



End of Studies Project

Topic :

OPTIMIZATION OF EXCESS OF LOSS REINSURANCE STRUCTURE case of the SAA fire portfolio

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List of figures

Figure 1 :Top 20 Global Reinsurers' Combined Ratio and ROE performance.....	18
Figure 2 :Net Premiums For Five Top Reinsurers.....	18
Figure 3 :Global Acceptances 2018.....	21
Figure 4: positioning of SAA by branch.....	40

List of tables

Table 1: Market shares by branch.....	40
Table 2:. Evolution of the industrial risk branch	41
Table 3:. Evolution of retention limits.....	41
Table 4:. Subscription capacities	41
Table 5:. Cession by reinsurance method	42
Table 6: Cession by mode and by branch	42
Table 7:. Cession evolution of 2017/2018	43
Table 8:. Cession by reinsurance market.....	43

Table of contents

General Introduction.....	1
CHAPTER One : INTRODUCTION TO REINSURANCE.....	4
SECTION 01: BASICS OF REINSURANCES	4
1.1 Definition of Reinsurance.....	4
1.2 Reinsurance Terminology.....	4
1.3 Different Forms of Reinsurance:	5
1.4 Different Types of Reinsurance	5
SECTION 02: TREATY WORDING AND REINSURANCE PLAN	7
2.1 Proportional wordings.....	7
2.2 Non Proportional wordings	9
2.3 The choice of treaty by branch.....	11
SECTION 03: INNOVATIONAL FORM OF REINSURANCE	13
3.1 Financial reinsurance:.....	13
3.2 ISLAMIC REINSURANCE "Retakaful"	14
CHAPTER Two : REINSURANCE MARKET	17
SECTION 1: THE INTERNATIONAL REINSURANCE MARKET	17
SECTION 02: THE ALGERIAN REINSURANCE MARKET	18
2.1 The Legislative and Regulatory Framework for Reinsurance in Algeria:.....	18
2.2 The impact of regulation on reinsurance policy.....	20
2.3 Economic Reality of the Algerian Reinsurance Market	20
SECTION 03: SOLVENCY 2 AND REINSURANCE.....	22
3.1 Objectives:.....	22
3.2 Description of the three pillars:.....	23
3.3 The impact of solvency II on reinsurance:.....	23
3.4. THE SOLVENCY OF INSURANCE COMPANIES IN ALGERIA	25
CHAPTER Three : INTRODUCING EXCESS OF LOSS PRICING METHODS	28
SECTION 01: PRICING AN EXCESS OF LOSS TREATY.....	28
1.1 THE PRICING METHOD	28
1.2 The choice of pricing model:	29
1.3 The Pricing Process: Creation Of An "As If" Statistic	29
SECTION 02: THEORETICAL ASPECTS OF PRICING BY THE BURNING COST METHOD:	30
2.1 presentation of the statistics:.....	31
2.2 the revaluation of premiums and claims:.....	31
2.3 The determination of the excess of loss charge.....	31

2.4 calculation of Burning Cost average (BCM):.....	32
2.5 Premiums Determination	32
SECTION 02: THEORETICAL ASPECTS OF PRICING BY THE PARETO METHOD:.....	34
2.1 The method basis :	34
2.2 The function:	34
2.3 Determination of α :	35
2.4 extrapolation of the frequency of claims:	36
2.5 estimation of claims' charges.....	36
2.6 Premiums determination	36
CHAPTER Four :EMPIRICAL STUDY	39
SECTION 01 : PRESENTATION OF THE SAA COMPANY	39
1.1 About the Company:	39
1.2 Reinsurance activity	41
Section 02: application of pricing models.	44
2.1 preparing the data.....	44
2.2 Pricing by the deterministic method (Burning Cost).....	45
2.3 Pricing by the Pareto method.....	47
3.3 Comparing both pricing method	50
General Conclusion	52

GENERAL INTRODUCTION

GENERAL INTRODUCTION

Unpredictable and catastrophic events sometimes surround us in our daily lives. Our health, income, purchases, homes and even our lives are usually at significant risk. As a result, insurance is considered as one of the most widely used techniques that allow individuals and businesses to face these risks.

An insurer, like an insured, may seek a coverage against multiple risks. Throughout a Mutual agreement with reinsurance companies, insurers cede or share risks and liabilities of their issued policies with reinsurers in return of a reinsurance premium or ceding commission. The insurer is exclusively obligated with fulfilling the responsibilities, services, and handling of claims and benefits to the insured in accordance with policy terms. Therefore it is in the interest of the insurance company to choose the cover that best suits their level of risk exposure.

In practice, many forms of reinsurance are used to allow insurance companies to manage their risks and adapt to market regulatory requirements. On one hand, there are treaties in proportional reinsurance, this form of treaty is qualified as the simplest form of reinsurance, it is known by its automatic portion sharing mechanism between the reinsurer and the cedant, **the reinsurer** covers part of the risk, receives part of the premium in the same proportions and bears part of the claims in these same proportions.

On the other hand, there are treaties in non-proportional reinsurance with its two types: reinsurance in excess of loss or stop loss. Unlike proportional treaties, the reinsurer will only get involved if the insurance company's losses exceed a specified amount, which is referred to as priority or retention limit. Hence, the reinsurer does not have a proportional share in the premiums and losses of the insurance provider.

On the excess of loss reinsurance treaty, which offers, to insurance companies a protection against extreme risks. This treaty is based on loss retention. The ceding insurer agrees to accept all losses up to a predetermined level. The reinsurer agrees to reimburse the ceding insurer for losses above the predetermined level and up to the reimbursement limit.

The subject of this dissertation falls within this framework and deals with the optimization of the pricing of a reinsurance treaty in excess of loss by the use of empirical and stochastic methods.

Problem Statement

What is the most appropriate pricing method to optimize an excess of loss reinsurance treaty with an application on the Fire reinsurance portfolio of the SAA Company?

Research Questions

This problematic cannot be developed without providing some answers to the following questions

- What is reinsurance? The usefulness of reinsurance?
- The different types of reinsurance?
- What is the legislative and regulatory framework for reinsurance?
- What are the pricing **methods** in excess of loss reinsurance?
- What are the advantages and disadvantages of each method?

