shurut).² Mudaraba was the first model employed by the takaful industry in Malaysia. In this model, the takaful operator serves as a manager (mudarib) while participants are capital providers (rabb al-mal). The operator will accept contributions from participants, which are then managed and invested in a Sharia'ah compliant manner. The contract specifies that any profit from managing the fund will be shared between the takaful operator and the participants based on a ratio agreed upfront. In the event of loss or deficit in the Participant Risk Fund (PRF)³, however, the takaful operator shall provide an interest free loan (qard) that should be repaid when the PRF generates profit. The underwriting surplus, if any, will be distributed to the participants. The next figure shows the mudaraba model in the context of a family takaful product.⁴ The next figure explains how mudaraba model works:

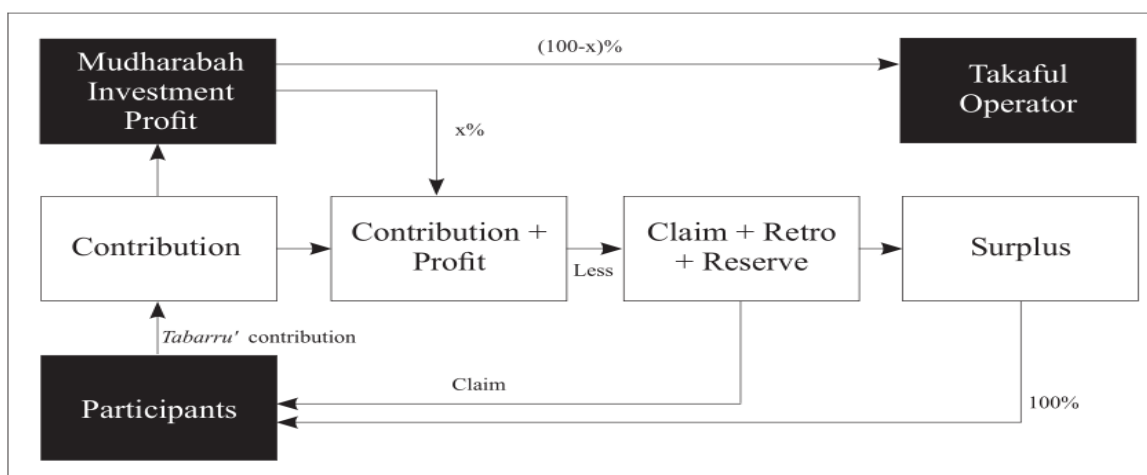
¹Ezamshah Ismail – Basic Takaful broking handbook – Malaysia, 2011.p.55.

² AAOIFI, 2010, p. 235-236.

³ PRF is a pool of tabarru funds.

⁴Dusuki, A.W - Islamic Financial System, Principles and Operations - Kuala Lumpur: ISRA, 2011. P.517.

Figure 1.3: Mudaraba Model.



Source: Mohammad Mahbubi Ali- takaful models: their evolution and future direction- Malaysia, 2016.

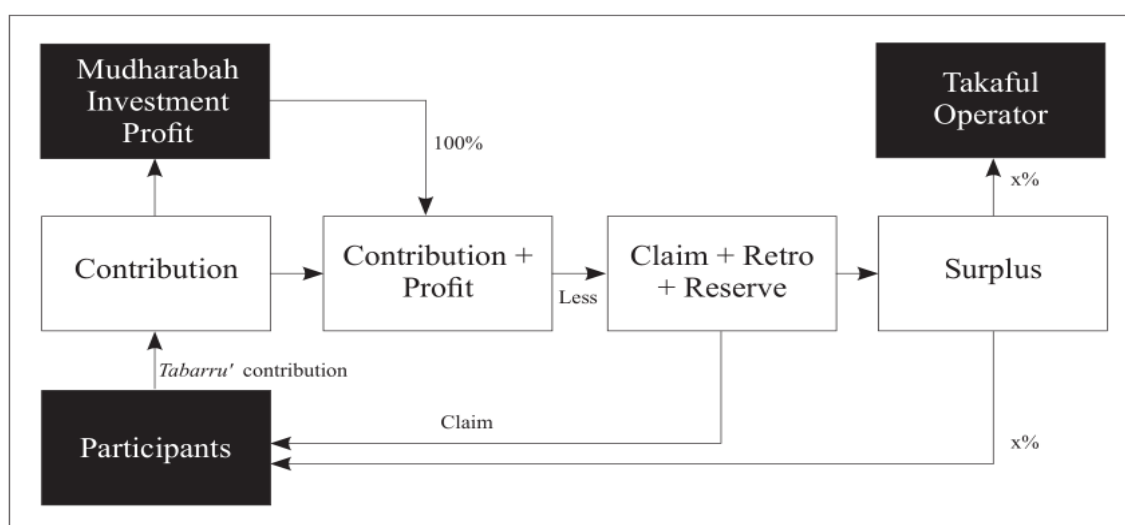
The mudaraba model allows takaful operators to share in profit in line with a pre-agreed ratio but not in underwriting surplus. The absence of surplus sharing renders this model commercially unviable. This model, therefore, was altered to become a modified mudaraba which construed the underwriting surplus as the ‘mudaraba profit’.¹ Operationally, this allowed the profit from investment activities to be pooled into the PRF, from where it could be used for claims, Retakaful and reserves. The remaining balance was then treated as the underwriting surplus and shared between the takaful operator and participants at an agreed ratio. The application of the mudaraba model within the takaful industry has provoked considerable criticism. Some specialists argued that the mudaraba concept is highly suitable for banking but not for insurance.² Takaful is established on the notion of mutual assistance and achieving societal goals, while mudaraba is a commercial-based contract. They are therefore two different concepts with completely different objectives. Ultimately, the application of mudaraba in the context of takaful brought some questions to the fore. Firstly, from the Sharia’ah point of view, is it possible to treat tabarru contributions concomitantly as mudaraba capital? For instance, tabarru causes the loss of the donor’s ownership, while in a mudaraba contract the capital providers retain ownership. Second, in the case of a deficit, does obliging the takaful operator to inject money into the fund go against the essential concept of mudaraba? A mudaraba contract is a trust contract in which the

¹Engku Ali, R.A. & Odierno, H.S. P. - Essentials Guide to Takaful (Islamic Insurance) - Kuala Lumpur: CERT, 2008. p. 46.

²Ayub - Understanding Islamic Finance – NYSE: John Wiley & Sons, 2007.p. 426.

operator is a trustee-manager and not a capital guarantor. Third, in the modified mudaraba model, is it permissible for takaful operators to take a portion of the surplus, and as is practiced by their conventional counterparts? Is, in other words, the surplus equivalent to profit? While profit is the positive outcome of a business activity, surplus is the accumulation of profit and what is left of contributions after deductions for claims, reserves and Retakaful.

Figure 1.4: modified mudaraba model

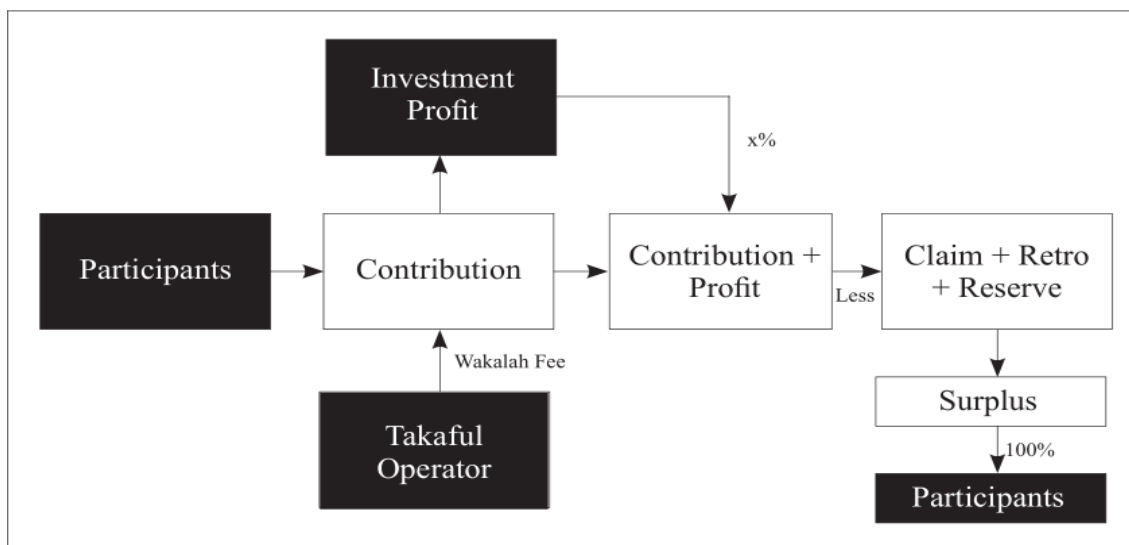


Source: Mohammad Mahbubi Ali- takaful models: their evolution and future direction- Malaysia, 2016.

11.2. The Wakala Model

The substantial criticisms and Sharia'ah issues associated with the mudaraba model pushed Sharia'ah scholars and industry players to search for an alternative. As a result, they introduced the wakala model, which takaful operators have gradually adopted. Wakala is an agency contract whereby a party mandates another party as their agent to perform a particular task. Under this model, the takaful operator serves as an agent charged with managing and investing the contributions of their participants and, in compensation, will enjoy a predetermined fee. The profit and underwriting surplus, if any, will be fully distributed to participants.

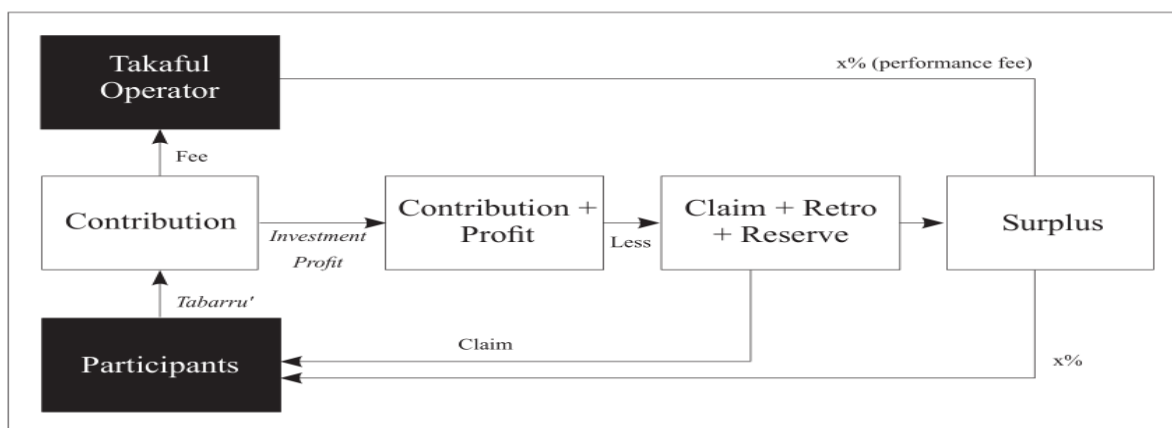
Figure 1.5: wakala model



Source: Mohammad Mahbubi Ali- takaful models: their evolution and future direction- Malaysia, 2016.

In its purest form, however, the wakala model is commercially unattractive for operators; the absence of any surplus sharing makes it unviable and has led to calls for it to be revisited. As a result, the original model has indeed been modified. In the modified version, the operator, and in addition to their entitlement to a wakala fee, takes a portion of the underwriting surplus based on performance.

Figure 1.6: modified wakala model



Source: Mohammad Mahbubi Ali- takaful models: their evolution and future direction- Malaysia, 2016

At the time the model was first introduced in Malaysia, operators took 90% of the surplus, with only 10% going to participants. This division was also applied in Saudi Arabia, where it remains in practice until the present.¹ In both places, however, it has triggered criticism: many considered the way surplus is being shared as exploitative and unjust. In response, the Central Bank of Malaysia issued guidance in the form of the Takaful Operator Framework (TOF) 2010. This stipulated that the total amount of incentive fee from the PRF payable to the takaful operators should not exceed the amount of surplus paid or accrued to participants.² In other words, a takaful operator's share of the surplus is limited to a maximum of 50%. Despite the issuance of TOF, the practice of surplus sharing under the modified wakala model still raises concerns. This is largely because the performance fee is based on the operator's capacity to underwrite the PRF. This criterion is difficult to measure and easy to manipulate. For example, to generate a large surplus the operators can make claims difficult, thereby reducing the reserve portion and/or minimizing the Retakaful contribution. Many argue that it would be fairer if the performance fee were based on the operator's ability to manage the investment fund effectively. For example, if the operator were able to generate a profit rate above 10%, they could keep the excess as a performance fee.

11.3. The Hybrid Model

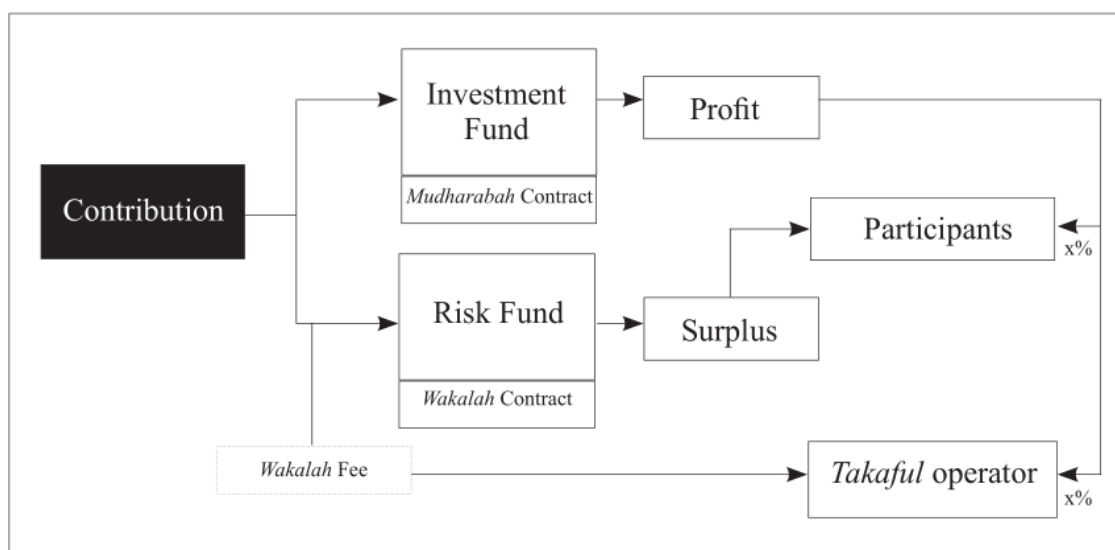
In view of the substantial criticisms directed at the practice of surplus sharing and the possibility of adopting a performance fee, industry players developed a new model: a combination of mudaraba and wakala called 'the hybrid model'. This model is normally applied to family takaful products and divides the participants' fund into two pools: PRF and Participant Investment Fund (PIF)³. The model employs a wakala contract to govern the operator's role in managing the PRF, while a mudaraba contract is used to explain the operator's capacity as an investment manager for the PIF. As compensation, the operator reserves the right to a predetermined fee for managing the PRF and a profit share for managing the PIF. In this model, the issue of surplus does not arise because all surpluses are supposed to be returned to the participants. Only a performance fee is taken from the PIF. Some takaful operators, however, still take a portion of the surplus from the PRF as an encouragement.

¹ Alpen Capital - GCC Takaful Industry Report - 12 January 2010, p. 24.

² BNM - Takaful Operational Framework - Kuala Lumpur: Bank Negara Malaysia, 2010, p. 17.

³ PIF is a fund dedicated to investment purposes.

Figure 1.7: Hybrid of Wakala and Mudaraba Model



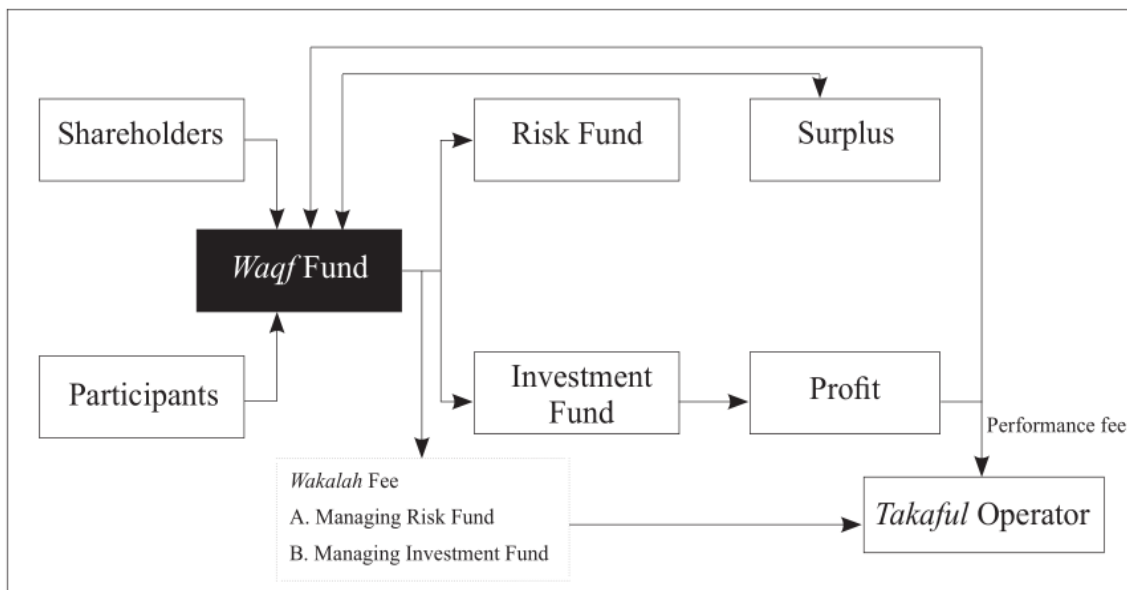
Source: Mohammad Mahbubi Ali- takaful models: their evolution and future direction- Malaysia, 2016.