Research Objectives

The objective of this research is to develop financial tools and models that allow The SAA Company to evaluate the optimal excess of loss reinsurance structure that satisfies the risk appetite and financial requirements, in the case of Fire portfolio

.Paper organization

This paper will be divided on four different chapters, at first we will discuss the theoretical aspects of reinsurance and in particular its characteristics and its different modes. The second chapter we will focus on the Algerian regulatory framework for reinsurance, its evolution and its impact on the reinsurance policy of Algerian insurance companies.

The third chapter will be dedicated to the theoretical presentation of the different pricing methods, where we will expose the pricing method by experience with its two approaches namely Burning Cost and Pareto.

The fourth and last chapter will be devoted to the application of the two methods already presented in the third chapter with the objective of developing an optimal reinsurance strategy for the Fire insurance portfolio of the SAA insurance.

CHAPTER 01: INTRODUCTION TO REINSURANCE

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SECTION 01: BASICS OF REINSURANCES

Reinsurance contracts might be presented with exotic and complicated terms that could be off-putting to many. A concerned could also face difficulties understanding the different particularities of a reinsurance treaty

The aim of this section is to, first make the reinsurance jargon once the meaning is explained, easily understood and used. Then we will present the different types and forms of a reinsurance treaty that one must know.

1.1 Definition of Reinsurance

The Association of Professionals in Reinsurance in France (APREF) defines reinsurance in a simplistic way as: "insurance of insurers", in fact, we can qualify reinsurance as a technique that allows the direct insurer to discharge " part of the risk he has taken out with another party called "reinsurer" against payment of a price called "reinsurance premium". Thus, insurers are protected against risks that exceed their own capacity and that could cause an **imbalance** in their balance sheet, which can lead to insolvency.

1.2 Reinsurance Terminology

The most essential and used jargon and terminology of reinsurance **are as under:**

- **Deductible excess** the amount of loss supported by the insurer. Used in order
- **Cession** the business passed from the insurance company to its reinsurer
- **Cede** the act of passing business from insurance company to the reinsurer
- **Ceding company** the insurance company that passes business
- to the reinsurer **to** minimize the number of small claims with expensive administrative expenses , or to decrease loss ratios, and to enforce a duty of care and responsibility on the insured.
- Limit the most amount which an insurer is ready to lose on any particular risk
- Line the level of risk which an insurer keeps for its own account which is that the maximum net loss which will be sustained on it risk by the cedant.

CHAPTER ONE: INTRODUCTION TO REINSURANCE

- **Retrocession** a second reinsurance, that's where the reinsurer decides, having accepted a cession to rearrange an additional reinsurance cover on its a part of the danger
- **Reinsured** the direct writing insurer that takes reinsurance protection, “the cedant.”
- **Reinsurer an organization** (insurer or reinsurance company) which accepts a number of the insurance risks underwritten by another insurer.
- **Retention** level of a risk which an insurer keeps for its own account

1.3 Different Forms of Reinsurance:

1.3.1 Facultative Coverage

This type of policy is the first form of reinsurance that existed until the 19th century; it is also the simplest form. It gives the insurer the option or the choose to cede, or not, part of the risk that it has subscribed to the reinsurer only for a specified person, risk or contract. As it gives the reinsurer the option or the choice to accept or not accept this cession.

1.3.2 Reinsurance Treaty (obligatory)

Unlike Facultative reinsurance, covers a multitude of risks or a set of underwriting in a given branch of insurance. It establishes reciprocal obligations between the ceding company and the reinsurer, that is to say, it obliges the insurer to cede all the risks in a given portfolio as it also obliges the reinsurer to accept them. This reinsurance method is often used to reinsure a whole risk community (e.g. a portfolio of property or marine insurance contracts).

1.4 Different Types of Reinsurance

There are two main types of reinsurance: proportional reinsurance and non-proportional reinsurance.

1.4.1 Proportional Reinsurance

Proportional reinsurance treaties are linked to the concept of capital. In other words, the reinsurer covers part of the risk, receives part of the premium in the same proportions and bears part of the claims in these same proportions. The reinsurer also undertakes to offer technical assistance to the insurer.

- **Quota share treaty**

CHAPTER ONE: INTRODUCTION TO REINSURANCE

This treaty is considered the simplest form of reinsurance, the reinsurer takes in charge a proportion of risks from his client portfolio and receives in return the same proportion of his premium .

➤ **Surplus treaty**

With this form of treaty, the ceding insurer retains a fixed amount of policy liability called a line and the reinsurer takes responsibility for what remains, in the limit of a defined capacity. Therefore, the reinsurer does not take part in all risks and then only takes part in the risks above what the insurer has maintained.

➤ **Facultative obligatory treaty(open-cover)**

Also known as open cover .This form of reinsurance allows the ceding company to decide on the ability of reinsuring a risk in acceptable proportions, as for the reinsurer he obligatorily undertakes to accept all the risks given by the ceding company under the constraint that the commitment does not exceed not a pre-set amount.

1.4.2 Non-Proportional Reinsurance

Unlike proportional treaties, the reinsurer will only get involved if the insurance company's losses exceed a specified amount, which is referred to as priority or retention limit.

Consequently, the reinsurer does not have a proportionate share of the insurance provider's premiums and losses. The priority or retention limit can be based on a single form of risk or on an entire business.

➤ **Excess of loss treaty**

Excess of Loss which indemnifies the reinsured for that part of a loss, which exceeds a specified monetary amount (deductible, excess or retention) up to a further, specified monetary amount (limit of liability or indemnity).

- **Per Risk Excess Reinsurance** : also known as specific, working layer, or underlying excess of loss reinsurance. A mechanism by which the insurer can recover losses on an individual risk in excess of a particular per risk retention. Has both property and casualty applications.
- **Excess of loss reinsurance per occurrence or per event:** Under this cover the reinsurer will indemnify the reinsured when the latter's liability exceeds an aggregate net loss agreed

CHAPTER ONE: INTRODUCTION TO REINSURANCE

upon the reinsurance contract and covered in the underlying policy. Such approach is ideal if a portfolio of risks is subjected to some catastrophic event that could give rise to multiple individual claims. In general, a catastrophic event affects more than one risk under the same reinsurance contract, such as car and property insurance, which takes place within a specific period; such a period is defined in a hours clause^{72.h}. An example of catastrophic event is a huge flood that causes damages both to property and to vehicles parked.

- **Catastrophe Excess Reinsurance:** protects insurance companies from the financial risks involved in large-scale catastrophic events. The magnitude and unpredictability of disasters cause insurers to take on an immense amount of risk. Although catastrophic events infrequently occur, when they do occur, they tend to cover wide geographic areas and cause large amounts of damage. If the insurer receives a large number of claims at once, the losses may possibly cause the new business to be limited or cause the insurer to refuse to renew current policies., limiting its ability to recover.

➤ **Stop-loss reinsurance treaty**

Or the aggregate excess insurance policy limits the amount to be paid by the policyholder for a fixed period of time. This is intended to cover policyholders who encounter an extraordinarily high number of claims that are deemed unexpected. Aggregate excess insurance provides payment for total losses that occur during a period, and is not limited to a per occurrence basis.

SECTION 02: TREATY WORDING AND REINSURANCE PLAN

A Reinsurance contract is subject to the general law of contract and, as well as the special rules applied on insurance contracts, particularly:

- Presence of an insurable interest.
- Contract is one of utmost good faith.
- Contract is one of indemnity

2.1 Proportional wordings

In a proportional treaty, we find essentially these main clauses:

- **Business Covered clause:** this clause clarifies the business to be ceded to the treaty.

Territorial Scope: used to circle the geographical limits the for underlying business

CHAPTER ONE: INTRODUCTION TO REINSURANCE

- **Method of cession clause:** sets out the nature and the cover as well as the main terms of the proportional reinsurance treaty.
- **Attachment and termination of treaty:** for the commencement of the treaty and the way in which it can be cancelled
- **Business excluded :** it details the exclusions on types of risk, perils which are not allowed, territories not covered and other general or specific exclusions
- **Original Net Premium:** The premium received from the insured, minus commissions
- **Reinsurance Commission:** the share or the percentage of reinsurance premium retained by the reinsured as an acquisition/administration costs
- **Premium Reserve:** The amount or percentage of the premium retained by the ceding company as a guarantee for the fulfilment of the obligations of the reinsurer.
- **Loss Reserve:** This is an amount equivalent to the actual known outstanding (ie unpaid but incurred) claims of the company. As with the premium reserve, it is effectively a guarantee of the payments of the reinsurers.
- **Run off:** On losses occurring treaties. Requires the reinsurer to provide 12 months cover in respect of risks that are still in force at expiry of the current period of reinsurance.
- **Portfolio Premium And Loss Transfer Clause:** Sets out that reinsurer shall assume liability for its share of all risks in force (premium portfolio) and all losses outstanding (loss portfolio assumption) with reinsured having option to withdraw premium portfolio and loss portfolio at expiry.
- **Periodical accounts:** This clause allows for rendering of accounts and settlement of balances between the parties. The majority of the treaties work on a quarterly basis in arrears but can also be biannually, annually or even monthly.
- **Claims advice and settlement clause:**

This section deals with all aspects of claims affecting the treaty and embraces the following;

CHAPTER ONE: INTRODUCTION TO REINSURANCE

- Losses will normally be debited to reinsurers in the accounts as described in the periodical accounts clause.
- Any individual large losses above a prearranged sum insured can be put forward by the ceding company for immediate payment by reinsurers. These are often called cash calls.
- Reinsurers must be advised of large losses of a predetermined amount.
- The ceding company has the sole right to adjust compromise and settle claims, and reinsurers agree to be bound by the ceding company's decisions.
- Outstanding losses may have to be reported to reinsurers. This is often a requirement at the anniversary date of the treaty.
- **Currency clause:** Business under a treaty may be written in more than one currency. Usually separate accounts will be maintained in each currency and settlement paid in each currency respectively. The currency may be converted to one account for settlement.

2.2 Non Proportional wordings

In a non- proportional treaty, we find essentially these main clauses:

- **Business covered and territorial scope:** They serve the same purpose as in proportional treaties.
- **Basis of cover :** This sets out in what circumstances a recovery is available to the ceding company and the extent of the recovery. The two necessities for recovery under non proportional treaties are that the reinsured has suffered a loss covered by the reinsurer and that the loss has exceeded the previously agreed point, the priority or deductible. The basis of cover clause will identify:
 - The amount of the priority
 - The reinsurer's limit of liability
 - The basis on which the reinsurance applies;
- **Period of cover:** This clause will identify the dates of cover provided. The three basis are;

CHAPTER ONE: INTRODUCTION TO REINSURANCE

- Policies issued or renewed
- Losses occurring
- Losses discovered or claims made Broadly the period clause needs to embrace the following clauses;
 - It must refer to the basis of cover clause and link that with which ever method applies: policies issued, losses occurring or claims made.
 - It must all allow for any necessary variations. On a losses occurring basis covering property and pecuniary business, some policy types will not fit.
 - This clause may allow for possible run off business if the reinsurance cover is cancelled or not renewed and some risks ~~stih~~ still have an unexpired portion of risk.
- **Business excluded:** The business excluded clause links with the business covered clause and again it is important that definitions are clear.
- **Reinstatement clause :** in a non-proportional treaty, the reinsurer puts a certain limit at the disposal of the cedant in a sinister occurs but the cedant must not be found uncovered if ever a second, or even a third loss occurred and absorbed the whole scope. the reconstitution clause is therefore used to restore the cover after a disaster, in other words to maintain the same level of protection for the transferor.
- **Annual aggregate deductible clause (AAD) :** the purpose of the Clause is to limit the reinsurer's commitment and therefore to reduce the cost of reinsurance. It behaves like an annual deductible applied to the sum of the amounts that would normally be due by the reinsurer without the application of this clause. the assignor retains responsibility for the first claim (s) above the priority of the XL until their cumulative amount exceeds the amount of the annual deductible (aggregate).

CHAPTER ONE: INTRODUCTION TO REINSURANCE

- **the indexing clause:** it makes it possible to maintain the economic level of the priority and liability of the treaty for successive years of occurrence. In fact over time the limits of the treaty lose their significance due to monetary erosion, in order to maintain coverage over the years we can therefore index the limits of the treaty on an economic index corresponding to the evolution of the cost of claims in the sector considered.

2.3 The choice of treaty by branch

The choice of the type of treaty, which must appear in a reinsurance plan, the most suitable for each branch is dependent on the advantages and disadvantages of this one in view of the characteristics of this risk class.