11.4. The Waqf Model

Mufti Taqi Usmani, a renowned Pakistani Sharia'ah scholar, has developed a combined cash waqf and wakala contract model for takaful. This model has been successfully implemented in Pakistan and South Africa. In essence, it aims to enable individuals to assist each other in the event of catastrophe by using a waqf fund. The shareholders in a takaful company will initially place donations in order to facilitate the establishment of the waqf fund. Simultaneously, participants contribute a sum of endowment to the fund. Thus, the fund consists of two sources: a fund established by the shareholders and another established by the participants. Throughout the process, the takaful operator serves as an agent (wakil) for both shareholders and participants, helping to manage the fund and pay claims. Along with, they act as an investment agent to help invest the fund in Sharia'ah-approved business activities. As payment, the operator will be entitled to a certain percentage of a predetermined wakala fee in addition to a performance fee. The proceeds of the waqf fund will be used to assist any participant who experiences misfortune and/or catastrophe.¹

¹ Ibid, p. 15

Figure 1.8: Waqf Model



Source: Mohammad Mahbubi Ali- takaful models: their evolution and future direction- Malaysia, 2016.

There are at least two main concerns surrounding the application of this model. First, the introduction of cash waqf into the operation of takaful undermines the fundamental objective of waqf. Thus, waqf should ideally provide benefit for both the poor and the rich. In takaful, however, only the rich (participants) will benefit. Second, inflation and the possibility of loss when investing the waqf fund could diminish the value of that fund, contradicting the perpetual nature of waqf.

12. Retakaful

Retakaful comes as an alternative to the re-insurance.

12.1. Definition

The Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) defines Retakaful as “a contractual arrangement under which the reinsurer will be liable for part or all of the risks that the insurer has insured. The insured legal right will not be affected by the reinsurance arrangement and the insurer is liable to the insured for paying claims as per the insurance policy terms and conditions.” In other words Retakaful is a risk management tool used by takaful operator to share some of their

insured risks to other third parties, which can be another takaful operator or a specially-formed Retakaful operator.¹

12.2. Retakaful functioning

Retakaful operates the same way that takaful does. The only difference is that participants (policyholders) of regular takaful products are individuals, businesses, and other commercial organizations. In a Retakaful contract, participants (policyholders) are various takaful companies, and the fund operator is the Retakaful Company. Of course, Retakaful companies need to operate according to sharia law and must make any investments or hedges accordingly.

The takaful operator and the Retakaful operator sign the Retakaful contract. The original policyholders of the takaful products aren't directly involved in the Retakaful contracts (even though the Retakaful premiums are paid using a portion of the takaful policyholders' fund). If a takaful operator faces insolvency because of unexpected claims by its participants, the Retakaful operator provides a qard hasan (interest-free loan) to cover the liability. The loan amount must be paid in subsequent years or is deducted from any Retakaful surplus belonging to the takaful operator in the following year. The contributions or premiums collected by the Retakaful company from the takaful operators are invested based on the wakala, mudaraba, or wakala-mudaraba combined contract, and profits and fees are shared between the takaful and Retakaful companies based on the specific contract agreement.²

12.3. Retakaful Purchase reasons

The benefits of Retakaful to the Takaful operator are quite similar to those in conventional reinsurance:

- Enables the Takaful operator to balance out its portfolio of risks. By selectively ceding out its peak risks, the Takaful operator is able to withstand losses or damages from the occurrence of particular events.
- The Retakaful operators also have a wealth of technical expertise that takaful operators can utilize in underwriting complex risks

¹Serap O. Gönülal - Takaful and Mutual Insurance Alternative Approaches to Managing Risks - 2012.p.177

² www.dummies.com (08-04-2020 12 :21)

- Retakaful also ensures the diversification of the exposure of the takaful operator.

12.4. Types of Retakaful

Just like conventional reinsurance, Retakaful can be obtainable in two ways i.e. Treaty Retakaful or Facultative Retakaful:¹

- **Treaty Retakaful:** This form of Retakaful contract offers automatic coverage for all risks written by the ceding Takaful Operator that fall within the terms of the Retakaful contract and subject to the limits and exclusions.
- **Facultative Retakaful** Contracts on the other hand cover the ceding Takaful operator for individual risks that either exceed the capacity of the treaty arrangement or are not covered under the terms of the treaty arrangement. The Retakaful Operator has the liberty to accept or decline the individual offers.

12.5. Spotting some of the players in the Retakaful industry

Like the rest of the Islamic finance industry, the Retakaful industry is relatively new when compared to conventional insurance; Retakaful came into existence only in the late 1970s. Retakaful operators take two business forms: They exist either as independent companies or as *windows* (arms or divisions) of conventional reinsurance companies. The first independent Retakaful operators to set up shop were these:

- 1979: Sudan National Reinsurance Company
- 1983: Sheikhan Takaful Company in Sudan
- 1985: Islamic Insurance and Reinsurance Company in Bahrain and Saudi Arabia
- 1985: BEST RE in Tunisia

Other independent Retakaful operators now do business all over the world from the Bahamas, Egypt, Iran, Kuwait, Malaysia, Saudi Arabia, Singapore, and United Arab Emirates etc. The following conventional reinsurance companies provide Retakaful window facilities:

- Mitsui Sumitomo (headquartered in Tokyo, Japan)

¹ www.linkedin.com (07-04-2020 15:47)

- Swiss Re (headquartered in London, England)
- Kuwait Re (headquartered in Kuwait City)
- Hannover Re (headquartered in Hannover, Germany)
- Trust Re (headquartered in Bahrain)
- Labuan Re (headquartered in Malaysia)¹

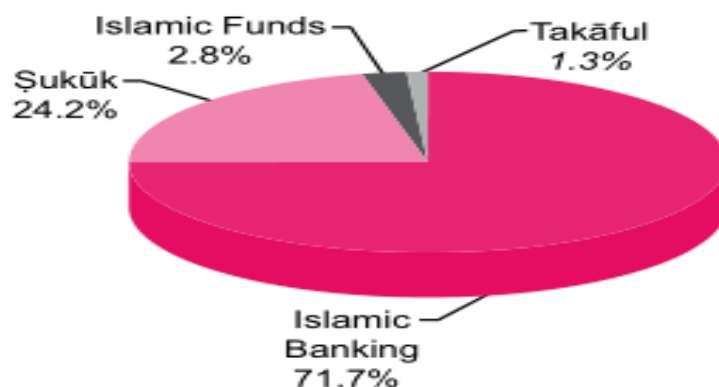
13. World takaful market

Takaful is a strong industry that has known a remarkable development over the years, here we present some numbers:

13.1. Takaful's share in Islamic financial market

Takaful industry occupies the smallest share of the Islamic financial market in the world with a share of 1,3% and gross contributions of the global takaful industry recorded at USD 27.7 billion in 2017.²

Figure 1.9: takaful's gross contribution in the islamic financial market



Source: IFSB Secretariat Workings 2019

13.2. Number of takaful operators and windows globally

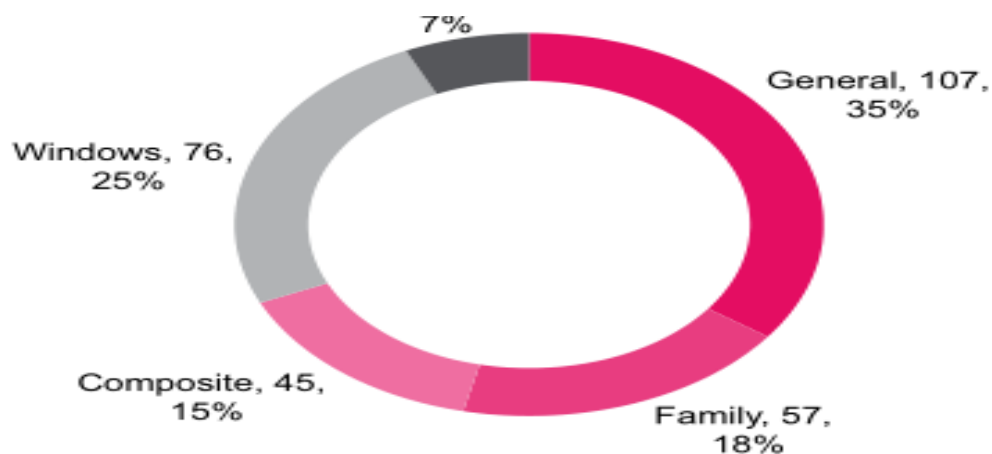
In reference to the recently published Global Takaful Directory 2019, the total number of takaful institutions is estimated at 306, including Retakaful and takaful windows offering takaful products in at least 45 countries. The majority of these countries have

¹ www.dummies.com (08-04-2020 12 :21)

² Islamic financial services industry stability report 2019 p.10

developed specific regulations on the sector, designed for the development of the takaful market¹.

Figure 1.10: Number of Takaful Operators and Windows globally (2018)

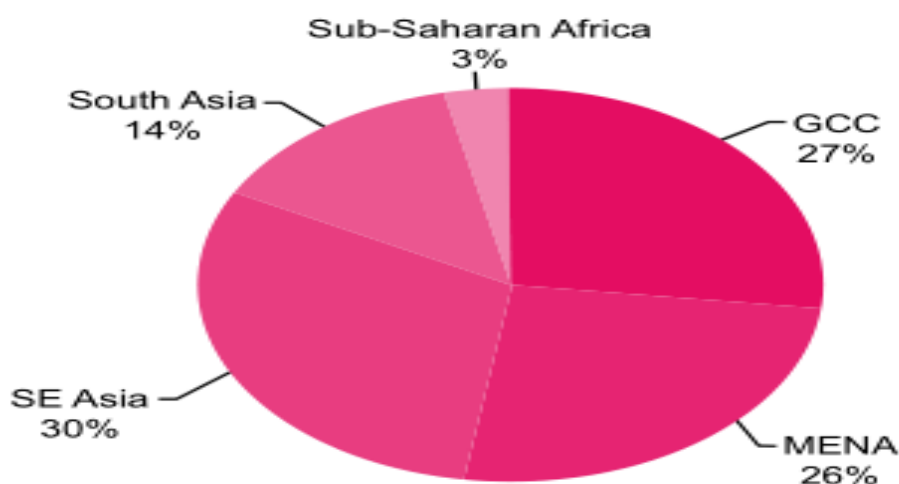


Source: IFSB Secretariat Workings 2019.

By region, South-East Asia has the largest number of takaful institutions (30%), followed by GCC and MENA with 27% and 26%, respectively. Given the significant presence of Muslim populations in these countries, takaful has significant opportunities to provide sound financial protection that is in line with consumers' religious sensibilities. However, the success of takaful operators depends on establishing strong business profiles, as more established insurers are already benefiting from greater brand awareness and established distribution networks. Furthermore, additional support from Sharia'ah scholars in promoting takaful products is essential for the growth of the takaful sector.²

¹Ibid.p.31

² Idem.p.33

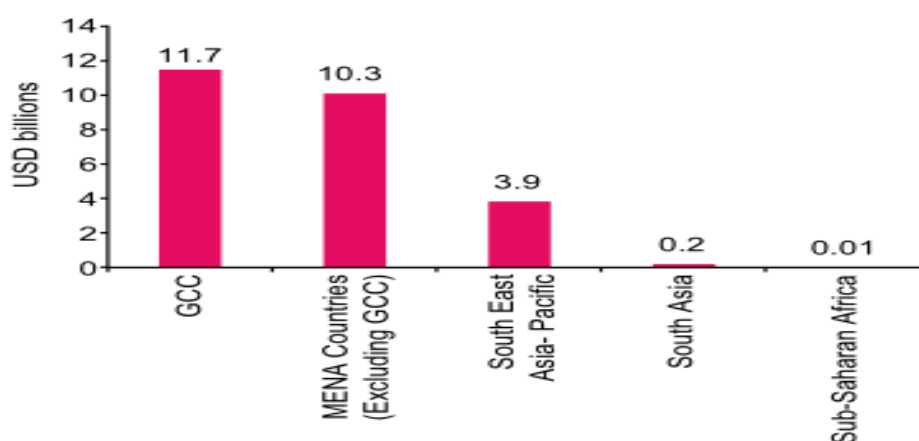
Figure 1.11: Number of Takaful Operators by Region (2018)

Source: IFSB Secretariat Workings 2019.

13.3. Global Takaful Industry

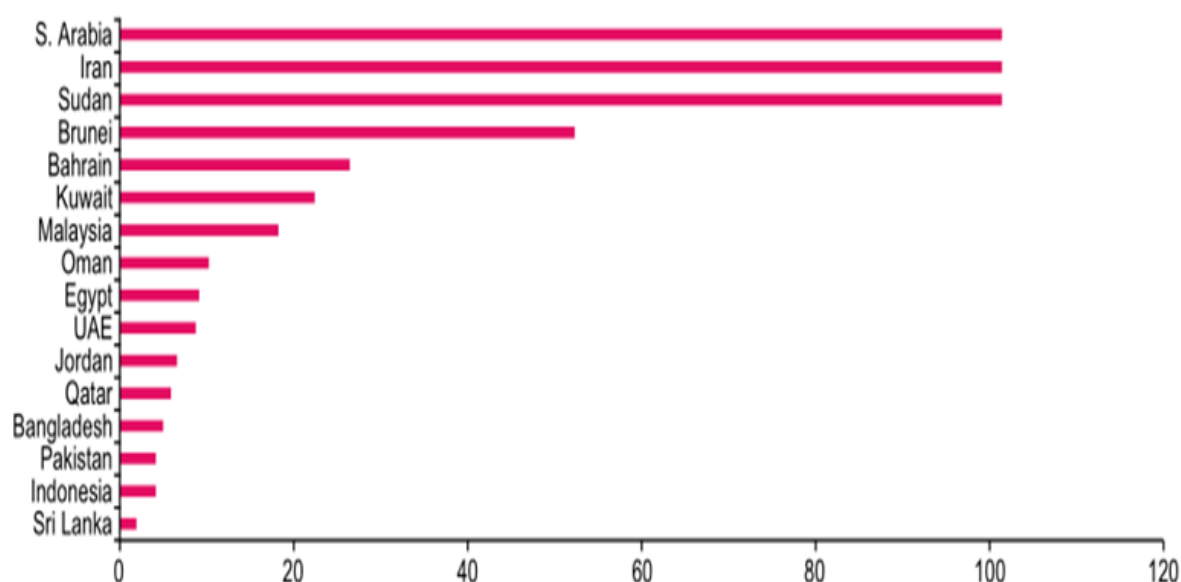
According to the Islamic financial services industry stability report 2019 the total takaful contributions grew by 4.3% in 2017 to an estimated USD 26.1 billion, from USD 25.11 billion reported in 2016. By region, the GCC retains its lead in 2017 as the largest global takaful market, with contributions estimated at USD 11.71 billion, accounting for over 44% of the total global contributions, followed by the Middle East and North Africa (ex-GCC) (USD 10.30 billion) at 31.4%; South and Pacific Asia (USD 5.2 billion) at 22%; and sub-Sahara Africa (USD 0.5 billion) at 2%. Country-wise, Iran, Malaysia, Saudi Arabia and the UAE are the major Islamic insurance markets, accounting in total for more than 87% of total contributions in 2017. The total contributions from general and family takaful in 2017 are estimated (in USD nominal value) as USD 7.159 billion (72.6%) and USD 18.94 billion (27.4%), respectively. Takaful in Turkey received a boost following the implementation of the participatory insurance regulatory framework. Similarly, in Algeria, Morocco, and Tunisia, takaful regulations are presently being drafted.¹

¹ Islamic financial services industry stability report 2019 p.29

Figure 1.12: Takaful Contribution by key Region (2017)

Source: IFSB Secretariat Workings 2019

The next figure illustrates countries where takaful contributions as a percentage of the insurance sector total premium were at least 2% in 2017. Three countries (i.e. Iran, Saudi Arabia and Sudan) operate a wholly Islamic insurance market; whereas, in others, the takaful sector exists alongside the conventional insurance industry. Moreover, only five countries crossed the threshold of 10% in 2017: Brunei (51%); Bahrain (26%); Kuwait (22.1%); Malaysia (18.1%); and Oman (10.1%).

Figure 1.13: Takaful Contribution/Total Sector Gross Premiums (%) (2017)

Source: IFSB Secretariat Workings 2019

13.4. Takaful in Europe and USA

Muslims number 16 million in the EU (2017), with one of the highest rates of banking and insurance penetration in the world. Muslims in Europe are among those with the most bank accounts and insurance coverage. This high penetration rate can benefit the takaful boom in this zone. In addition, there are many forms of insurance companies provided by European jurisdictions to practice both General and Family takaful while remaining faithful to the principles of mutualism and philanthropy. Recently, US insurer AIG, in collaboration with London broker Cobalt Underwriting, presented the first Takaful insurance policy for the MENA zone. This policy protects investors making mergers and acquisitions in this area from any risk of asset depreciation related to mispricing. Germany was the first western country to tap the Islamic capital markets in 2004. With the largest economy in Europe and a large Muslim population, Germany has everything to see its Islamic financial sector grow. In 2017, the first Islamic bank in continental Europe, KT Bank, opened a new branch in Cologne and INAIA Finance launched a new Family Takaful product brought by FWU. In Spain, Mussap signed an agreement with CoopHalal, Spain's leading Islamic financial services cooperative. Through this agreement, the entity will offer different Takaful products from Mussap and Previsora.¹

¹ Ezzedine Ghlamallah - European Takaful emergence - December 2017.p.62

Section 03: Comparison between conventional insurance and Islamic insurance Takaful

In this section we highlight how both conventional insurers and Takaful operators can make profit; and major differences between conventional insurance companies and Takaful companies.