Therefore, a small or newly founded company must choose in the beginning to reinsure treaties in Quote share, because they have the advantage of being easy to apply, while waiting to have acquired enough experience to be able to underwrite its risks judiciously. For large risks, the company must choose facultative reinsurance.

Excess of loss reinsurance is suitable for companies that underwrite large volumes of business, involving catastrophe risk, to protect themselves from the possible occurrence of an exceptional number of small claims, the accumulation of which during the same year, could have disastrous consequences, the company may choose to an annual stop loss cover.

After having established a balanced portfolio, acquired technical experience and sufficient financial capacity, the company will have to for simple branches of insurance (fire, maritime insurance, individual accident insurance, etc.) abandon the first reinsurance system and adopt excess of loss coverage.

Thus, it will gain from retaining for its own account a higher volume of premiums and being able to selectively set the limit of each of its commitments in its net portfolio

To draw up its reinsurance program a company must consider each branch separately in order to be able to maintain a certain control over the claims declared for each. However, it is possible that a treaty covers a set of branches, in other words certain reinsurance plan protects several branches together: an insurer can decide to group all these proportional or non-proportional treaties in a bouquet with single placement, which it has the advantage for the insurer of simplifying the management by mixing among the good treaties some very vulnerable which

CHAPTER ONE: INTRODUCTION TO REINSURANCE

will never find a taker if he should be reinsured, a combined assessment is necessary as shown in the following examples.

- When the volume of reinsurance premiums relating to a given branch of insurance is low, it may be that when it is combined with other branches, a better balance between commitment and income is achieved which will facilitate the classification of reinsurance risks.

- To protect the company from the consequences of an accumulation of net losses occurring in one or more branches or subdivision of insurance branches due to the same event, treaties are sometimes adopted especially in reinsurance in excess of loss covering more than one branch or subdivision, such a plan can have the effect of reducing the cost of reinsurance coverage and providing necessary protection.

Once the insurer has theoretically defined the ideal combination of proportional or non-proportional treatment that meets his own needs, he will be confronted in a practical way:

- To the legislation in force which will impose direct constraints on it, for example compulsory legal session
- To the intervention of reinsurance brokers who will guide his choice
- To the various reinsurers who will negotiate to assert their own requirements.

Therefore, we can say that a reinsurance plan is a compromise between the various sometimes-contradictory objectives of the ceding company of its brokers and its reinsurers.

The reinsurance plans vary according to the companies and according to the markets and follow the fluctuations of supply and demand but we can note some general trends by branch:

FIRE: the surplus treaty system prevails, however a newly founded company should perhaps start with a quota treaty until it has acquired enough experience to register these risks more judiciously.

MARINE: in the insurance of maritime cargo it is generally quota-share treaties which predominate because the surplus treaty requires work to process information concerning among other things cargo movements, transshipment, type of vessel used. Excess of loss treaties offer many advantages in this case due to the simplicity of the administrative work, which it requires, but they are intended to cover relatively unimportant claims linked to the ordinary cargo insurance account and not by the most serious accidents such as total loss, significant partial

CHAPTER ONE: INTRODUCTION TO REINSURANCE

loss and General guarantee for considerable amounts. In hull insurance, both the quota-share treaty and the surplus treaty are used. As the problem of complexity of treatment consisting in listing commitments, which characterize cargo insurance, does not arise in the case of hull insurance, one can also have recourse for the latter to the treaty in excess of claims.

SECTION 03: INNOVATIONAL FORM OF REINSURANCE

3.1 Financial reinsurance:

Financial reinsurance is an unconventional form of risk transfer that protects the insurance company's balance sheets by dealing with the risks for which the traditional reinsurance market does not offer sufficient capacity or else it offers them to prices deemed too high. In financial insurance, "FINITE" reinsurance and alternative "ART" risk transfers are destined.

3.1.1 "FINITE" reinsurance :

Called structured financial reinsurance is a structured reinsurance program based on the value of money over time, generally concluded over several years, with aggregate limits and a mechanism for profit sharing.

Such a program combines self-financing generating investment income, with pure risk transfer.

"FINITE RISK" contracts can cover either traditional insurance risks or non-traditional risks such as price fluctuations.

Estimates based on experience take into account expected financial flows. These flows are updated to determine the amount of the premium. In the event of a very favorable loss experience, the transferor receives a participation in the surpluses. On the other hand if this course is very unfavorable, the reinsurer receives an additional premium.

Often "balances" are not paid during the term of the contract, the transferor only pays a margin. at the end of the settlement period the balance will be established.

It is therefore a treaty with a limited transfer of risk between the ceding company and the reinsurers which makes it possible to manage the top of the balance sheet and makes it possible to smooth the result over a period determined in advance, via a sharing of the lot between reinsurance and ceding fixed from the start.

CHAPTER ONE: INTRODUCTION TO REINSURANCE

3.1.2 Alternative Risk Transfer

Alternative risk transfer ART is a concept, which gather together alternative financing techniques to the traditional insurance market; they concern both conventional risks (liability damage, etc.) and specific risks (climatic, etc.). The products offered on the capital markets can be securitization operations, protections with a free market loss, options and subordinated swap.

The most developed operation and that of securitization; it allows the company to focus on its activity of issuing and managing insurance policies by transferring these extreme risks to the financial market. Insurance risks are transferred to the financial market through the intermediary of a legally and financially independent structure: the SPV (Special Purpose Vehicle), often located in a tax haven.

The insurance or reinsurance company issues the securities, through the creation of an SPV to which it pays a premium. In return, investors buying the securities entrust funds to the SPV and pay them to the ceding company if a high intensity event occurs.

In case the event does not occur before the securities mature, the investor receives the principal and the interest.

For protection buyers, securitization is an innovation in terms of risk and capital management, this operation makes it possible to foster financial innovation and promote competitiveness by transforming very rare but very intense risks into financial markets "peak risk". The most significant risk of this transaction lies in catastrophe bonds.

Reinsurance contracts are based on insurers' actual losses. Therefore, the reinsurers pay an indemnity corresponding to the actual losses of the insurer's portfolio. On the other hand, in the absence of expertise in matters relating to insurance risks transfer and given that it is a transaction similar to the banking context, costs may be different from the insurer's actual losses.