1. Reasons Islamic Sharia Prohibits Conventional Insurance

An opinion was sought from a religious scholar Syed Ibn-Abdin about insurance related to sea. In his opinion it is not according to Islamic Sharia'ah that a trader pays amount of premium to insurance company so that he may be indemnified. Conventional insurance include Riba, Maisir, and Gharar which are against Islamic Sharia'ah:¹

1.1. Riba

It is used in Arabic language which means excess or addition in something. In Islam loan without interest is allowed and if interest is charged then it is Haram and against Sharia'ah however service charges are allowed .It is narrated by Hazrat Jabir (R.A),”The Holy Prophet (PPA) cursed the devourer of usury, its payer, its scribe and its two witnesses and they were equal (in sin)” (Karim).

1.2. Gharar

is uncertainty in a contract in which one party is in benefit and loss is beard by other party. Gharar may be in case of any insurance contract in which there is no idea about payment as promised or there is no idea about how much amount should be paid at the time of its payment.

1.3. Maisir

In insurance is in which policy holders invest small amount premium with hope to gain large profit and sometime due to losses they lose their premium invested and claims may be higher than contributions. Maisir refers to obtaining or acquiring something without any effort. This is done in gambling .In Holy Quran Allah has clearly declared Maisir (gambling) unlawful and there is no relaxation in it (Quran, 627 A.D).

About 200 scholars participated in a conference in Makkah and concluded that insurance practiced in conventional insurance companies is against Sharia'ah (First international conference on Islamic economics, 1976). In this conference it was also

¹ Mubbsher Munawar Khan Hassan Mobeen Alam - Comparative Analysis of Islamic and Prevailing Insurance Practices - International Journal of Business and Social Science; June 2011,p.283

concluded that Islamic insurance system is different from conventional insurance system and is according to Sharia'ah. Council of Islamic Ideology of Pakistan in 1983 rejected all the models of commercial insurance.

2. Profit of conventional insurance companies

There are five basic ways a conventional insurance can make profits. These include:¹

- Underwriting surplus: undertaking policyholders risk and retaining underwriting profits (i.e. premium received less claims outlay less operating expenses).
- Spread Management surplus: surplus/profit accrues from the difference between the cost of funds and the uses of funds.
- Information processing surplus: from transactions processing, administering financial products and programs for a fee.
- Aggregating money returns: funds under management are long-term without accepting investment risk. A larger fund results to reduced management fees and/or the performance fees as a share of positive returns. Direct marketing or distribution returns: this can arise from marketing or distribution products and/or services at a mark-up or brokerage fee.

3. Profit of Takaful operators

Considering the principles regulating Takaful, how do Takaful operators make profit? In contrast to conventional insurers, Takaful operators do not bear risk directly; but the participants (policyholders) borne their risks uniquely. Takaful operators charge fees for services rendered by managing Takaful pools or funds. Takaful operators can make profits by efficiently and effectively manage pools' expenses within regulated and pre-determined management fee structure.²

4. Takaful VS conventional insurance:

Both types of insurance companies have some common features and disagreement as follow:

¹Fadun, Olajide Solomon. Op. Cit p.19

²Ibid.p.20

4.1. Points of convergence

The first point is the "solidarity" aspect, in both forms of insurance. The insurer assists the insured who cannot face the risks alone and during particular moments. The member-policyholders show solidarity with each other, there is mutual assistance.

The second point is the improvement of the economic well-being of the insured through insurance. Indeed, this allows a better allocation of risks and a good distribution of the budgets of the policyholders or member-policyholders over time.

The contribution of both forms of insurance is important both at the individual and societal level. They facilitate the management and transfer of risks, they encourage savings, and they release the entrepreneurial energy of insured and reassured investors.

The third point is participation in the financing of the economy: Since the production cycle is reversed, i.e. premiums are collected before the benefit is paid out, it is important to ensure the financing of the economy.¹

4.2. Points of divergence

The fundamental difference between Takaful and conventional insurance is rooted in the type of contract. The conventional insurance contract is basically constructed between two parties, namely the insured and an insurance company. The insured deals with the insurance company by paying regular installments (premium) in return for the guarantee to pay compensation, in case the event stipulated in the contract happens. It is thus one of the probabilistic contracts since the compensation is contingent on events that may or may not occur. This definition and nature of conventional insurance invoke many Sharia'ah issues.

Takaful differs from conventional in the sense that the Takaful operator is not the insurer insuring the participants. In fact the persons participating in the scheme, or Takaful participants, mutually insure one another. This is the essence of Takaful that signifies mutual guarantee, help and cooperation with one another. The Takaful operator simply functions as administrator of the Takaful fund and whose responsibility includes managing and investing the fund according to Sharia'ah principles.

The Takaful Industry Report recognizes that the sharing of responsibility between the shareholders and policyholders is the exclusive difference between Takaful and

¹ AMIROU Rabah. Op. Cit, p.38

conventional insurance. Earlier, in 1965, the Congress of Islamic Research in Cairo also has discussed the legitimacy of insurance in the Islamic world. In the First International Conference on Islamic Economics held at Mecca, Saudi Arabia in 1976, international consensus was reached that insurance for profit is contrary to the Sharia'ah. This was confirmed by the Islamic Fiqh Academy at Jeddah in 1985. "The contract of commercial insurance with periodical fixed premium provided by the present day insurance companies is a contract which is void and therefore haram in accordance with the requirement of Sharia'ah." The European Council for Fatwa and Research has reaffirmed the rulings: "Commercial insurance is originally haram as agreed upon by most contemporary scholars. It is well-known that in most non-Islamic countries there are co-operative and mutual insurance companies. There is no harm from the Sharia'ah point of view to participate in these activities."¹

The next table shows the main differences between Takaful and conventional insurance:

Table 1.3: Main differences between Conventional and Takaful insurance

Conventional Insurance	Takaful operators
Sources of laws and regulations are set by state and man-made,	Sources of laws are based upon Divine revelations (holy Quran and Hadith),
Profit-motive, maximizing returns to shareholders,	Community well-being optimizing operations for affordable risk protection as well as fair profits for the operator,
Profit and/or bonus units to be returned to policyholders as determined by managers and board of insurer,	Takaful contract specifies in advance how and when profit/surplus and/or bonus units will be distributed,
Initial capital supplied by shareholders,	Initial capital supplied by Rabb al Mal (agent) or paid via premiums from participants,
Separation of policyholder and insurer with	Coincidence of interests between

¹ Suria Zainuddin, IzyanNadiyahMd Noh - An Overview of the Emergence of Takaful: An Islamic Type of Insurance Policy- International Journal of Business and Economics Research, 2013.p.114

differing interest,	policyholder and operator as appointed by participants,
Transfer of losses among insurance pools and from policyholders to shareholders,	Losses related within classes of business written and sole obligation of participants,
Right of insurable interest is vested in the nominee absolutely in life insurance,	Right of insurable interest is determined by Islamic principles of Faraid (inheritance),
Insured may elect cost or replacement cost valuation and claim accordingly whether or not rebuild property,	Insured may not “profit” from insurance and entitled to compensation only for repair or rebuild or replacement,
Agents and brokers are typically independent from insurer and paid a fee from the premium charged to policyholders that is not disclosed,	Agents are employees of the Takaful and any sales commission should be disclosed,
Investment of premiums conducted by insurer with no involvement by policyholders,	Takaful contract specified under principles of mudaraba how premiums will be invested and how results are shared. Under wakala, similar practice plus participant can direct his investments into a range of unitized funds,
Insurer invests premiums consistent with profit-motive with no moral guidelines, hence co-existence of Riba and Maisir,	Takaful invests premiums in accordance with Islamic values and sharia’ah guidelines,
Dissolution- reserves and excess/surplus belong to the shareholders,	Dissolution-reserves and execs/surplus could be returned to participants, although consensus opinion prefers donation to charity,
Taxes-subject to local, state, and federal taxes,	Taxes-subject to local, state and federal taxes (if any) plus obligated to arrange annual Zakat donations to charity,
Benefits paid from general insurance account owned by insurer,	Benefits paid from contributions made by participants as mutual indemnification,
Accounting consistent with GAAP and prevailing statutory rules auditing for	Accounting standards consistent with national rules plus prevailing statutory rules,

uniform application of accounting standards.	auditing same standards plus conformance with Islamic rules, typically with sharia'ah advisory oversight.
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Source: Ilham iddin Ikramovich Nazarov - A Conceptual Understanding and Significance of Takaful (Islamic Insurance): History, Concept, Models and Products –Malaysia, 2019.

The main differences between the two types of insurance are focused in the nature of the contract.

5. Takaful insurance and mutual insurance:

Mutual and Takaful insurance present some similarities and also differs from one another, here we detail some of the similarities and differences:¹

5.1. The similarities

The principle on which Takaful insurance is based is in line with the logic of mutuality. The insured pays a contribution to the insurer which can be assimilated to a donation. In return, the insurer undertakes to compensate the insured for the loss suffered by the insured if the dreaded event, which is the subject of the contract, occurs. The difference is that if the event does not occur, the insured is entitled to receive the totality of what he initially paid. In fact, it is the community of insureds that benefits from this right: all donations are pooled, as are claims.

The mechanism is identical to that of the variable-contribution mutual, which must, at the end of the financial year, refund to its member-policyholders the excess amount received over the claims paid. As for our variable-contribution companies, and for the same economic and practical reasons, Islamic insurance companies do not refund surpluses to their member-policyholders. They use them to strengthen their financial strength or to lower future premiums. Because the profits are shared equally between the policyholders and the insurer, the mechanism escapes the prohibition of interest. Takaful appears to be similar in appearance to the concept of a traditional mutual insurance company, but a closer look reveals that the vast majority of Takaful companies today operate as public limited companies. Unlike traditional mutual insurance companies, these companies are indeed hybrid, profit-making and capitalized

¹Mohamed Ali KHOUAJA Takaful - Le chemin islamique à l'assurance Développement d'un outil de tarification Takaful Auto – RC, Université de Cadi Ayyad, 2015 .p.50

like any ordinary joint-stock company. The mutuality element is reduced to the Takaful fund, where contributions are collected and investment gains.

5.2. Difference between Takaful and mutual insurance

The following table explains some differences between Takaful and mutual insurance:

Table 1.4: Main Differences between Takaful and Mutual insurance

	Takaful	Mutual
Contract	Donation/mutual contract	
Responsibility of the company	Payments on funds collected; snacks The deficiency can be borrowed without interest (Qard Hassan)	Payment from funds raised
Responsibility of the participants	Pay contributions	Pay premiums
shareholder equity	Capital contributed by participants	Capital contributed by shareholders
Investment	Must be Sharia-compliant	No restrictions other than prudentially.

Source: Mahmood, N. R - Takaful: The Islamic System of Mutual Insurance: The Malaysian Experience – 1991.

To conclude, Conventional insurance, the relationship between the insurer and the insured is that of buyer and seller. This is not the case with Islamic insurance; Takaful promotes shared responsibilities, solidarity, mutual assistance and cooperation to protect participants.

Conclusion

Conventional Insurance is an important activity in the national and international economy because of its virtues of financial protection granted to natural and legal persons against the risks or hazards they incur.

Takaful is a new kind of insurance, combining the principles of conventional insurance and Islamic ethical values. This makes it an attractive alternative to conventional insurance. In the other hand both of them are growing strongly making the insurance industry worldwide one of the most rentable and strong sectors.

As has been shown, conventional insurance is divergent from Takaful. The differences between Islamic and conventional insurance were found mainly in governance and concepts, in the ownership and financing of the company, management, etc., in which the premiums are invested. However, conventional insurance and Takaful were found similar in some of the elements. Both of them are utilized as a protection in the event of unforeseen incidents and the contributions that must be made to start the coverage.

Chapter 2:
Concept of efficiency
and its measurement

Introduction

The role of the financial sector in the economic development of any country is very significant so an effective and productive insurance sector ultimately contributes to a nation's economic growth. Consequently insurance is a very important segment of the economy of most countries and in the current era of globalization they operate within a very competitive environment, In order to be successful in such an environment they must carry out their activities efficiently and hence it is important to determine how well insurance companies perform and how viable they are for the benefit of other industries and indeed national economies.

Efficiency is a main determinant of a company's viability in that it represents the company's capability to create outputs (such as premiums and investment income) incorporating inputs (such as administrative and sales staff and financial capital). In the last decade, more studies have begun to address the issues of insurance companies' efficiency using numerous approaches primordially using DEA a non-parametric approach allowing to determine the efficiency frontier of a giving sample.

The aim of this chapter is to define the concept of efficiency its relation to performance and some notions related to it, as well as its measurement methods which include the DEA method. Also we will spot the light on the specifications of efficiency measures in insurance industry and how it can be measured with DEA by presenting some works that has been done in this context and explain the method and its characteristics. This chapter is divided into 3 sections as follow:

- Section 01: key performance and efficiency concepts.
- Section 02: Generalities on DEA method.
- Section 03: Data envelopment analysis: literature review.

Section 01: Key Performance and efficiency Concepts

In this section, the notion of efficiency will be addressed by providing definitions of the term, followed by a discussion of the types of efficiency that researchers have identified. Also, we will look at how we have moved from performance measurement to efficiency measurement, and the methods used to assess efficiency, beside that we will discuss some of the specifications of insurance performance.

1. Definition of performance

Performance has been differently defined depending on the field we put it in, it might mean the excellent result of an action (mechanical systems); the result of an action, no matter if it is excellent or not (biological system) or the maximum of capability (management company)¹.

The term performance emerged in the mid-nineteenth century and was first used in defining the results to a sporting contest. In the twentieth century, the concept has evolved and developed a series of definitions that were meant to comprehend the widest sense of what is perceived through performance². Precisely we are going to be focusing on organizational performance.

Since performance is a subjective concept, it can be analyzed, defined and quantified by several approaches depending on the vision and the perception of the concept itself and the area operating in. With that being said economic performance has always been confounded with notions such as: productivity, efficiency, effectiveness, economy, earning capacity, profitability, competitiveness etc.

Here are some definitions found in the literature:

- Performance "is a great result achieved in management, economics, trade, etc.. that prints features of competitiveness, efficiency and effectiveness to the organization and to its procedural and structural components " (Verboncu I., 2005,p.162);
- Performance "is a state of competitiveness of the company, reached by a level of efficiency and productivity which ensures a sustainable market presence" (Niculescu M., 1999,p.52);
- Performance is to "achieve the goals that you have been given in convergence with the enterprise's guidelines" (Noye D., 2002.p.68). Thus, performance is not a simple

¹ Răzvan Dorin BURZ SEA - the concept of performance - West University of Timisoara Practical Application of Science, 2013 p.256.

² ION ELENA IULIANA - organizational performance – a concept that self-seeks to find itself- University of Târgu Jiu, Economy Series, 2016, p179.

finding of a result but it is the consequence of a comparison between the result and goal;¹

- According to the paper of the author Profiroiu (2001), defining performance involves "the existence of a relationship between objectives, means and results so that performance is the result of simultaneous exercise of efficiency, effectiveness and adequate budgetary process"². The content of this definition is also found in the work of the author Matei, L. (2006) and is graphically represented in the following figure:

Figure 2.1: Definition of Performance



Source: Matei, L., Management public– Second Edition, Economic Publishing House, Bucharest, 2006, page 192.

2. Performance as a function of effectiveness and efficiency

Performance is often seen as a function of two components: effectiveness and efficiency.

Performance = f (effectiveness, efficiency) or, simply: Performance = Effectiveness + Efficiency. The next table explains this approach defining performance as mentioned above:

¹ Răzvan-Dorin BURZ SEA, Op. Cit, p.256.

² ION ELENA-IULIANA, Op. Cit. p. 181.

Figure 2.2: Performance, effectiveness and efficiency

Criteria	PERFORMANCE	
	EFFECTIVENESS	+ EFFICIENCY
As a result	Extent to which the expected effect produces The extent to which the goal is achieved	The ratio of all useful effects (results) and total effort (expenses) - the higher the ratio is, the greater the efficiency is
As action	What must be done – things that must	Be done properly
As attribute	The attribute to produce the desired effects, expected	The attribute to produce more favourable effects

Source: Răzvan-Dorin BURZ SEA, Op. Cit. p.258

2.1. The concept of effectiveness

Effectiveness has been differently defined:¹

- According to Fare, Grosskopf, & Lovell (1985.p.47) Effectiveness, is defined as the quality or the degree achieved by producing a set of desired effects.
- Nicolescu et al., (1996); Burlaud and Simon, (1999) said that Effectiveness is reaching the objectives set and obtaining results that fall into defined strategy or fulfilling the required tasks.
- Morris et al., (2001.p.33) mentioned that: A company becomes operationally effective when it knows to identify, master and control the interaction between internal and external sources of development, responding as well to expectations of external partners.