3.2 ISLAMIC REINSURANCE "Retakaful"

Much as in traditional insurance, where insurance firms cover themselves against the risks they underwrite through Reinsurance, in Islamic insurance, so does the Takaful Operator through Retakaful.

CHAPTER ONE: INTRODUCTION TO REINSURANCE

The "retakful" reinsurer functions like a pure mutual insurance company, it acts as a manager of the risk pool on behalf of the companies, which transfer their business to it.

The difference between conventional reinsurance and "retakful" is that reinsurance is a means of mitigating shareholder losses while "reatakaful" constitutes an effective risk sharing between participants in the "takaful" fund as the shareholders.

There are currently three models: conventional operators with a "Retakaful" window to maintain their market share locally, operators mixing "Retakaful" with conventional and operators who are totally dedicated to the "Retakaful" industry.

- **Challenges Faced by the Retakaful Industry.**

The Retakaful industry is still very limited compared to the traditional Reinsurance industry. Even so, the industry is faced with various obstacles in seeking to extend its geographical footprint. Some of these problems include

1. The available capacity is not adequate to meet the needs of the Takaful operators.
2. Competition: Retakaful Firms are faced with tough competition from their rival conventional Reinsurers. The credit ratings of most traditional reinsurers are high, giving them an advantage over the Retakaful firms
- .3. The lack of technical skills and knowledge is also a significant obstacle to Retakaful operators.

Conclusion

We can qualify reinsurance as the technique most used by insurance companies to immunize their portfolios and capital against the hardships that can strike their financial solidarity. The comfort that reinsurance provides to insurance companies allows them to develop their business and launch new products. Reinsurance offers several types and forms of cover and it is the responsibility of the ceding company to determine the appropriate cover for its portfolio.

CHAPTER 2: REINSURANCE MARKET

CHAPTER 02 REINSURANCE MARKET

CHAPTER TWO: REINSURANCE MARKET

SECTION 1: THE INTERNATIONAL REINSURANCE MARKET

From a historical point of view, the origins of the concept of modern reinsurance go back to the end of the 19th century in Germany, where it accompanied the beginnings of the industrial revolution. Reinsurance did not take its form as a fully-fledged professional activity until the early 1980s, and this is because reinsurance activity has now been taken over by specialized reinsurance companies and no longer by conventional insurance companies.

In the 20th century, the reinsurance market was in a state of disequilibrium because the demand for reinsurance was very important compared to the offer.

In that period Reinsurance companies faced more than one enormous event, such as the winter storm 1990 in Europe, Typhoon Mireillen in Japan (1991) and Hurricane Andrew in the USA (1992) which caused 15 billion dollars of losses to reinsurance companies . This number is to be compared with the previous ten years where no year has registered more than 5 billion USD dollars losses. Eventually such events have caused the bankruptcy of many reinsurance companies.

Reinsurers have an significant role to play in climate and natural disaster risk management. In 2017, catastrophic events cost the global insurance industry around US\$ 136 billion. Hurricane Katrina, which occurred in 2005, was one of the most devastating natural disasters for the insurance industry, as well as one of the deadliest hurricanes recorded in the United States. Katrina 's covered losses amounted to more than US 60.5 billion.

In today's market, Revenues from the global reinsurance market reached 257 billion USD in 2018, an improvement of 5% over one year.

CHAPTER 02 REINSURANCE MARKET

Figure 1 :Top 20 Global Reinsurers’ Combined Ratio and ROE performance

Top 20 Global Reinsurers' Combined Ratio And ROE Performance							
(%)	2014	2015	2016	2017	2018	2019f	2020f
Combined ratio	89.9	90.7	95.1	109.0	101.0	95-98	95-98
(Favorable)/unfavorable reserve developments	(5.4)	(6.5)	(6.0)	(4.6)	(4.7)	(4)-(5)	(4)-(5)
Natural catastrophe losses impact on the combined ratio	3.1	2.8	5.7	17.0	9.4	8-10	8-10
Accident-year combined ratio excluding catastrophe losses and reserve developments	92.2	94.5	95.4	96.5	96.3	91-93	91-93
ROE	12.5	10.4	8.4	1.6	2.9	7-9	7-9

The top 20 global reinsurers are: Alleghany, Arch, Argo, Aspen, AXIS, China Re, Everest Re, Fairfax, Hannover Re, Hiscox, Lancashire, Lloyd's, Market, Munich Re, PartnerRe, Qatar Ins., RenRe, SCOR, Sirius, and Swiss Re. f--Forecast.

Source : S&P Global Rating , Global Reinsurance Highlights Edition 2019

Almost half of the premiums, or 214.59 billion USD, are underwritten by the top five reinsurers:

Figure 2 :Net Premiums For Five Top Reinsurers

					Net Reinsurance Premiums Written (Mil. \$)	
Ranking	Company	Country	Rating	Outlook	2018	2017
1	Swiss Reinsurance Co.	Switzerland	AA-	Stable	34,042.0	32,316.0
2	Munich Reinsurance Co.	Germany	AA-	Stable	33,685.6	36,454.4
3	Hannover Rück SE	Germany	AA-	Stable	19,953.2	19,321.4
4	Berkshire Hathaway Re	United States	AA+	Stable	16,532.0	24,212.0
5	SCOR SE	France	AA-	Stable	15,803.1	16,163.5

Source : S&P Global Rating , Global Reinsurance Highlights Edition 2019

SECTION 02: THE ALGERIAN REINSURANCE MARKET

2.1 The Legislative and Regulatory Framework for Reinsurance in Algeria:

The insurance and reinsurance activity in Algeria is under the supervision of Ministry of Finance, at the level of the Insurance Department which includes three aspects of control and supervision, namely: regulation (under Regulatory Department), documentary control (Sub Direction of Analysis), and on-site control (Under Control Department). In what follows we will present the main rules that govern this activity.

I-Regulations Governing the Algerian Insurance Sector:

Law 95-07 promulgated on January 25, 1995, is considered the text founder of the current configuration of the insurance sector. It was supplemented and modified by ordinance 06-04 of

CHAPTER 02 REINSURANCE MARKET

February 20, 2006. What one would observe through reading the law texts is the almost equal legal framework in terms of insurance and reinsurance activities. The form "insurance and / or re-insurance..." is always used by the Algerian legislator in this legal and regulatory text . This allows us to conclude that the activity of reinsurance is framed in the same way as that of insurance. We will present next the main rule that governs this activity.