So an action is said to be effective when it produces the expected effect achieved on a previously set goal. In other words, a producer is effective if its objectives are achieved, ineffective if its objectives are not. These objectives take on an economic dimension: lower costs, higher turnover, etc. business, profit margins or increased market share; but, may be of a non-profit nature, as are those of government and organizations humanitarians.

¹ Cosmin Octavian Dobrin ,Gheorghe N. POPESCU ,Veronica Adriana POPESCU ,Cristina Raluca POPESCU - the concept of performance in business organization –case of study on the employee performance in Romania business organization - BUCHAREST, ROMANIA, 15-16 november 2012, p312.

The concept of effectiveness is a measure of the extent to which the product achieved in a system comes close to the objectives explicitly set by that system. In this sense, Effectiveness is measured by the gap between desired and achieved results.¹

2.2. The concept of efficiency

Efficiency is related to the way in which an organization transforms inputs into outputs. In other words it is the (often measurable) ability to avoid wasting materials, energy, efforts, money, and time in doing something or in producing a desired result. In a more general sense, it is the ability to do things well, successfully, and without waste. In more mathematical or scientific terms, it is a measure of the level to which input is well used for an anticipated task or function (output). It often specifically comprises the capability of a specific application of effort to produce a specific outcome with a minimum amount or quantity of waste, expense, or unnecessary effort. Efficiency is often measured as the ratio of useful output to total input, which can be expressed with the mathematical formula $r=P/C$, where P is the amount of useful output ("product") produced per the amount C ("cost") of resources consumed. It is very often confused with effectiveness. In general, efficiency is a measurable concept, quantitatively determined by the ratio of useful output to total input. Effectiveness is the simpler concept of being able to achieve a desired result, which can be expressed quantitatively but does not usually require more complicated mathematics than addition.²

This study is concerned with efficiency in economics.

2.3. Effectiveness Vs Efficiency: The Importance of Distinction

Before analyzing the concept of economic efficiency, the ambiguity of the notion of effectiveness and efficiency must be pointed out. As indicated, performance covers several concepts including effectiveness, efficiency and productivity etc. We noted that many research and articles find that the terms efficiency and effectiveness are interchangeable (researchers often translate "efficiency" into "effectiveness"). However, the two concepts are distinct. March & Sutton (1997) argue that an organization can be

¹ BENZAI Yassine - Mesure de l'Efficiency des Banques Commerciales Algériennes par les Méthodes Paramétriques et Non Paramétriques - 2015/2016.p86.

² Robin C. Sickles, Valentin Zelenyuk - Measurement of Productivity and Efficiency - Cambridge University Press 2019.p.59.

very effective without being efficient and can achieve relatively high levels of efficiency without being effective¹.

Therefore, it is essential to pay some attention to the ambiguity between the two concepts. A first explanation for this ambiguity could be the ascendancy of management science as management is a product of economics; economists agree that only the concept of efficiency exists, productivity being an indicator.²

And yet the term "effectiveness" is widely used in the management literature for measure the performance of any organization (market or non-market organization) at long term. This term can be defined as the relationship between the results achieved by a system and its objectives. As a result, the closer the results are to the objectives, the more the system is effective³. To conclude The difference between effectiveness and efficiency can be summed up shortly by– Being effective is about doing the right things, while being efficient is about doing things right.

2.4. Efficiency as a measure of performance

Efficiency is a concept that refers to performance, and can be used as an indicator to measure a firm's success. For a long time, performance evaluation has been carried out by means of an analysis using ratios defined by the ratio between a quantity of outputs and a quantity of inputs. This approach has been widely used in the literature, but has shown several shortcomings, (Barnes, 1987; Smith, 1990; Fernandez- Castro and Smith, 1994). According to Yeh (1996), the major drawback of the ratio approach is the use of reference ratios that are usually set arbitrarily. In addition, it would be difficult to establish a synthetic diagnosis of the performance since the use of several ratios at the same time can lead to divergent results.

Although the ratios are useful and indicate the level and change in efficiency over time, they do not provide a clear picture of the time, they represent a final result and do not allow the sources of inefficiency to be identified, and where improvements are needed

¹ Lusthaus Charles, Adrien Marie-Hélène, Anderson Gary, Carden Fred, MontalvánPlinio - Evaluation organisationnelle : Cadre pour l'amélioration de la performance - Les Presses de l'Université Laval et le Centre de recherches pour le développement international, Canada, 2003, p160.

² Olivier De La VILLARMOIS - Le concept de la performance et sa mesure : un état de l'art -, Centre Lillois d'analyse et de la recherche sur l'évolution des entreprises UPRESA, 2001, p2.

³ Ibid, p13.

(Daley and Matthews, 2009). Sherman and Gold (1985), indicate that financial ratios aggregate several aspects of performance, which weakens their informative content. Indeed, the analysis of the performance by efficiency frontiers has shown its superiority over the by ratios, making it possible to identify good and bad practices in the sector. This would allow managers to adjust their policies and procedures in order to prevent common misconducts among firms far from the efficient border.

To clarify more the meaning of efficiency here are the definitions of some terms that can be confounded with efficiency:¹

- **Productivity:**

It is the ratio between the production of goods and services and the resources or means necessary to achieve this production. It measures the efficiency with which an entity uses the means at its disposal to achieve its goals.

- **Profitability:**

It expresses the relationship between the flow of profit and the flow of the company's activity. It concerns the performance of the activity.

- **Economy**

It consists in providing the means and necessary resources at the minimum cost for an activity, in simple words buying inputs as cheaply as possible

3. Types of efficiency in economics

We can differentiate several types of efficiency in economics:²

- **Economic efficiency:**

Refers to the optimization of resources to best serve each person in that economic state. It is an economic state in which every resource is optimally allocated to serve each individual or entity in the best way while minimizing waste and inefficiency. When an economy is economically efficient, any changes made to assist one entity would harm another. In terms of production, goods are produced at their lowest possible cost, as are the variable inputs of production.³ This concept will be detailed later.

- **Market efficiency:**

Describes how well prices integrate available information. Markets are thus said to be efficient when all information is already incorporated into prices, and so there is no way

¹ Idem.p14.

² www.investopedia.com (20-04-2020 19:29).

³ Ibid.

to "beat" the market since there are no undervalued or overvalued securities available. Market efficiency was described in 1970 by economist Eugene Fama, whose efficient market hypothesis (EMH) states that an investor can't outperform the market, and that market anomalies should not exist because they will immediately be arbitrated away.

- **Operational efficiency:**

Measures how well profits are earned as a function of operating costs. The greater the operational efficiency, the more profitable a firm or investment is. This is because the entity is able to generate greater income or returns for the same or lower cost than an alternative. In financial markets, operational efficiency occurs when transaction costs and fees are reduced.

This section will attempt to address the notion of economic efficiency, its typology and its relation to performance of organization.

4. Economic efficiency

As presented before Economic efficiency includes the ideal distribution of resources to serve every element or individual in the most ideal manner while minimizing costs.

Thus, the economic definition of efficiency, which refers to the ratio of input/output, consists of maximizing the use of resources without increasing costs, or according to Desreumaux (1992), delivering a level of production or service by reducing factor allocations, (De la villarmois, 2001). More generally, efficiency refers to the difference between the observed values and the optimal values of inputs, outputs and inputs/outputs.¹ Our study focuses essentially on the concept of economic efficiency.

In order to facilitate the calculation and evaluation of the efficiency of a productive firm, Farrell (1957) decomposed it into two entities: technical efficiency and allocative efficiency. The main purpose of this decomposition is to detect inefficiencies in a productive system, which will enable the public authorities to take the necessary measures and actions to correct and improve the performance of improper and irregular areas:²

¹ DHOUHA.N - Efficience des intermédiaires financiers : validité de la méthode DEA - thèse de doctorat, Université de Carthage, 2011, p17.

² Julien LEVEQUE et William ROY - Quelles avancées permettent les techniques de frontière dans la mesure de l'efficience des exploitants de transport urbain ? - Université Lumière Lyon 2, 2004

4.1. Technical efficiency

It refers to the production technique. Tjalling C. Koopmans (1951) was the first to propose a formal definition according to which a production unit is technically efficient. If it is possible to increase any of its outputs without reducing at least one other output or increase at least one input; or if any of its inputs cannot be decreased without increasing at least one other input or decreasing at least one output.¹

Farrell (1957), on the other hand, defines technical efficiency as production a maximum output with a given amount of inputs. However, a technically efficient firm is one that masters the technical aspects of its production and manages to offer the maximum of services with the minimum of resources.²

Technical efficiency can be decomposed into the product of pure efficiency and scale efficiency:³

-Pure technical efficiency

Refers to the ability of the firm to maximize the production for a given level of inputs or inversely, for a fixed level of output the firm aim to minimize the use of inputs.

-Scale efficiency:

it is primarily related to the notion of economy of scale, it presents the gap between what has been found and what would be achieved in a competitive equilibrium (when there is no profit), i.e., the company is efficient if it is in a situation where returns to scale are constant, just as it is inefficient when returns to scale are increasing or decreasing, in other words A decision unit is inefficient at scale if it fails to maximize its profit and therefore its marginal cost will be different from the market price.

4.2. Allocative efficiency

This type of efficiency involves the concept of factor prices, it refers to the firm's ability to choose for a level of output the combination of inputs that minimizes cost. According to Anup Agrawal and Charles R. Knoeber (1996) allocative efficiency allows for

¹ Berger, A.N. & Mester, L. J - Inside the black box: What explains differences in the efficiencies of financial institutions? - Journal of Banking & Finance, 1997. p947.

²OUAKED Lydia, OUAZAR Safia - Essai d'analyse des déterminants de l'efficience bancaire : Cas des banques Algériennes - université MOULOUD MAMMERI de Tizi-Ouzou, 2017, P33.

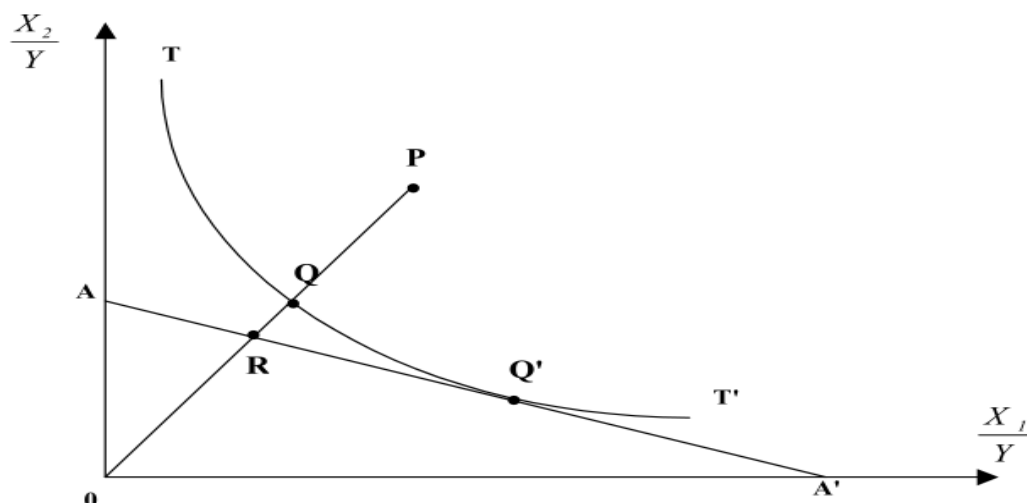
³ Ibrahim H. Kuhail - Evaluation of Academic Departments Efficiency Using Data Envelopment Analysis (DEA) and Shannon's Entropy Approaches - Islamic University of Gaza Faculty of Higher Education School of Business Administration, July 2013, p12.

provide additional performance information and refer to the ability to combine inputs and outputs in optimal proportions in view of the prevailing prices. However, a decision unit is said to be allocatively inefficient if it uses its production in erroneous proportions in view of their prices.¹

5. Economic efficiency decomposition according to Farrell

Farrell (1957) proposed the construction of a non-parametric frontier to introduce technical and allocative efficiency and how they are calculated. It considered in first, a company that uses two factors of production to produce a single product. The author assumes that the efficient production function is determined at saying that the output of an efficient business can be produced using combinations of different inputs², as shown in the figure below:³

Figure 2.3: Economic Efficiency Decomposition



Source: Farrell M. J -The Measurement of Productive Efficiency - Journal of the Royal Statistical Society, Series A, Part III, 1957, p254

The TT' isoquant represents the production frontier of all vectors (firms) "technically efficient" for a given level of output. Knowledge of this production frontier (via the DEA method) will enable us to measure technical efficiency. If a firm consumes a certain quantity of inputs, defined by point P, in order to produce a unit of output, then its

¹ Bannour Boutheina and Labidi Moez - Efficience des banques commerciales Tunisiennes : étude par l'approche de frontière stochastique - PANOECONOMICUS, 2013, p109.

² HENNI Amina - Les déterminants de l'efficience des banques des trois pays du Maghreb (Algérie - Maroc Tunisie) - Faculté des Sciences Economiques et de Gestion, Thèse en vue de l'obtention du doctorat en sciences économique, 2018, p68.

³ Gervais Thenet, Raymond Guillouzo - la conception de la technologie comme boîte noire par le contrôle de gestion bancaire: la mesure de la performance opérationnelle des agences par la méthode DEA (data envelopment analysis) - France, May 2002, p6.

technical inefficiency can be measured by the distance QP corresponding to the proportions of inputs that could be reduced without reducing the amount of output. Under these conditions, for each unit of output, technical efficiency (ET) is measured by the ratio:

$$ET = OQ/OP \quad (0 \leq ET \leq 1)$$

A value of 1 means that the firm is technically efficient. For example, point Q is efficient since it is on the isoquant. Moreover, as shown by microeconomic theory, the tangent AA' represents the iso-cost line, the slope of which is equal to the ratio of factor prices: at the optimum, it is tangent to the isoquant TT'. In this case, the combination of factors will be "allocatively" efficient if the marginal rate of technical substitution is effectively equal to the factor price. The slope AA' is therefore a measure of the firm's allocative efficiency (EA): for P, it is equal to:

$$EA = OR/OQ \quad (0 \leq EA \leq 1)$$

The RQ distance represents the cost reduction if the production was at the point Q'. The latter is allocatively efficient, since it is determined by the tangent from AA' iso-cost to TT' iso-cost. Finally, the total efficiency (ETT) which also economic efficiency is assessed for each production unit by:

$$ETT = OR/OP = OQ/OP \times OP/OQ = ET \times EA$$

6. Efficiency measures

The efficiency measurement concept reflects the company performance measured relatively to a pre-specified frontier also called "best practice" frontier. This frontier is defined through the most efficient firms in the sample. Berger and Humphrey DB (1997) distinguished two empirical methods for measuring efficiency:¹

6.1. Parametric Approaches

This approach includes 3 main methods the thick frontier approach (TFA), stochastic frontier approach (SFA) and the distribution-free approach (DFA).

¹Bilel Jarraya and Abdelfatteh Bouri - Efficiency concept and investigations in insurance industry: A survey - Sfax University, 2012, p.45-46.

✓ **Thick Frontier Approach (TFA)**

The Thick Frontier Approach is developed by Berger and Humphrey (1992) and applied in banking sector. This method is a distribution free way to estimate cost frontier based on panel data. In a first step, we sort data on the average costs. In a second step, two thick-frontiers must be estimated. One for the lowest average cost quartile of firms and the other for the highest average costs quartile of firms. In third step, one independently executes these estimated frontiers for each year in the sample. Finally, based on a comparison of the two tick frontiers, one calculates the average inefficiency of the highest quartile firms. This method is useful for regulatory conclusions since it only allows the estimation of average efficiency scores. Berger and al. (2000) and Yuengert (1993) use this method to estimate efficiency in USA insurance industry.

✓ **Distribution Free Approach (DFA)**

This method aims to estimate the efficiency score of each firm using a functional form of the frontier. Estimated scores of this firm are used to compare its average residual to the average residual of the best practice firm at the frontier. However, the stability of relative efficiencies across firms is not usually realizable (Berger & Humphrey, 1997). Therefore, this method requires fewer hypotheses, but needs several data years. Several studies use this method to investigate efficiency in the insurance industry (Ryan & Schellhorn, 2000; Meador and al., 2000).

✓ **Stochastic Frontier Approach (SFA)**

The SFA is an econometric approach based on the quantitative economy theory. This method aims to decompose the error term on two components. The first component represents the inefficiency term and it is assumed to be half normally distributed. The second component is the error term that follows a symmetric distribution (also called standard normal distribution). This method ensures that efficiency term is non-negative. Several studies apply this approach in the insurance industry (Cummins & Weiss, 1993; Yuengert, 1993; Toivanen, 1997; Berger and al., 2000; Chaffai & Ouertani, 2002; Ward, 2002; Ennsfellner and al., 2004).

6.2. Non-Parametric Approaches

Non-parametric methods which itself includes two methods the data envelopment analysis (DEA) and free disposable hull (FDH):

✓ **Data Envelopment Analysis (DEA)**

Based on the search paper of Farrell (1957), Charnes and al. (1978) have proposed the DEA method. This is a linear programming technique that examines, from a given sample, how operates a decision making unit DMU¹ compared to other units. This method aims, in a first step, to build a frontier from efficient decision making unit. In the second step, an efficiency score is calculated for each decision making unit placed below the boiled frontier. These scores are belong [0, 1], the efficient decision making unit are placed at the frontier and their scores is equal to 1. Several research works have used this method to investigate efficiency in the insurance industry (Cummins and al., 1996; Brockett and al., 1998; Carr and al., 1999; Cummins, 1999; Barros and al., 2005; Yao and al., 2007). This point will be detailed in section02 of this chapter.