➤ **Insurance and / or reinsurance companies accreditation:**

For the authorization of reinsurance companies, the regulations have clearly clarified the conditions that insurance companies must fulfill. In its paragraph 10.2 the article cited above fixes the main directors that the company proposes to monitor reinsurance matters, in particular (the level of retention in line with its financial capacity, the reinsurance plan, the list and qualities of the reinsurers with which it intends to establish business relationships.) N.B: the minimum share capital for joint stock companies exercising all branches of insurance as well as reinsurance including cession in reinsurance abroad, must not be lower than 450 million DA.

➤ **Obligatory cession**

In accordance with articles 3,4 and 5 of the executive decree n ° 10-207 of September 9, 2010 ,relating to mandatory cession in reinsurance, the Algerian insurance companies are obliged in accordance with the regulations in force to cede part of the premiums to the central reinsurance company (CCR), The minimum rate for this cession to be reinsured is set at 50%.

➤ **CESSION TO AFRICARE**

In accordance with the provisions of article 27 paragraph 2 of the agreement establishing the reinsurance company (AFRICA RE) of which the Algerian State is a member, insurance and / or reinsurance companies operating in Algerian territory are required to cede at least 5% of their reinsurance treaties to this company and under the conditions granted to the most favored reinsurers.

➤ **MINIMUM rating of the selected reinsurer**

Reinsurance placements abroad must be made with reinsurers with a minimum rating of BBB except in the case where the Algerian State is a shareholder; either directly or indirectly; in the capital of the reinsurer.

CHAPTER 02 REINSURANCE MARKET

2.2 The impact of regulation on reinsurance policy

The regulation leaves insurance companies free to choose their reinsurance policy. However, insurers must keep sufficient reinsurance coverage at all times which the supervisory authority provided by ordinance 95-07 of January 25, 1995 must regularly assess.

The insurer must provide suitable information on reinsurance cover and the selected reinsurers and explains how and within what limits, future policies will be reinsured. The supervisory authority checks the validity of the information provided by the insurance company to examine and evaluate the reinsurance cover, in order to ensure that this policy covers the maximum foreseeable loss and that the reinsurers offer sufficient security.

When an inadequate re-insurance policy affects the insurer's ability to resolve the issue of insufficient coverage, poor quality of the reinsurer or non-compliance with vigorous regulatory constraints. The supervisory body, having the legal and administrative powers under the regulations in force, must discuss it with the management of the insurer in order to initiate corrective measures.

2.3 Economic Reality of the Algerian Reinsurance Market

Large risks are covered mostly on a facultative basis with foreign rated reinsurers. As for the remaining share and as previously mentioned, the reinsurance activity in Algeria is exercised, essentially, by the Central Reinsurance Company (CCR), rated B + by the AM Best international agency .

The CCR's technical activity was characterized, in 2018, by 8,84% increase in overall business turnover. National and international turnover recorded an increase of respectively 7,75 % and 16,25%

CHAPTER 02 REINSURANCE MARKET

Figure 3 :Global Acceptances 2018



Source : www.ccr.dz

The overall written premium for national acceptance in 2018 amounted to DZD 27,700 million compared to 25,707 million DZD in 2017, with a positive development of 7.75 per cent (+ 1992 million DZD).

NON-MARINE CLASSES

Non-marine premiums rose by 7.15 per cent in 2018, i.e. by 1 620 million DZD, from 22 676 million DZD in 2017 to 24 297 million DZD in 2018. This represents 87.71% of the national premium and 75.75% of CCR’s total premium.

A/ -PROPERTY & CASUALTY LINES (P&C):

The P&C class of business (Fire, Accident and Other Risks), including Engineering and the Decennial Liability, recorded in 2018 a premium of 20 135 million DZD against 19 181 million DZD in 2017, reaching a progression of 4.97%. This increase mainly concerns Fire (+937 million DZD) and Decennial Liability (+ 775 million DZD).

B/ - NATURAL DISASTERS: The natural disaster premium in 2018 amounts to 2 897 million DZD, compared to 2 074 million DZD in 2017, an rise of 39.68 % (+ 823 million DZD) sustained by the increase in conventional underwritings.

C/ - LIFE: The life insurance portfolio, which includes two classes “life insurance” and “travel assistance”, recorded a premium volume of 1 244 million DZD for 2018, compared to 1 441 million DZD in 2017, which represents a decrease of 2.05%, i.e. -157 million DZD, which has

CHAPTER 02 REINSURANCE MARKET

its origin in premiums reduction of two segments “Life” and “Travel Assistance”. The 2018 premium consisted of 55.93 per cent of the life insurance premium, i.e. 707 million DZD, and 44.07% of the "travel assistance" premiums, i.e. 557 million DZD.

TRANSPORT CLASSES

The transport classes, composed of Aviation, Marine Hull and Marine Cargo classes registered in 2018 a premium of 3 403 million DZD against 3 031 million DZD in 2017, marking an increase of 21.27% (+372 million DZD) and a level of achievement of 215.53% of the 2018 targets set at 2 72 million DZD.

A/ -AVIATION :The Aviation class recorded, at 2018, a premium volume of DZD 1211 million compared to DZD 1135 million in 2017, showing a rise of 6.69% due mainly to premiums adjustment relating to previous years, 2013, 2014 and 2015 and exchange rate gains on the dollar / dinar parity.

B/ -MARINE: The Marine class (Marine Hull & Cargo) premium, achieved in 2018, amounts to 2 192 million DZD, recording an increase of 0.5% (+296 million DZD), compared to the 2017 premium (1 896 million DZD).

SECTION 03: SOLVENCY 2 AND REINSURANCE

Solvency 2 could be defined as regulation of the European Union (EU) which is addressed toward European insurers. It defines new capital requirements to higher cover all of the risks incurred by players within the insurance market. Above all, it encourages them to adopt overall risk management approach, by fitting work sites covering the whole company.

3.1 Objectives:

The objective of Solvency 2 is to provide a fair and refined perception of the actual situation of any insurance company, in particular with regard to the risks incurred. Companies are encouraged to leverage internal risk models to learn, assess, monitor and track the various risks to which they are exposed.