✓ **Free Disposable Hull (FDH)**

Deprins and al. (1984) are the pioneers of this nonparametric method. In this context, one can classify the producers' efficiency by making a comparison between individuals' performances referring to the production possibility frontier. For a given level of input, one can observe the highest possible level of output/outcome along this production possibility frontier. Conversely, one can determine the lowest necessary level of input to achieve a given level of output. The FDH is characterized by its parsimonious approach in building the production frontier. This method doesn't depend neither on a previous specification of the production function nor on any restriction imposed to the frontier shape. The best-known application of this method in the insurance sector is led by Cummins and Zi (1998).

6.3.Parametric vs non-parametric methods

Most researchers interested in efficiency measurement agree that frontier-based techniques (DEA, SFA, TFA, DFA ...) are more relevant than standard financial ratios, and despite the vast amount of research conducted, no preferred technique has emerged.

The parametric approaches impose a particular functional form (and associated behavioral assumptions) that presupposes the shape of the frontier. If the functional form is miss-specified, measured efficiency may be confounded with the specification

¹ Decision making Units (DMUs): They are the economic entities or units whose efficiencies will be measured by the model; those units should be homogeneous, work in the same field and have the same inputs and outputs variables.

errors. The nonparametric studies impose less structure on the frontier but commit the sin of not allowing for random error owing to luck, data problems, or other measurement errors. If random error exists, measured efficiency may be confounded with these random deviations from the true efficiency frontier. As seen below, the conflict between the nonparametric and parametric approaches is important because the two types of methods tend to have different degrees of dispersion and rank the same financial institutions somewhat differently. It is not possible to determine which of the two major approaches dominates the other since the true level of efficiency is unknown.¹

According to Kalaitzan donakes, Shunxiang & Jian-chu (1992), the non-parametric approach has a number of advantages over parametric approaches including next three:²

- ✓ It does not impose an ad-hoc functional form on the production function;
- ✓ It imposes no restrictions on the distribution of inefficiency;
- ✓ It allows the estimation of production frontiers in multi-product and multi-facility situations; and for multiple inputs without imposing additional restrictions.

However, some criticisms have been made of the non-parametric approach.

- ✓ The frontier function obtained by the non-parametric measures is deterministic; this means that any deviation that a firm shows from this frontier is attributed to inefficiency: no random variation is possible.
- ✓ The frontier function estimated by such techniques has no property statistics to test hypotheses.
- ✓ The frontier function estimated using these techniques is very sensitive to extreme observations, which are largely responsible for the determination of this border.

7. Performance appraisals of insurance companies

The notion of performance is fundamental when we are interested in knowing the position of an entity and its ranking in relation to others in the same activity. It is a question of achieving what it wanted to do at the beginning but at the lowest cost. As an organization, the insurance company is also concerned about its performance and seeks to be more efficient than others. The management control system makes it possible to

¹ Allen N. Berger David B. Humphrey -Efficiency of Financial Institutions: International Survey and Directions for Future Research- January 1997.p.8.

² BENZAI Yassine, Op. Cit.p.89.

evaluate and measure performance while relying on the three pillars: effectiveness, efficiency and relevance. This helps to make a comparison between the existing services within the company, detect errors and implement instruments and suggestions to participate in making the right strategic and operational decisions.¹

In the past, specialists have relied on financial analysis tools to measure the performance, but today these methods have become insufficient. Hence, we record new techniques developed to reduce previously marked imperfections, except that there is no consensus on how to proceed. Some of the best known performance measurement tools include the dashboard which is a summary document that summarizes all the indicators financial and non-financial information, the activity based costing method ABC which is a method used to measure the costs of each activity also the new tool used is benchmarking which is a system of systematic comparisons of the performance of the company, or of some of its functions, with the outside world, and the DEA method we are using in our study is a sort of benchmark in term of efficiency.²

- **Insurance ratios and key indicators**

Key figures are important tools for analyzing the characteristics and health of each company. In particular, they are widely used by external financial analysts. They seek to measure the health and performance of the company either to give an opinion in terms of stock market valuation or to assess the insurer's ability to meet its commitments. Here some of the ratios that might be used:³

- **Loss ratio (S/P)**

Gross claims expenses N / Earned premiums N

The lower the ratio, the more profitable the insurance company and vice versa. If the loss ratio is above 1, or 100%, the insurance company is likely to be unprofitable and may be in poor financial health because it is paying out more in claims than it is receiving in premiums.

¹ Ibid.p.19.

² M. GERVAIS - Contrôle de gestion - 8ème édition, Ed. Economica, Paris, 2005, p.446

³ www.cours-assurance.org (25-05-2020 00.02).

This ratio, which is widely used in non-life insurance, reflects the cost of claims relative to premiums. Other ratios and indicators are also calculated internally to monitor and analyze the cost of claims:

- **Combined ratio (Ratio combined)**

The combined ratio is, together with the claims ratio, an important element of financial analysis and communication in non-life. It combines the claims ratio and the expense ratio.

Gross claims expenses N / Earned premiums N + Management expenses N (excluding claims handling expenses) / written premiums N

It measures of profitability to understand how an insurance company is performing in its daily operations. The combined ratio is typically expressed as a percentage. A ratio below 100 percent indicates that the company is making an underwriting profit, while a ratio above 100 percent means that it is paying out more money in claims that it is receiving from premiums. Even if the combined ratio is above 100 percent, a company can potentially still be profitable because the ratio does not include investment income that's why many insurance companies believe that the combined ratio is the best way to measure success because it does not include investment income and only includes profit earned through efficient management.

- **Financial revenue ratio**

This ratio measures the contribution of the financial result to the underwriting result expressed in percentage of premiums written.

Financial result N / Written premiums N (or earned premiums)

- **Liquidity ratio**

Liquidity ratio = Available cash or cash equivalent / Short-term debt

This indicator measures the amount of cash available to cover "short-term" obligations.

- **Solvency ratio**

Solvency Ratio = Admitted Assets / Liabilities =

The general solvency ratio reflects the financial strength of the insurance company and its ability to pay its present and future commitments.

Section 02: Generalities on data envelopment analysis DEA method

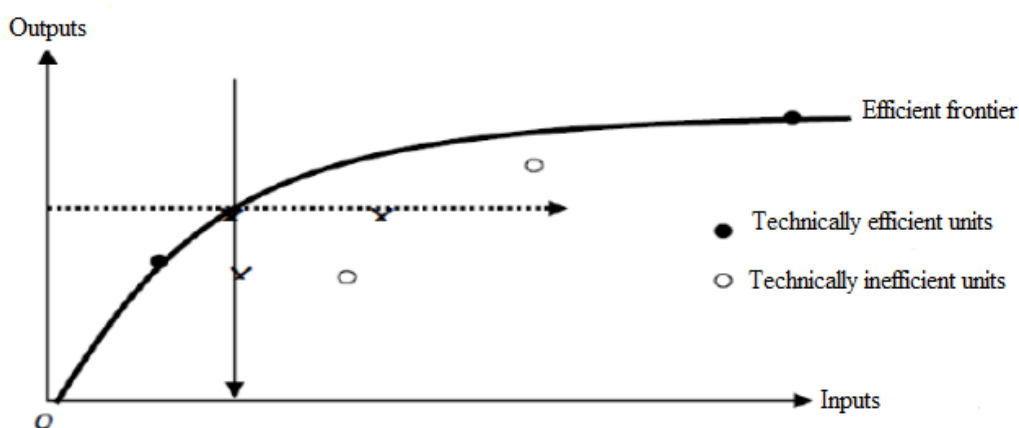
For the aim of the best application of DEA, it is necessary to make clear some of the main aspects relating to this method. In this next section we will try to define it with and determine its characteristics and specify the details of its application in general and in insurance industry.

1. DEA definition

The DEA was defined by Charnes, Cooper and Rhodes (1978) as a mathematical programming model applied to observational data that provides a new means of obtaining empirical estimates of relations, such as production functions and/or areas of efficient production opportunities that are the cornerstones of the modern economy. DEA is a relatively new data-driven approach to evaluating the performance of a set of peer entities called Decision-Making Units (DMUs) that convert multiple inputs into multiple outputs (Olivier et al 2005). It is also a method used to measure efficiency in cases where multiple input and output factors are observed and where it is not possible to transform them into an overall input or output factor.¹

It determines an efficient deterministic frontier from the comparison of relatively homogeneous units by assuming that each entity produces outputs from inputs in a given population taking into account several dimensions simultaneously.²

Figure 2.4: Principle of the DEA method



Source: made by us by reference to P-Y. BADILLO et J-C PARADI - la méthode DEA : analyse des performances - HERMES, Paris, 1999, p29.

¹ Ibrahim H. Kuhail, Op. Cit.p.15

² J-M. Huguenin - Data Envelopment Analysis (DEA).Un guide pédagogique à l'intention des décideurs dans le secteur public- IDHEAP - Cahier 278, 2013, p 10

2. Origins of the DEA method

The DEA method was developed by Charnes, Cooper, and Rhodes in 1978 who published the first scientific article on DEA in the journal *Management Science*. In fact, it finds its origins in the doctoral thesis of Edouard RHODES under the direction of W.W. COOPER. This thesis dealt for the first time with the problem of the efficiency of multi-input and multi-output firms. It is considered as a generalization of the work of FARELL 1957 and of FARRELL and FIELDHOUSE in 1962. E. RHODES' thesis sought to evaluate the performance of the "Follow Trough" program, an educational program for disadvantaged students undertaken in American public schools. The analysis consisted of a comparison of performance in a group of schools, applying and not applying the program in question. Indeed, the method is based on the calculation of the efficiency ratio, which is the ratio of a virtual output and a virtual input which are calculated by weighting the totality of the inputs, and outputs using certain estimated parameters.¹

3. Explanation of DEA method

Basically, the DEA method aims to determine the efficiency frontier of a sample made up of units called decision units (DMU), such that each one uses X_i of inputs to produce Y_i outputs, depending on the context of its activity. The technical efficiency of a DMU is the result of the ratio of a weighted sum of outputs to a weighted sum of inputs, the only condition is that this ratio must be equal to or less than 1 for all other DMUs observed.

The DEA method consists of determining efficiency benchmarks (reference production units) and situating all units in relation to these benchmarks. It proceeds by data wrapping. The units located on the envelope (or empirical production boundary) constitute the benchmarks. A distance of other units from this production frontier is a measure of their inefficiency.²

¹ C. ALI BELHADJI - mesure de performance des agences bancaires par la méthode DEA - Ecole supérieure de banque, Alger, 2014, p50.

² Laurent Cavaignac, Fabienne Villesèque Dubus - Les principaux apports de la méthode DEA à la gestion simultanée des coûts, de la qualité et des délais : résultats issus d'une simulation - Université de Nantes 2009.p.6.

In other words, DEA is a model that combines all the input and output information on the firm into a single measure of productive efficiency that lies between zero (i.e. a completely inefficient firm) and unity (i.e. a completely efficient firm). In addition, the DEA effectively estimates the frontier by finding a set of linear estimates that bound (envelop) the observed data (Leong et al., 2003). Thus, this technique is a benchmarking technique in the sense that the ‘best practice’ firms lie on the frontier and ‘envelop’ other inefficient firms (Neal, 2004).¹

4. Measurement system

To determine the distance between the production plan and the efficient frontier we distinguish two types of measures that are commonly used:²

4.1. The radial measure

It is selected when efficiency measurement is used to target individual benchmarking for each DMU observed. In other words, this measure presents the potential progression of each DMU which is linked by its level of output produced. This measure requires that the ratios between the various inputs and outputs be kept constant.

4.2. The directional measure

The choice of this measure comes into play when the objective of efficiency measurement is to benchmark between groups of DMU and obtains the performance of each unit. This measure makes it possible to improve the decision-making aspect of a branch.

5. Returns to scale

returns to scale refers to the variation or change in productivity that is the outcome from a proportionate increase of all the input that’s why the efficiency frontier obtained by the DEA method is influenced by the choice of the return of scale hypothesis, such that there are two forms :³

¹ Norma Md. Saad - An Analysis on the Efficiency of Takaful and Insurance Companies in Malaysia: A Non-parametric Approach - Dept of Economics, Kulliyah of Economics and Management Sciences, International Islamic University Malaysia, 2012.p.35.

² Ibid.p37

³ Jean-Marc Huguenin - Data Envelopment Analysis (DEA) A pedagogical guide for decision makers in the public sector - IDHEAP – Cahier 276/2012.p.9

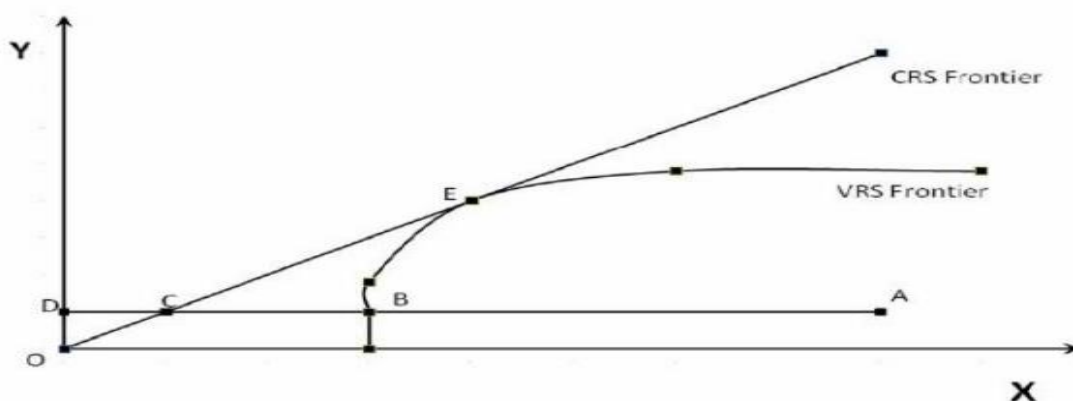
5.1. Constant Returns to Scale (CRS)

Return to scale is said to be constant, when one records a change in output in the same proportion as the change in inputs. The efficiency frontier will be in the form of a straight line.

5.2. Variable returns to scale (VRS)

Return to scale is said to be variant when one marks a change in the level of production of a different proportion (more or less proportional) of that of the level of production factors. The efficiency frontier in this case, takes the convex form.

Figure 2.5 : A presentation of returns to scale



Source: J-M. Huguenin.201, Op. Cit .p.18.

6. DEA orientation models

There exist two types of orientations: ¹

6.1. Input orientation

In an input orientation, DEA minimizes input for a given level of output; in other words, it shows how much a firm can decrease its input for a predetermine level of output.

The problem can be defined as follows:

$$\left\{ \begin{array}{l} \text{Min } C \\ \text{SC: } Y=y \end{array} \right.$$

¹ Ibid. p.13.

6.2. Output orientation

In an output orientation, DEA maximizes output for a given level of input; in other words, it indicates how much a firm can increase its output for a given level of input.

The problem can be defined as follows:

$$\left. \begin{array}{l} \mathbf{Max Y} \\ \mathbf{SC: C = Cte} \end{array} \right\}$$

In general, input oriented model closely focuses on operational and managerial issues where as output oriented model is more associated with planning and strategy.¹

The efficiency frontier will be different in a CRS or a VRS model. However, the frontier will not be affected by an input or an output orientation with whatever model it is. For example, the efficiency frontier under VRS will be exactly the same in an input or an output orientation which means Firms located on the frontier in an input orientation will also be on the frontier in an output orientation. In a CRS model, technical efficiency scores have the same values in an input or an output orientation. But these values will be different according to the model's orientation when VRS is assumed. However, Coelli and Perelman (1996, 1999) note that, in many instances, the choice of orientation has only a negligible impact upon the technical efficiency scores calculated in a VRS model.²

7. DEA models

Data Envelopment Analysis (DEA) includes several models that address different analysis and provides useful results but have different orientations. They can determine an efficient frontier that may be piecewise linear, piecewise log-linear or piecewise Cobb-Douglas (Charnes, 1994), here's a brief explanation of each model, and we note that in the following we make the following assumptions:³

- There are "n" decision making units to be evaluated;

¹ Dr. T. Rajasekar, Dr. MalabikaDeo - Is There Any Efficiency Difference between Input and Output Oriented DEA Models: An Approach to Major - Pondicherry University, 2014.p.20.

² Jean-Marc Huguenin, Op, Cit.p.10.

³ P Yue « Data Envelopment Analysis and commercial bank performance : a primer with applications to Missouri banks », 1992.p. 51.

- Each DMU consumes different amounts of "m" inputs and produces "k" outputs. The inputs and outputs are the same for all DMUs;
 - A DMU j consumes X_{ij} of inputs and produces Y_{rj} of outputs, such as $j \in \{1, \dots, n\}$, $i \in \{1, \dots, m\}$ and $r \in \{1, \dots, k\}$;
 - No DMU can produce an output without consuming inputs ($X_{ij} > 0$) ;
 - X is an input matrix of size $(m \times n)$ and Y is an output matrix of size $(k \times n)$.
- By the way, under these assumptions the main models of the DEA approach are:¹

7.1.The CCR Model

Presented by Charnes, Cooper, and Rhodes 1978 this model is based on an evaluation with a production technology and a constant output of scale, as well as than a linear fragmentation efficiency frontier. The model can be developed with input or output orientation. In the first case, we assume the possibility of reduction of inputs with a constant output, and in the second case we invert the trend.

- Input orientation of CCR model:

In this model we make the following assumptions:

- There is a strong convexity of the production set;
- The technology is at constant returns;
- There is a free availability of inputs and outputs.

We introduce the DEA method in the form of a ratio that links all the outputs and inputs from each decision-making unit. And we note:

$$\theta = U' Y_i / V' X_i$$

And we note:

U' : the vector $(m, 1)$ of the weights associated with the outputs;

V' : the vector $(k, 1)$ of the weights associated with the inputs;

X_i : the vector $(k, 1)$ of the observed quantities of inputs of the assessed MISP;

Y_i : the vector $(m, 1)$ of the observed quantities of outputs of the MISP being evaluated.

The problem is to determine the optimal set of weights for each decision unit by solving a linear programming problem:

$$\left\{ \begin{array}{l} \mathbf{Max} \ U \ V \ (U' Y_i / V' X_i) \\ \mathbf{SC} : \ U' Y_i / V' X_i < 1 \quad i = 1, 2, \dots, n \text{ et } U, V > 0 \end{array} \right.$$

¹ BENZAI Yassine, Op. Cit p.79.

The resolution of the previous system admits an infinite number of solutions. To this end, Charnes et al (1978) used linearization of the program by introducing the constraint $V' Xi = 1$. The program is then written as follows

$$\left\{ \begin{array}{l} \mathbf{Max} \ U \ V \ (U' \ Y_i) \\ \mathbf{SC} : \ U' \ Y_i - V' \ X_i < 1 \\ \quad \quad \quad V' \ X_i = 1 \quad \quad \quad i = 1, 2, \dots, n \text{ et } U, V > 0 \end{array} \right.$$

By applying the principle of duality, the program can be rewritten as follows:

$$\left\{ \begin{array}{l} \mathbf{Min} \ \theta, \ \lambda \ \theta \\ -y_i + Y\lambda \geq 0 \\ \theta x_i - X\lambda \geq 0 \\ \lambda \geq 0 \end{array} \right.$$

θ : the technical efficiency score of the i th DMU with $0 \leq \theta \leq 1$; if $\theta = 1$ we conclude that the decision-making unit is located on the efficient frontier, i.e. it is efficient in the Frell sense, and if $\theta < 1$, the decision-making unit is located below the efficient frontier, this indicates the existence of technical inefficiency.

λ : the vector $(n, 1)$ of constants called multipliers (weights). These indicate how the decision units combine to form the boundary against which the i th decision unit will be compared. These multipliers are called peers with reference to the efficient decision units ($\lambda > 0$) that form each segment of the efficiency frontier.

By integrating the input and output slacks, the linear program is written as follows

$$\left\{ \begin{array}{l} \mathbf{Min} \ \theta, \ \lambda, \ SO, \ SI \ \theta - (\xi \ \Sigma \ SO + \xi \ \Sigma \ SI) \\ \theta x_i - X\lambda - SI = 0 \\ -y_i + Y\lambda - SO = 0 \\ \lambda, \ SO, \ SI > 0 \end{array} \right.$$

ξ : a non-archimedean (infinitesimal) constant.

OS: the deficit amounts for each output. 1

IS: the excess amounts for each input.

Therefore, the decision unit is technically efficient if and only if:

$\theta=1, SO=0$ And $SI=0$

- **Output orientation of the CCR model:**

Transformation by linear fractional programming produces the output-oriented CCR model is done in the same way as the input orientation:

$$\left\{ \begin{array}{l} \text{Max } \theta, \lambda, SO, SI \theta + (\xi \Sigma SO + \xi \Sigma SI) \\ \theta y_i - Y\lambda + SO = 0 \\ x_i - X\lambda - SI = 0 \\ \lambda, SO, SI > 0 \end{array} \right.$$

7.2. The BCC Model

Presented by Banker, Charnes & Cooper 1984 this model allows, contrary to the CCR model to distinguish between technical efficiency and efficiency of scale. This model allows an evaluation under the assumption of a non-increasing return on scale, a non-decreasing return on scale, or a variable return on scale. The BCC model is estimated under the assumption of a fragmentation efficiency frontier linear with input or output orientation.

- **Input orientation of the BCC model :**

The model that corresponds to this model is:

$$\left\{ \begin{array}{l} \text{Min } \theta, \lambda, SO, SI \theta - (\xi \Sigma SO + \xi \Sigma SI) \\ \theta x_i - X\lambda - SI = 0 \\ -y_i + Y\lambda - SO = 0 \\ \lambda, SO, SI > 0 \\ \Sigma \lambda = 1 \end{array} \right.$$

- **Output orientation of the BCC model :**

The essential difference between the two orientations is that output-oriented BCC is based on

a linear program that maximizes the score to achieve a proportional increase of Output.

The program is as follows:

$$\left\{ \begin{array}{l} \text{Max } \theta, \lambda, SO, SI \theta + (\xi \Sigma SO + \xi \Sigma SI) \\ \theta y_i - Y\lambda + SO = 0 \\ x_i - X\lambda - SI = 0 \\ \lambda, SO, SI > 0 \\ \Sigma \lambda = 1 \end{array} \right.$$

As with the CCR model, the decision unit is efficient if and only if:

$$\theta=1, \text{SO}=0 \text{ And } \text{SI}=0$$

A DMU is efficiently characterized in an input-oriented model if, and only if, it is characterized as efficient in the same output-oriented model. Also, a DMU efficient in a CCR model is necessarily efficient in the corresponding BCC model; the reverse is not necessarily true.

7.3. The Multiplicative Model

Also presented by Charnes et al. 1982, 1983 it offers different characteristics at the efficiency frontier, unlike the multiplicative CCR and BCC model, using log-linear fragmentation, or Cobb-Douglas to identify the efficiency frontier. The assumptions of return to scale depend on of the interpretation given to the production process in determining the boundary; the use of a log-linear surface assumes an efficiency of scale while the Cobb-Douglas form is more consistent with a constant yield of variable scale.

7.4. The Additive Model

Charnes et al., 1985 it is a non-oriented model, i.e. it does not assume a difference between an input or output orientation. Indeed, it is possible to assume a reduction in input with a simultaneous increase in output. The model assumes constant returns to scale and linear fragmentation of the frontier efficiency.

8. Strengths of DEA

Due to its non-parametric feature and its ability to combine multiple inputs and outputs, DEA has been found to be a powerful tool when used appropriately. A few of the characteristics that make it powerful are:¹

- DEA can handle multiple input and multiple output models.
- It does not require an assumption of a functional form relating inputs to outputs because it is a non-parametric approach.
- Does not impose any restrictions on the form of the production function,
- DMUs are directly compared against a peer or a combination of peers.
- Inputs and outputs can have very different units.

¹ Ibrahim H. Kuhail, Op .Cit.p.31.

- As pointed out in Cooper, Seiford and Tone (2000), DEA has also been used to supply new insights into activities (and entities) that have previously been evaluated by other methods.
- Proven to be useful in uncovering relationships that remain hidden for other methodologies.
- The sources of inefficiency can be analyzed and quantified for every evaluated unit.

9. Weaknesses of DEA

The same features that make DEA a powerful tool can also create problems. The following limitations must be considered when choosing whether or not to use DEA:¹

- DEA is good at estimating “relative” efficiency of a DMU but it converges very slowly to “absolute” efficiency. In other words, it can tell you how well you are doing compared with your peers but not compared to a theoretical maximum.
- Since a standard formulation of DEA creates a separate linear program for each DMU, large problems can be computationally intensive.
- The dependence of its results to the selected sample, data and study period, which increases the probability of errors either in the collection or processing of the information collected.
- The choice of input and output variables in a subjective way can lead to the following results contradictory with reality, such that one can eliminate one or more inputs or outputs that have a large influence on the decision-making units and replace them with other variables that are not determinant. We will not have the best results that help us to find the source inefficiency in any unit.

10. Approaches used In DEA application in insurance industry

In order to define the inputs and outputs and according to the previous studies on insurance companies’ efficiency we find three main approaches followed, the intermediation approach, the user cost method and the value added approach:²

10.1. The intermediation approach

In this approach the insurance company is considered as a financial intermediary (Brocket et al., 1998). Therefore, it collects funds from policyholders transforming them

¹ Idem.p.32.

²Bilel Jarraya and Abdelfatteh Bouri, Op. Cit.p.44.

into assets, essentially by paying out claims, investing in capital market... The main objective of this approach is to maximize simultaneously the value of claims' ownership and capital return adjusted to risk. But insurance companies offer other services in addition to financial intermediation. Ignoring these other functions allocated to the insurance company leads to erroneous results in efficiency studies.

10.2. The user cost method

This approach aims to classify financial product as an input or output basing on its net contribution to the firm's revenues (Hancock (1985), Cummins and Weiss (2000)). so if an asset's return (or a liability's cost) exceed (is less than) its cost opportunity then the product is considered as an output, else it is considered as an input. At the theoretical level, this approach is the most ideal, but at a practical level, it is almost impossible to find the necessary data.

10.3. The value added approach

This is the most used approach for studying insurance companies' efficiency. An asset or a liability is considered as an output if it has a meaningful added value based on operating cost allocations. The remainder of assets and liabilities are considered as inputs, intermediate product, or unimportant outputs while taking account of considered activity (Berger et al., 2000).

Section 03: The use of Data envelopment analysis: Literature review

The DEA method has been widely used in several sectors to measure the economic efficiency of production units such as manufacturing industry, electricity distribution, analysis of production processes, distribution and logistics networks, agriculture, forestry engineering, the education and higher education sector, the insurance sector, in the health and hospital sector, and so on.

1. DEA applications to measure efficiency in several industries

DEA has been used in several industries as a significant tool to measure efficiency, we below mention a sample of many studies found in the literature:

1.1. Banks

The first study applying this method dates back to the 1980s with the article by Sherman and Gold Bank branch operating efficiency: Evaluation with Data Envelopment Analysis. The latter used a small sample of 14 US bank branches to demonstrate the importance of the DEA method. Following Parkan in 1987 used a sample of 35 Canadian bank branches to apply the Charnes, Cooper and Rhodes model. Then in 1997, Berger & Humphrey conducted a review summarizing 55 applications of the approach in the banking sector. Several studies were then carried out worldwide.

In 2011, a study was carried out in Femise (Euro-Mediterranean Forum of Institutes of Economic Sciences) on a sample of 206 banks in the countries of the Mediterranean basin during the period from 1995 to 2008. The results show that the most efficient banks are those that are large in size and well capitalized. Moreover, growth country's economic performance and institutional quality contribute to bank efficiency.

Sufian (2007) conducted a study on domestic and foreign banks in Malaysia by using Deposits, Labor and Fixed Assets as Inputs and Total Loans and total income as Outputs. The study indicated that Domestic banks have gained more productivity improvement than foreign banks in Malaysia.

Ram Pratap Sinha (2013) measures the comparison of commercial banks by using DEA analysis, where 49 Indian commercial banks were used for the study. The results assumed that each bank simultaneously attempts to maximize good output and minimize bad output. The analysis of the results indicated that the new private sector commercial banks performed the best followed by the old private sector banks, nationalized banks and the SBI Group.

In 2014, Alrafadi Khaled et al. conducted a study on a sample of 17 Libyan banks during the period 2004-2010. They found that Libyan banks register a better pure technical efficiency than an efficiency of scale.

1.2. Education

The study of McMillan M L. and Datta D., (1998) titled "The Relative Efficiencies of Canadian Universities: A DEA Perspective" This study applied DEA to assess the relative efficiency of 45 Canadian universities using DEA in 1992 -1993. Outcomes are obtained from nine different specifications of inputs and outputs. The universities are categorized in to three categories: Comprehensive with medical school, Comprehensive without medical school, and primarily undergraduate. The result was most of the universities were relatively efficient. The relative efficiencies are quite consistent across the alternative specifications. A subset of universities including universities from each of three categories (comprehensive with medical school, comprehensive without medical school, and primarily undergraduate) are regularly found efficient and a subset quite inefficient but, overall and for most universities, the efficiency scores are relatively high. Regression analysis is used in an effort to identify further determinants of efficiency.

The study of Malcolm A. and Chris D., (1999) titled "Technical and Scale Efficiency of Vocational Education and Training Institutions: The Case of the New Zealand Polytechnics" This study applied DEA to estimate the technical and scale efficiency of vocational education and training in 25 New Zealand polytechnics serving a total of 94,201 students. The average level of technical efficiency was high in 1995 and rose slightly. In terms of scale efficiency, only 4 polytechnics operated with constant returns to scale in 1995, 9 were producing too much output relative to the optimal scale, and 10 were producing too little output. In 1996, 6 of the polytechnics operated with constant returns to scale, 14 were producing too little output, and 1 was producing too much output.

Another study of Lia L., Lee C., and Tzeg G. (2000) titled "DEA Approach for the Current and the Cross Period Efficiency for Evaluating the Vocational Education" DEA was used to examine the relative managerial efficiency for evaluating current-period and cross-period efficiency of 38 technological institutes upgraded from junior colleges in Taiwan by 1998. The used inputs were Building Area, Faculty Number, Annual

Expenditure, Library Collection, and Periodical Categories whereas the outputs were Number of Graduates, Research Expenditures and school-industry-collaboration and continuation education Income. The managerial efficiency variations of each individual institute in between 1995 and 1998 were also determined. The study results show that private schools performance.

1.3. Hospitals

Faze et al. (1989) evaluated the plant capacity of hospitals by applying non- parametric DEA modelling and using ‘number of beds’ as the proxy for capacity. The authors found that there were no major differences between rural and urban hospitals, in terms of ‘capacity utilization’ and ‘cost efficiency’. However, they did find that urban hospitals employed more doctors and other medical staff than rural hospitals.

Harrison et al. (2004) included a larger sample of US hospitals in a non-parametric DEA approach in order to calculate and compare efficiency levels. The findings demonstrated the significant effects of inefficiency over the years and the potential to increase efficiency through better resource management. For example, the efficiency rate increased from 68% in 1998 to 79% in 2001. The proportion of highly-efficient hospitals also increased from 10% in 1998 to 16% in 2001.

The second study explored the differences in efficiency between German and Swiss hospitals (Steinmann et al., 2004). The German hospitals were found to be much more efficient than the Swiss ones. The authors did not arrive to conclusive results about the possible factors behind these differences. However, a similar study ran by Linna et al. (2005) compared the efficiency levels between Norwegian and Finnish hospitals, and found the latter to have a considerably higher score. The differences in input prices and medical cultures were attributed to be the most important factors associated with this difference.

A few studies which applied DEA modelling in order to measure efficiency in African hospitals found some similar results (Kirigia et al., 2002, Osei et al., 2005, and Zere et al. 2006), as follows: public hospitals were found, on average, to be more efficient than private hospitals; efficiency scores could be improved if the numbers of medical officers and technical staff decreased and the numbers of maternal and child care visits, deliveries and discharges increased; several small-sized hospitals appeared to be more

efficient than their capacity had allowed them due to “scale effects”, that is increasing returns to scale might have reduced the magnitude of efficiency loss. For this reason, it was suggested that merging small hospitals in specific geographic areas could significantly improve the overall actual technical efficiency in secondary care

2. DEA application to measure efficiency in insurance industry

DEA has been used widely in the insurance sector, we mention:

2.1. In insurance industry in general

A majority of research on the efficiency of conventional insurance industries focuses on the United States and other 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. Diacon, Starkey, and Obrien (2002) assess the pure technical and scale efficiencies of 450 insurance firms across 15 European countries and conclude the average technical efficiency declined during 1996–1999. Eling and Luhn (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).

Cummins and Xie (2008a) examine efficiency, productivity and scale economies in the US PC insurance industry¹ 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. Over the sample period, the industry experienced significant gains in total factor productivity, and there is an upward trend in scale and allocative efficiency. However, cost efficiency and revenue efficiency did not improve significantly over the sample period. Regression analysis shows that efficiency and productivity gains have been distributed unevenly across the industry. More diversified firms, stock insurers,

¹ PC insurance – contracts providing protection against (a) damage to or loss of property caused by various perils, such as fire, damage or theft, (b) legal liability resulting from injuries to other persons or damage to their property, (c) losses resulting from various sources of business interruption, or (d) losses due to accident or illness.

and insurance groups were more likely to achieve efficiency and productivity gains than less diversified firms, mutual, and unaffiliated single insurers. Higher technology expenditures increase the probability of achieving optimal scale for direct writing insurers but not for independent agency firms.

The Japanese life insurance industry is analyzed by (Fukuyama, 1997) who concluded that there is an increased in Total Factor Productivity (TFP) by 19% in Japanese insurance firms over the time span of 1988 -1993. Whereas, Cummins et al. (1996) found that the TFP growth is 3.4% of Italian insurance industry from 1986 to 1993. In Spain, Cummins and Rubio –Misas (2001) reported that efficiency of Spanish insurance firms in terms of cost is recorded lower than to US counterparts. In Germany, Rees and Kessner (2000) concluded that the mean levels of German insurance efficiency is 48% and lower than that of British companies which are at mean levels of 57%.

Barros et al (2008) investigated the technical efficiencies of Nigerian insurance companies under the period from 1994 to 2005 and found that the efficiency levels declined as a result of inadequacies in technology, scale and management.

Adu, et al (2011) assessed insurance companies efficiencies in Ghana from the period of 2006 to 2008 and reported as the average efficiency score of life insurance in Ghana was higher than that of non –life insurance firms.