Between Solvency I and Solvency 2 the goal is the same, to ensure adequacy between the obligations and the assets presenting them, but the valuation methods are different to achieve this. Solvency 2 intensifies and complicates the valuation of the properties and commitments of the insurer with respect to solvency I.

CHAPTER 02 REINSURANCE MARKET

3.2 Description of the three pillars:

Solvency 2 is based on a 3-pillar framework, the first pillar is structured to identify quantitative criteria for the valuation of properties, liabilities, solvency margin requirements, the measurement of technical provisions and equity.

❖ In this first pillar, dual regulatory levels for equity are represented: the MCR and the SCR.

MCR (minimum capital requirement): reflects the minimum equity amount at which the supervisory authority's interference will be mandatory.

SCR: (solvency capital requirement): The task of SCR is to handle unexpected losses in the case of a high-risk exercise, for example, in the case of non-compliance, an action plan to be accepted by the supervisor must be drawn up.

The SCR is determined on the basis of a standardized calculation or an internal model established by the company which will correspond to a Value at Risk of 99.5%, i.e. a chance of failure once in 200 years.

❖ The purpose of the second pillar is to set qualitative criteria for internal risk management and to identify the forces of the supervisory authority. Identifying the "riskiest" business is an objective and the supervisory authorities would have the authority to order these businesses to retain more capital than the sums indicated in the assessment of the SCR and to reduce their exposure to risk. In addition, this pillar facilitates the harmonization of control standards and procedures and promotes the exchange of best practices between supervisory authorities and organizations.

❖ The third and final pillar deals with the issue of prudential and public records, with, on the one hand, the disclosure of financial reports by businesses with a dedication to increasing transparency and encouraging greater business management and, on the other hand, reporting to supervisors in an annual register.

Ultimately, a common goal emerges from the analysis of each of these pillars: the ability to reduce the risks incurred by a company, whatever they might be, by establishing risk management. The key purpose is to protect the insured from any error on the part of the insurer.

3.3 The impact of solvency II on reinsurance:

The influence of solvency 2 on reinsurance policy can be summarized in three points:

CHAPTER 02 REINSURANCE MARKET

3.3.1 Impact on regulatory requirements:

The ceding companies have made their arbitrations in compliance with two parameters: the quality of the protection and the budget.

A third element of the solvency reform 2 would have to be added: the regulatory capital requirements of the "SCR" insurers. Inevitably, considering this would have a strong effect on reinsurance strategies.

This could lead to an increase in the return on equity and lower reinsurance demand for large insurers with diversified portfolios. Although small and medium-sized insurers or even large insurers whose portfolio appears inadequately diversified, they will still have to return to reinsurance.

3.3.2 Impact on the measurement of the solvency margin

Under solvency I, the effect of the reinsurance on the available margin was fairly simple:

- Proportional treaties were taken into account up to 50% of the non-life transfer rate;
- Non-proportional treaties had no substantial impact;
- The rating of the reinsurers and their number in the same pool had no impact on the margin requirement.

Under Solvency 2, the capital gains provided by reinsurance constitute a significant factor to boost the profitability of insurers. Furthermore, if certain eligibility criteria are met, it is possible for the insurers to plan for the complete transfer of the risk to the reinsurers, with subsequent savings on their capital requirements.

3.3.3 Impact on reinsurance choices:

Unlike solvency I, reinsurance ranking and diversification have a direct influence on the capital needs of ceding firms; both of these improvements reinforce the value of choosing a full and optimized reinsurance strategy.

In addition, solvency I did not add importance to the quality of the counterparty, either the AAA or BBB ratings had no impact on the solvency measurement of the cedant. While in the new prudential framework, the strength of all counterparties and, more specifically, of reinsurers, is taken into account both quantitatively and directly in solvency capital.

CHAPTER 02 REINSURANCE MARKET

3.4. THE SOLVENCY OF INSURANCE COMPANIES IN ALGERIA

In Algeria, the current solvency requirements for insurance firms are based on:

Terms of licensure: The requirements of approval are as follows:¹

Good moral character and proven professional qualifications of the company's managers; other requirements on the share capital; structure (payment in cash, contribution in kind, origin, etc.) and a minimum amount of capital; insurance products and contracts subject to a visa;

The minimum capital required: since 2006, the minimum capital has been entirely paid-up in cash when the company is formed.

Establishment of technical provisions (other than reserves): this is a guarantee clause designed to improve the solvency of the insurance company with a view to compensating for the potential inadequacy of contractual debts and the clause of catastrophe danger.

Creation of technical debts: the establishment of these debts shall comply with the rules laid down in the Regulations. As far as damage insurance is concerned, these are claims, expenses to be charged, and premiums or contributions to be issued or approved carried forward to the next financial year, known as 'current risks'. In the case of personal insurance and physical injury insurance, these are mathematical provisions.

Representation of regulated liabilities: technical provisions and technical debts must be reflected on the assets side of the balance sheet by government securities; other transferable securities and similar securities; real estate assets and other investments.

The proportions of this representation are set as follows: a total of 50% for government securities, of which at least half for medium and long-term securities.

The remainder of the regulated liabilities are distributed among the other assets on the basis of market opportunities, without the share of investments in transferable securities and similar securities issued by Algerian companies not listed on the stock exchange exceeding the rate of 20% of the regulated liabilities.

¹ Workshop Solvency CCR Alger, le 21/10/2015.

CHAPTER 02 REINSURANCE MARKET

Solvency margin: ²The solvency of insurance and/or reinsurance firms must be shown by the justification of the presence of an additional technical debt or solvency margin. This supplement consists of share capital, cumulative reserves and technical provisions.

The solvency margin of insurance or reinsurance firms shall be at least 15% of the technical debts as calculated on the liabilities side of the balance sheet. During any time throughout the year, the solvency margin shall not be less than 20% of the amount of net insurance production.

If the solvency margin is smaller than the average of 20% of the volume of reinsurance revenue, the corporation has a period of 6 months to restore the level of this margin, either by raising its share capital or by depositing a bond to the treasury to restore the balance sheet.

² Z.boukhebbache , dissertation IFID 34 th promotion



**CHAPTER 03: INTRODUCING EXCESS OF LOSS
PRICING METHODS**

CHAPTER 3: INTRODUCING EXCESS OF LOSS PRICING METHODS

CHAPTER THREE: INTRODUCING EXCESS OF LOSS PRICING METHODS .