Abidin and Cabanda (2011) examined 23 Non-Life Insurance companies of Indonesia in term of the relative efficiency for the period of 2005 to 2007. They reported that the size of the insurance company has significant impact on the operational efficiency, thus confirming the theory of economies of scale.

Dutta and Sengupta (2010) conducted a study to inspect the blow of technological innovation on the Indian insurance industry efficiency. They evaluated the panel data of 12 life insurance companies for the period of 2006 -2009 and found that an increase in investment on IT-infrastructure significantly enhance technical and scale efficiency.

2.2. Takaful VS conventional insurance analysis using DEA

While large numbers of studies evaluate the efficiency of conventional insurance, few pay attention to the efficiency of Takaful insurance. 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 evidence 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.

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).

Rahman (2009) examines the Takaful performance in Malaysia by looking at the growth of the Takaful industry. Based on the study, she finds that the population size and demographic factors play a vital role in contributing to the growth of the Takaful industry. However, in the study, she only used descriptive statistic from a secondary data. 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.

Antonio and. Al (2013) compared the cost efficiency between Takaful and conventional insurance in Malaysia over the period of 2009-2011 which was measured by input approach (cost efficiency). This study found that the overall cost efficiency of conventional insurance companies in Malaysia was better than that of Takaful companies in 2011 although Takaful had better overall cost efficiency level in 2010 and 2009.

Al-Amri, Gattoufi, and Al-Muharrami (2012) analyze the performance of the insurance sector in GCC countries and present a comparative analysis of its different units between 2005 and 2007. Their results reveal that the efficiency of GCC's insurance industry was moderate and there is scope for improvement. However, Al-Amri et al.'s study is limited to four insurance companies and thus, cannot be considered representative of Saudi Arabia's insurance sector.

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.

Kader, Adams, and Hardwick (2009) conduct a DEA to analyze the cost efficiency of 26 Takaful insurance firms in 10 Islamic countries from 2004 to 2006 and indicate that the size of a firm and its board as well as products specialization positively impact Takaful insurance firms' cost efficiency.

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 terms 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.

The next table is a summary of some studies that had used DEA method to measure efficiency in the insurance industry:

Table 2.1: Studies based on DEA in measurement of insurance companies' efficiency

authors	Sample size	inputs	outputs	year	region
Eling and schaper (2017)	970	Number of employees, debt capital, equity capital	Losses plus additions to reserves, total invested assets	2002–2013	14 European countries
Wanke& Barros (2016)	843	Current Assets, Real Assets, Long	Direct Premium, Insurance Premium,	1995–2013	Brazil

		Term Fixed Assets and other Long-Term Assets	Retained Premium and Earned Premium		
Al-Amri (2015)	115	Labor, Debt capital and Equity capital	Losses incurred and investments	2004–2009	GCC countries
Khan & Noreen (2014)	17	Labor, fixed assets, business services and equity capital	Invested assets, net premium	2006–2010	Pakistan
Ertugrul et al. (2016)	70	Labor expenses, equity capital and debt capital	Insurance technical provisions and losses paid	2010–2014	Turkey
Antonio, Ali, & Akbar (2013)	73	Management expenses, fees and commission expenses	Gross premium and Investment income.	2009–2011	Malaysia
Ismail et al. (2011)	666	Labor, business services and materials, and equity capital	Real incurred losses, and the real value of investments	2007–2011	13 countries

Cummins et al. (2010)	4546	Life &H Ins. 10057 P&L Ins. Labor, business services and equity capital	Individual annuities, Group annuities, Personal (Commercial) short and long tail	1993–2006	U.S.A
Eling & Luhn (2009)	3831	Labor and business service, Debt capital, Equity capital.	Non-life claims + additions to reserves, Life benefits + additions to reserves, Investments.	2002–2006	36 countries
Davutyan and Klumpes (2008)	472	business services, labour, and equity capital	The actuarial, underwriting and related expenses, Real financial services, The net interest margin	1996–2002	7 countries

Source: made by us on the basis of the literature review made by Slah Benyoussef and Wael Hemrit (2019).

Conclusion

In this chapter, we have introduced the concept of performance, as well as the different concepts that compose it essentially efficiency, so we have seen its typology, measures and we have also shown that the measurement of efficiency through frontier analysis methods can be seen as the way the more relevant for evaluating insurance company's performance.

To measure efficiency, there are several methods available and one of these methods is the one initially proposed by Charnes, Cooper & Rhodes (1978) which is the DEA data envelopment analysis. We judge that this technique has many advantages and can be considered as the method of the most appropriate measure of insurance companies' efficiency since it allows for comparisons between the different establishments of the insurance sector. Several studies has used DEA to measure efficiency successfully in different field, insurance was one of them.

Chapter 3:
Measurement of the
efficiency of
conventional and
takaful insurance
companies

Introduction

After the presentation of all primordial theoretical concepts related to our study from the definition of conventional and takaful similarities and differences to the concept of efficiency and its measurement where we focused mainly on the data envelopment analysis which is our tool to conduct our study, we are going, in this chapter, to concrete the theoretical notions we mentioned before.

To start, we will present the MENA insurance market and detail some conventional and takaful characteristics in terms of numbers.

For an appropriate application of the DEA method, we will broach the hypothesis related to the DEA model applied on our sample.

After the determination of the model hypothesis, we will measure the efficiency of conventional and takaful insurance companies in the MENA zone using the DEA method which is the main purpose of this study.

So this chapter will be presented as follows:

- Section 01: conventional and takaful insurance industry in MENA zone.
- Section 02: methodological elements.
- Section 03: measurement of the efficiency of conventional and takaful insurance companies in MENA zone.

Section 01: Conventional and Takaful insurance industry in MENA zone

As this study is focused on measuring the efficiency of a sample of Conventional and Islamic insurance companies in the MENA zone, it is necessary to present an overview of the insurance industry in MENA region.

1. MENA Region Background

MENA is the acronym for "Middle East and North Africa" regularly used in academic and business writing. It refers to a large region, from Morocco in northwest Africa to Iran in southwest Asia, which generally includes all the countries of the Middle East and North Africa. The Middle East was a Eurocentric term coined sometime during the 19th century, referring to a trans-continental area between North Africa (Egypt) and South West Asia. Over time, its use has become commonplace among both Europeans and non-Europeans, however the ambiguity of what countries the geographical region actually includes remains an issue today. To this end, international organizations such as the World Bank and UNICEF have started using more specific terms such as MENA to refer to the region spanning horizontally from Morocco to Iran. The acronym is sometimes analogous to the term "Greater Middle East", coined by the second Bush administration to refer to the area of the Middle East and also other Muslim majority countries such as Iran, Turkey, and Pakistan. The following countries are normally included in MENA: Algeria, Bahrain, Egypt, Iran, Iraq, Palestine, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates, Palestine, and Yemen. Sudan and Turkey are sometimes included in MENA.¹

The region is one of the most youthful in the world with Oman, Iraq, Yemen, Syria, Jordan, and the Palestinian Occupied Territories all having over 50% of their populations under the age of 24. For the African states, of the 47 countries and 6 islands (counted for our purposes as countries) the percentage of youth as a part of the total population is even higher. 35 African states have over 60% of their population under the age of 24. the next table shows the countries of MENA ranked by population:²

¹ www.mena-forum.com (29.05.2020).

² [Www. istizada.com](http://www.istizada.com) (29.05.2020).

Table 3.1: MENA region by population

Egypt	100,388,073
Iran (Islamic Republic of)	82,913,906
Algeria	43,053,054
Iraq	39,309,783
Morocco	36,471,769
Saudi Arabia	34,268,528
Yemen	29,161,922
Syrian Arab Republic	17,070,135
Tunisia	11,694,719
Jordan	10,101,694
United Arab Emirates	9,770,529
turkey	82,003,882
Lebanon	6,855,713
Libya	6,777,452
State of Palestine	4,981,420
Oman	4,974,986
Kuwait	4,207,083
Qatar	2,832,067
Bahrain	1,641,172

Source: 2019 UN World Population prospects

As it is shown in this table above Egypt is the most populated country in MENA zone with a residential census of 100 million followed by Iran with almost 83 million.

In terms of gross domestic product GDP¹ here's a table ranking MENA countries by GDP:

¹ Gross domestic product (GDP) is the total monetary or market value of all the finished goods and services produced within a country's borders in a specific time period. As a broad measure of overall domestic production, it functions as a comprehensive scorecard of a given country's economic health.

Table 3.2: MENA region by GDP 2018 (in millions of USD)

Saudi Arabia	782,483
Iran	454,013
United Arab Emirates	414,179
turkey	2,249,864
Egypt	250,895
Iraq	225,914
Qatar	192,009
Algeria	180,689
Kuwait	141,678
Morocco	118,495
Syrian	77,460
Oman	79,295
Lebanon	56,639
Jordan	42,291
Tunisia	39,861
Libya	48,320
Bahrain	37,746
Yemen	31,268
State of Palestine	14,498

Source: www. istizada.com

According to this table the top is leading by KSA with a GDP of almost 800 million USD which represent 21% of the total GDP of MENA zone, followed by Iran with a part of 12.76% of the total GDP.

2. Takaful industry in MENA zone

Takaful industry has known a strong growth in a remarkable period of time, here are some numbers showing the recent takaful market evolution:

➤ Overview on takaful market growth

Total contributions in the takaful sector in the MENA region grew on average by 8.2% (USD10.2 billion 46) in 2017, accounting for 31% of the global takaful contributions.

Iran, the largest market in the region, grew by 2.5% to USD 7.9 billion, accounting for more than two-thirds of the total contributions. The contributions from the general takaful segment in Egypt showed an impressive growth of 34% (albeit from a very low level), where family takaful contributions shrank to 5.5% in 2017. On aggregate, both segments pooled USD 58.8 million, which represents almost 9% of the insurance market gross written premium in 2017. 48 In Jordan, the contribution is estimated to have grown by 3.4% to reach USD 88.86 million in 2017, accounting for 10.6% of the market aggregates (USD 838 million) in 2017. The two takaful operators in Jordan (i.e. Islamic Insurance Co. and Solidarity First Insurance) were among the top five insurers controlling around 46% of the market premiums in 2017. In Sudan, the takaful industry registered an average growth rate of 18%, estimated at almost USD 450 million, with general takaful accounting for at least 90% of the total contribution. The low volume of family takaful business is attributed to a lack of awareness and inadequate coordination between the relevant authorities responsible for insurance market developments.¹

Takaful in Tunisia, Algeria and some other countries in the region remains in its nascent stage, but is growing steadily. For instance, three takaful operators are currently operating in Tunisia. The new takaful rules introduced in these countries are expected to strengthen the sector. However, takaful operators in these markets will have to compete with well-established conventional players. Notwithstanding, slow economic activity in these countries presents an additional challenge.

The economic slowdown in the GCC² countries stifled the growth of takaful contributions by 6.87%, reducing it to an estimated USD 11.71 billion in 2017 (USD 12.57 billion: 2016). However, the region maintains its lead as the largest global takaful market, with a share of over 44%. The contraction in the general business in Saudi Arabia (the largest Islamic insurance market) was the main cause of the drag on overall contributions.³

¹ Swiss Re Sigma - World Insurance in 2017- No. 3, 2018, p. 7.

²GCC: Bahrain, Kuwait, Oman, UAE, KSA

³Saudi Arabian Monetary Authority Annual Report 2018,p. 8.

➤ **Number of takaful operators in MENA region**

The total number of takaful institutions is estimated at 306 in 2018, including Retakaful and takaful windows offering takaful products in at least 45 countries. By region, GCC and MENA have 82 and 79 operator respectively (53% of the global takaful market). The next table details some of the important countries in term on number of takaful operator:¹

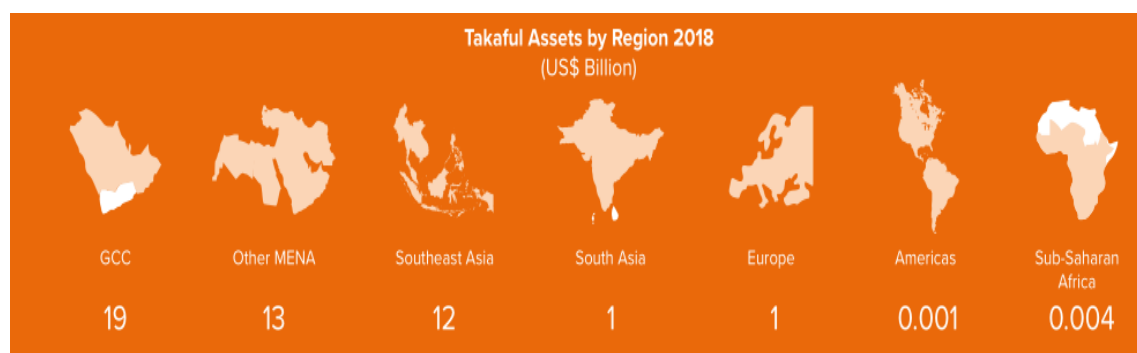
Table 3.3: Number of operator and total assets of takaful in the main countries of MENA zone

Country	Number of takaful operator	Total assets (US billion 2018)
KSA	36	15
Iran	26	13
UAE	17	3
Qatar	8	1

Source: developed by us based on Islamic financial services industry stability report 2019.

KSA is leading the market with having 11% followed by Iran with 8% of the total takaful operators. The next figure shows the total takaful assets by region:

Figure 3.1: Total takaful assets by region 2018



Source: Islamic Finance Development Report 2019.

¹ Insurance Supervisory Authority of Sudan Annual Report 2017.

Saudi Arabia remained the largest market, with total assets of US\$15 billion, up 4% from 2017. Although the average return on assets for Islamic insurers in Saudi Arabia was reported at 1%, almost a third of Saudi takaful companies reported losses in 2018.

3. Conventional insurance in MENA zone:

The Middle East and North Africa (MENA) insurance markets have seen robust growth over the last decade, according to a new report by AM Best. However, in recent years, the region's economic growth has slowed, attributable largely to the global economic slowdown and the lower price of oil, the commodity on which these markets depend for infrastructure spending. Nevertheless, growth in the insurance segment remains higher in comparison with most mature markets, with the region remaining attractive to investors. The insurance written premiums in the Middle East and North Africa (MENA) reached 56.965 billion USD in 2018 against 58.936 billion USD in 2017, thus decreasing by 3.5%. Global premiums, however, rose by 4.8%.¹

By region The GCC insurance industry has continued to witness increasing gross written premiums, albeit slowly, despite challenging economic conditions. Driven by the introductions of mandatory insurance coverage, increased regulatory oversight and overall improvements in risk management, the GCC insurance market has grown of 8.9% from US\$18.4 billion in 2013 to US\$ 28.2 billion in 2018. However, the industry witnessed a relatively muted performance between 2016 and 2018. In North Africa the combined turnover of the three Central Maghreb countries (Tunisia, Algeria, and Morocco) is estimated at 4.8 billion USD in 2011. This amount represents a substantial share of the African market, i.e. 7.2% of the total collections made on the continent. In terms of ranking The United Arab Emirates and Morocco remain at the top of the ranking. These two countries alone accounted for 58.6% of the total premium volume. Qatar ranks third with a market share of 8.74%.²

¹ www.atlas-mag.net (30.05.02020 22:41).

² GCC Insurance Industry | November 24, 2019. p11.

Figure 3.2: Industry structure of some MENA's countries 2019

Country	Total No. of Insurers	Type of Insurers		Domicile		No. of Public-Listed Insurers	Top 3 Companies (by GWP)
		Conventional	Takaful	Foreign Insurers	National Insurers		
Bahrain	36	30	6	12	24	5	<ul style="list-style-type: none"> • Bahrain Kuwait Insurance Co BSC • Bahrain National Holding Co BSC • Solidarity Bahrain BSC
Kuwait	39	26	13	11	28	7	<ul style="list-style-type: none"> • Gulf Insurance Group KSCP • Al Ahleia Insurance Co SAKP • Kuwait Reinsurance Co KSCP
Oman	20	18	2	10	10	10	<ul style="list-style-type: none"> • National Life and General Insurance Co SAOC • Dhofar Insurance Co SAOG • Oman United Insurance Co SAOG
Qatar	12	8	4	8	4	5	<ul style="list-style-type: none"> • Qatar Insurance Co QSPC • Doha Insurance Group QPSC • Qatar General Insurance and Reinsurance Co QPSC
Saudi Arabia	35	-	35	-	35	33	<ul style="list-style-type: none"> • Bupa Arabia for Cooperative Insurance Co SJSC • Co for Cooperative Insurance SJSC • Al Rajhi Co for Cooperative Insurance SJSC
UAE	62	50	12	27	35	30	<ul style="list-style-type: none"> • Oman Insurance Co PSC • Orient Insurance PJSC • Abu Dhabi National Insurance Co PSC

Source: Respective Regulatory Authorities, Regional Indexes.

UAE has continued to rank as the largest insurance market in the MENA region for more than a decade and stands 37th globally in terms of GWP¹ written during 2017-2018.

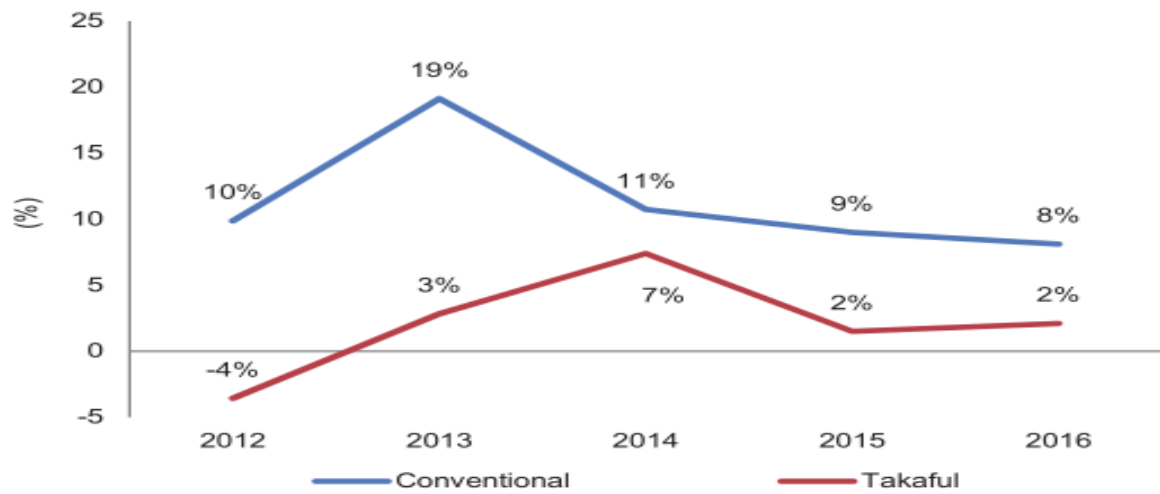
4. Financial performance of conventional vs takaful insurance in MENA zone

In general, MENA takaful companies have underperformed compared to their conventional counterparts. Return on Equity (ROE) metrics over the five-year period between 2012 and 2016 show takaful operators struggled to match returns achieved by their conventional peers, the next figure shows a comparison of the ROE of the takaful and conventional insurers:²

¹ The gross world product (GWP) is the combined gross national income of all the countries in the world.

² V A.M - Best, Market Review: Takaful in the MENA Region: Finding the Right Ingredients for Success - 14 May 2018. p4.

Figure 3.3: Return on Equity for MENA Takaful and conventional insurers (2012-2016)



Source: A.M. Best data and research.

The underlying reason for poorer ROE metrics is the underwriting profitability, which takaful operations have found challenging. Yet further many researches have shown that the takaful operators are emerging in terms of profitability, growth premium and penetration and competing strongly the conventional market in the last 10 years.

Section 02: Methodological Elements

In the previous chapter we discussed concepts and terms related to the DEA method and we specified that it consists of determining efficiency benchmarks and it is a model that combines all the input and output information on the firm into a single measure of productive efficiency that lies between zero and a unity. To accomplish the application of DEA, we must point out the assumptions needed to construct a DEA model. The following section will take place to highlight all the details.

1. Methodology and data description

Before measuring the efficiency, we first need to highlight the choice of the assumptions:

1.1. The sample determination

This study will analyze data for 30 insurance companies selected randomly 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 3.4: 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	Acıbadem Sağlık ve Hayat Sigorta Anonim Şirketi	Turkey
15	Oman Qatar insurance company	Oman

Source: developed by us.

Table 3.5: the selection of takaful 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

Source: developed by us.

1.2. 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.

1.3. 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.

1.4. The models used

Like 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.

1.5. 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 make 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.

1.6. 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

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.

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, two main services are being provided by an insurance company:¹

- **Risk-pooling and risk-bearing:** Through pooling mechanism, insurance company provides a risk reduction service for insurable contingencies of businesses and consumers. A great part of collected premiums are redistributed by the insurer to policyholders who face losses. The value added in insurance is composed essentially by the underwriting, actuarial and linked expenses to the risk pool activities. So, the reduced risk is supported by other stakeholders such as: shareholders for stock companies, previous policyholders for mutual organizations and other actors holding the insurance company's debt. So, this will increase economic security and allows creation of value added.
- **Intermediation:** Insurers collect funds from annuities and insurance policies and invest them until they are removed by policyholders or used to reward claims. Insurers invest collected funds principally in marketable assets. The value added of the intermediation process is the interest margin between return earned rate on assets and provide rate 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:

¹Bilel Jarraya and Abdelfatteh Bouri. Op. Cit p45.

Table 3.6: table 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).
capital	<p>Capital= equity+ cash</p> <p>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.</p> <p>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.</p>	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 3.7: table 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.

2. 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 descriptive statistics will be illustrated by the following tables:

Table 3.8: Descriptive analysis of the 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 3.9: Descriptive analysis of 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 expenses	2016	2341899	4562559	39161136	1570243,744
	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 5 variables where we conclude a significant growth for the industry.

Table 3.10: 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.

Section 03: Measurement of the efficiency of conventional and takaful insurance companies in MENA zone

This section will be the object of the presentation and the interpretation of the results obtained after the application of the DEA method to measure the efficiency of 30 insurance companies from the MENA zone.

1. Presentation of the results

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. 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 3.11: 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	-
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 (wataria)	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 3.12: 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
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 3.13: 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

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 Oman Qatar 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.

In 2018, Qatar insurance company and Acıbadem 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 société at-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 level this time of only 19.1% in 2018.

3. Benchmarks companies

In the DEA approach, each inefficient company is compared to a group of "referent" 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 occurrence of each one:

CHAPTER 03: MEASUREMENT OF THE EFFICIENCY OF CONVENTIONAL AND TAKAFUL INSURANCE

Table 3.14: number of occurrence 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	Acıbadem 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
Acıbadem Sağlık ve Hayat Sigorta Anonim Şirketi	10	Zitouna takaful	6	La Ciar	4
La société at-takafulia	2	Wethaq insurance company	1	Acıbadem 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

Based on the table above, 3 companies have been able to appear as benchmarks for the whole three years period and 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 3 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.

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 3.15: the efficiency decomposition of conventional and takaful companies from 2016 to 2018

	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 really 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.

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

The MENA insurance market has known such a growth in the last decade with the growth of takaful companies and their large expansion which has create a competitive environment to innovate.

With the application of the DEA method on a sample of 30 conventional and takaful insurance companies from the MENA insurance market from 2016 to 2018 assessing the efficiency of both types of companies, we came to a conclusion that conventional insurance companies are more efficient than takaful insurance companies as their efficiency scores marked higher values significantly in 2016 while for next two periods, the difference in term of efficiency was slightly noticeable as the takaful companies has marked some remarkable improvements in term of performance and efficiency.

General conclusion

*T*his study has attempted to assess the efficiency of 30 insurance companies in which 15 are conventional insurance and 15 are takaful operating in the MENA zone during the period 2016-2018 and for that we applied a DEA model which is a mathematical programming approach to frontier estimation that consists of determining efficiency benchmarks after obtaining efficiency scores that had helped us answer our main research question.

Through the bibliographical documentation as well as the application of the DEA method, we managed to find answers to the questions posed in the general introduction and to confirm or invalidate our hypotheses.

After exploring the insurance industry notions in the theoretical part, we came to a conclusion that firstly, conventional insurance system and Islamic insurance system takaful have some similarities since the main activity is the insurance. However, it was confirmed that there exist significant differences in terms of basics and principles between the two types of companies and that confirm the hypostasis **H1**. Another key concept was conducted in this study was the efficiency and its measurement and after the getting to understand this notion, we came to a conclusion that it can be measurable using many methods one of them is the non-parametric approach DEA which confirm the hypothesis **H2**.

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 but still they dominate the game even though the difference in term of efficiency was not significant in the last two periods and with that being said, hypothesis **H3** can be confirmed and conventional insurance companies remain more efficient than takaful one in the MENA zone 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.

Using the DEA method leads us to face some constraints we judge as limits of this study:

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- The results obtained depend only on the combination used i.e. using other combinations leads to other results.
 - The application of the DEA method in the MENA zone might affect the results since the companies used are not operating in the same conditions and under same laws.
 - The size of the companies used might also affect the results since the determination of the sample was done randomly.
 - The small size of the sample can give erroneous vision and inaccurate results.
 - The results obtained by the application of DEA in the MENA zone depend on the sample chosen and can give a misleading vision in case the size of the sample is small, thus the results can not reflect the reality of the market and cannot be generalized.
 - The dependence of the result on the period subject of the study.

As we come to the end of our study, we see that this research has made contributions to the following on three main axes:

- Theoretical axis: this work allows a better theoretical understanding of the basics and the principles of the Islamic insurance and highlights the divergence between takaful and conventional insurance, and also other several concepts such as performance, efficiency and other related notions, it helped to discover new methods and tools to measure efficiency rather than traditional ones.
- The methodology axis: this study enables to apply the data envelopment analysis method proceeding by the determination of the model hypothesis to the application of the model to come out with the results previously presented.
- The managerial axis: this research is likely to interest several actors, such as regulatory and supervisory authorities as well as insurance companies' decision makers. However, it brings a synthesis on the situation of insurance sector in the MENA zone and the degree of difference in terms of efficiency between conventional and Islamic insurance companies.

After having carried out this study, some guidelines can be given that may help in future studies concerning firstly the target area of the study, it is considered very important to apply such a study on the national level of the countries firstly to have a global vision on the insurance sector and for the continuous improvement of the value-creating

competition of these two types of companies, using a wide range of combinations to detect more and more sources of inefficiencies and with the continuous improvement of the companies' performance on the local level, the comparison on the international level will be more reliable. Another important point worth mentioning is the size of the sample used; enlarging the sample and the period allows giving more precise, accurate and realistic results and therefore serving the decision makers and fulfilling the real objective of the study. A study on the evolution of the efficiency of the two types of companies would be very instructive and will help to complete and confirm these results.

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Appendixes

Annex 2: continued

```
. ranksum crste2016, by(firm)
```

Two-sample wilcoxon rank-sum (Mann-Whitney) test

firm	obs	rank sum	expected
0	15	165.5	232.5
1	15	299.5	232.5
combined	30	465	465

```
unadjusted variance      581.25
adjustment for ties      -10.99
-----
adjusted variance        570.26
```

Ho: $\text{crs} \sim 2016(\text{firm}==0) = \text{crs} \sim 2016(\text{firm}==1)$

```
z = -2.806
Prob > |z| = 0.0050
```

```
. ranksum vrste2016, by(firm)
```

Two-sample wilcoxon rank-sum (Mann-Whitney) test

firm	obs	rank sum	expected
0	15	184	232.5
1	15	281	232.5
combined	30	465	465

```
unadjusted variance      581.25
adjustment for ties      -28.45
-----
adjusted variance        552.80
```

Ho: $\text{vrs} \sim 2016(\text{firm}==0) = \text{vrs} \sim 2016(\text{firm}==1)$

```
z = -2.063
Prob > |z| = 0.0391
```

```
. ranksum scale2016, by(firm)
```

Two-sample wilcoxon rank-sum (Mann-Whitney) test

firm	obs	rank sum	expected
0	15	168.5	232.5
1	15	296.5	232.5
combined	30	465	465

```
unadjusted variance      581.25
adjustment for ties      -10.86
-----
adjusted variance        570.39
```

Ho: $\text{sca} \sim 2016(\text{firm}==0) = \text{sca} \sim 2016(\text{firm}==1)$

```
z = -2.680
Prob > |z| = 0.0074
```

.

Source: elaborated via STAT 11 software

Annex 3: non-parametric test for 2017

```
. ttest crste2017, by(firm)
```

```
Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
0	15	.3908	.0859508	.3328859	.4124539
1	15	.7686667	.0551597	.2136328	.6303608
combined	30	.6827333	.0526522	.2883881	.5730474
diff		-.1718667	.102128		-.3810664

```
diff = mean(0) - mean(1) t = -1.6829
H0: diff = 0 degrees of freedom = 28
```

```
H0: diff < 0 H0: diff = 0 H0: diff > 0
Pr(T < t) = 0.0518 Pr(|T| > |t|) = 0.1035 Pr(T > t) = 0.9482
```

```
. ttest scale2017, by(firm)
```

```
Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
0	15	.9038667	.0450241	.1743776	.8072996
1	15	.9486667	.0178114	.0689831	.9104631
combined	30	.9262667	.0241494	.1322719	.8768755
diff		-.0448	.0484192		-.1439821

```
diff = mean(0) - mean(1) t = -0.9253
H0: diff = 0 degrees of freedom = 28
```

```
H0: diff < 0 H0: diff = 0 H0: diff > 0
Pr(T < t) = 0.1814 Pr(|T| > |t|) = 0.3627 Pr(T > t) = 0.8186
```

```
. ttest vrste2017, by(firm)
```

```
Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
0	15	.661	.0887696	.3438033	.4705081
1	14	.8160714	.053995	.2020306	.6934224
combined	29	.7329655	.0537549	.2894788	.6238537
diff		-.1490714	.1057244		-.366

```
diff = mean(0) - mean(1) t = -1.4100
H0: diff = 0 degrees of freedom = 27
```

```
H0: diff < 0 H0: diff = 0 H0: diff > 0
Pr(T < t) = 0.0850 Pr(|T| > |t|) = 0.1700 Pr(T > t) = 0.9150
```

Source: elaborated via STAT 11 software

Annex 4: continued

```

. ranksum orste2017, by(firm)
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

```

firm	obs	rank sum	expected
0	15	197.5	232.5
1	15	207.5	232.5
combined	30	405	465

```

unadjusted variance      581.25
adjustment for ties     -21.34
-----
adjusted variance       559.91
H0: ors~2017(firm=0) = ors~2017(firm=1)
      z = -1.479
      Prob > |z| = 0.1391

```

```

. ranksum vrste2017, by(firm)
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

```

firm	obs	rank sum	expected
0	15	204.5	225
1	14	230.5	210
combined	29	435	435

```

unadjusted variance      525.00
adjustment for ties     -37.11
-----
adjusted variance       487.89
H0: vrs~2017(firm=0) = vrs~2017(firm=1)
      z = -0.928
      Prob > |z| = 0.3534

```

```

. ranksum scae2017, by(firm)
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

```

firm	obs	rank sum	expected
0	15	230.5	232.5
1	15	228.5	232.5
combined	30	459	465

```

unadjusted variance      581.25
adjustment for ties     -21.34
-----
adjusted variance       559.91
H0: sca~2017(firm=0) = sca~2017(firm=1)
      z = 0.169
      Prob > |z| = 0.8658

```

Source: elaborated via STAT 11 software

Annex 5: non-parametric test results for 2018

```
. ttest crste2018, by(firm)
Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	15	.5136657	.0806491	.3123525	.3406916	.6866417
1	15	.6846657	.0827893	.3206415	.5071013	.862232
combined	30	.5991667	.0589619	.3229475	.4785761	.7197573
diff		-.171	.1155783		-.4077514	.0657514

```
diff = mean(0) - mean(1)
H0: diff = 0
t = -1.4795
degrees of freedom = 28

H0: diff < 0
Pr(T < t) = 0.0751
H0: diff != 0
Pr(|T| > |t|) = 0.1502
H0: diff > 0
Pr(T > t) = 0.9249

. ttest vrste2018, by(firm)
Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	15	.5391333	.082142	.3181345	.3629563	.7153103
1	15	.8244	.0697831	.2702689	.6747301	.9740699
combined	30	.6817667	.0592083	.3242974	.560672	.8028613
diff		-.2852667	.1077821		-.5060483	-.064485

```
diff = mean(0) - mean(1)
H0: diff = 0
t = -2.6467
degrees of freedom = 28

H0: diff < 0
Pr(T < t) = 0.0056
H0: diff != 0
Pr(|T| > |t|) = 0.0132
H0: diff > 0
Pr(T > t) = 0.9934

. ttest scale2018, by(firm)
variable scale2018 not found
r(111);

. ttest scale2018, by(firm)
Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	15	.9360667	.0217401	.0841991	.8894387	.9826946
1	15	.8276667	.0594917	.2304104	.7000696	.9552637
combined	30	.8818667	.0327061	.1791385	.8149752	.9487581
diff		.1084	.0633395		-.0213452	.2381452

```
diff = mean(0) - mean(1)
H0: diff = 0
t = 1.7114
degrees of freedom = 28

H0: diff < 0
Pr(T < t) = 0.9510
H0: diff != 0
Pr(|T| > |t|) = 0.0981
H0: diff > 0
Pr(T > t) = 0.0490
```

Source: elaborated via STAT 11 software

Annex 6: continued

```

. ranksum crste2018, by(firm)
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

```

firm	obs	rank sum	expected
0	15	200.5	232.5
1	15	264.5	232.5
combined	30	465	465

```

unadjusted variance      581.25
adjustment for ties      -10.86
adjusted variance        570.39
Ho: crs~2018(firm=0) = crs~2018(firm=1)
      z = -1.340
Prob > |z| = 0.1803

```

```

. ranksum vrs2018, by(firm)
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

```

firm	obs	rank sum	expected
0	15	178	232.5
1	15	287	232.5
combined	30	465	465

```

unadjusted variance      581.25
adjustment for ties      -47.07
adjusted variance        534.18
Ho: vrs~2018(firm=0) = vrs~2018(firm=1)
      z = -2.358
Prob > |z| = 0.0184

```

```

. ranksum scale2018, by(firm)
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

```

firm	obs	rank sum	expected
0	15	245.5	232.5
1	15	219.5	232.5
combined	30	465	465

```

unadjusted variance      581.25
adjustment for ties      -11.12
adjusted variance        570.13
Ho: sca~2018(firm=0) = sca~2018(firm=1)
      z = 0.544
Prob > |z| = 0.5861

```

Source: elaborated via STAT 11 software

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