Each form of non-proportional reinsurance: XS per risk, XS per event or Stop Loss presents its own pricing singularities. The pricing models are applicable either within the framework of a market approach starting from global statistics representative of the considered market, or starting from the individual experience of the considered business.

The reinsurer will charge a premium for the coverage he is providing in the Excess of Loss Contract. This rate is applied on The Gross Net Premium Income (GNPI). This rate takes into account, among other things, the cost of paying claims, the expenses incurred by the reinsurer i.e. administrative expenses and the expected return the reinsurer wants.

The three most common methods of evaluating the price of an Excess of Loss Treaty are the 1. The Burning Cost Method, 2. The Exposure Method and 3. The Probability Method. This chapter will be dedicated to the presentation of the various elements necessary for the pricing of a reinsurance treaty in excess of loss as well as the theoretical aspects of the methods used.

SECTION 01: PRICING AN EXCESS OF LOSS TREATY

The objective of pricing is to define the premium associated with each treaty. Currently actuaries use several quotation methods to assess the premium: experience pricing also called burning pricing, probabilistic pricing and pricing on exposure. Once the pure premium is set, a safety load will be added to cope to the volatility of claims. The final premium will also take into account management fees, brokerage fees and the profit margin of reinsurers.

1.1 THE PRICING METHOD

1.1 .1 EXPERIENCE-BASED PRICING:

This method is based on the loss experience observed in the past to predict the potential future loss experience of a given portfolio. It is also the most used in reinsurance.

This method is used when claims that have already occurred can be considered representative of claims likely to occur, during the pricing year (the contractual year), this

CHAPTER 3: INTRODUCING EXCESS OF LOSS PRICING METHODS

assumes that the general conditions of the treaty remain unchanged. Two methods are used to calculate the risk premium

- BURNING COST.
- Extrapolation (PARETO model).

1.1.2 PRICING BASED ON EXPOSURE:

If we want to price a treaty in excess of a claim and we do not have a representative database, it is impossible to calculate the risk premium based on pricing by experience, therefore the quotation must base on the composition of the portfolio.

The purpose of exposure pricing is to distribute the premium for each policy between the cedant and the reinsurers according to the risk assumed by each party. For this purpose, we use so-called exposure curves established from a distribution of the amount of claims. These curves determine the share of premium that the cedant can keep, for the share of risk not exceeding priority. The reinsurer receives the remainder of the premium.

1.2 The choice of pricing model:

The different pricing models encountered in non-proportional reinsurance are conditioned by the following **criteria**

- The nature of the reinsurance considered: conventional or optional treaty.
- The nature of the branch considered: branch with short or long development.
- The nature of the working cover (ta cover affected by the history of individual claims or non-working cover (having never been affected by the history of individual claims).

1.3 The Pricing Process: Creation Of An "As If" Statistic

- **claim update:**

Both claims and premiums need to be discounted against monetary inflation to make the years comparable.

- **adjustment of claims:**

The aim of the adjustment is to restore a homogeneous portfolio base over time, taking into account the evolution of the risk profile.

- **reevaluation of premiums and claims:**

CHAPTER 3: INTRODUCING EXCESS OF LOSS PRICING METHODS

The revaluation of the statistics aims to take into account different factors for example, the evaluation of the cost of risk (example evolution of the costs in raw materials) and the change of the legal environment, this revaluation makes it possible to place portfolio on the basis of " a homogeneous environment.

These three procedures use two indices to create an "as if" statistic

- **Premium index:** it must reflect original tariffs and guarantees. the revaluation of premiums makes it possible to calculate the premium bases that would have been issued (and acquired) over the years of experience if the economic and tariff conditions had been that of the year of coverage.
- **claim index:** it must reflect the change in the cost of the claim, ie the inflation of the various components of the claim.

SECTION 02: THEORETICAL ASPECTS OF PRICING BY THE BURNING COST METHOD:

This method is widely used to price excess of loss contracts .This statistical method is based on past claims experience for working cover, where there are enough loss statistics. It is a relatively simple statistical method. The Reinsurer shall use the losses of the insured to determine the rate to be charged for the treaty. It consists of an adjustment of claims and premiums to erase the impact of monetary inflation and the evolution of risk profiles (capital, sum insured, etc.). To provide a better rate, claims data for a minimum of at least 5 years is usually required.

In concrete terms, the insurer has historical statistics observed over several years of experience, including the number of years depending on the nature of the branch. it also has technical pricing parameters, notably revaluation indices, allowing it to construct revalued statistics known as "As If " representative of the exposure to be rated.

The burning cost is only used for claims charges in excess "As If" and the total amount of updated premiums collected by the ceding company. The steps to follow to proceed to the pricing of treaties in excess of claim are as follows:

CHAPTER 3: INTRODUCING EXCESS OF LOSS PRICING METHODS

2.1 presentation of the statistics:

the statistics on the number and amount of claims history as well as the premium base (over at least five years) must be available in order to calculate the treaty price in excess of claims.

2.2 the revaluation of premiums and claims:

First, choose appropriate update indices, for example in fire, use the construction price indices. The calculation of the revaluation index in a given year is done as follows:

- The calculation of the revaluation index for a given year is done as follows:

$$J_k = \frac{I_n}{I_k} \text{ with } i = 1, \dots, n$$

I_n : Index of the year n.

I_k : Index of the year k.

- The revaluation of the premium bases is determined as follow

$$P_k(\text{as if}) = P_k * \frac{I_n}{I_k}$$

$P_k(\text{as if})$: adjusted premium base for the year k.

P_k : the premium base for thr year k.

- The revaluation of the amount of claims is determined as follows:

$$S_{ik}^{\wedge} = S_{ik} * \frac{I_n}{I_k}$$

S_{ik}^{\wedge} : adjusted sinister num i of the year k.

S_{ik} : sinister num i of the year k.

2.3 The determination of the excess of loss charge

The excess of loss charge is calculated as follows:

$$EC = 0, \text{ if: } S_i < f .$$

$$EC = S_i^{\wedge} - f, \text{ if : } f < S_i^{\wedge} \leq l .$$

$$EC = P, \text{ if : } S_i^{\wedge} \geq l .$$

With:

CHAPTER 3: INTRODUCING EXCESS OF LOSS PRICING METHODS

EC: the excess of loss (XL) charge.

f : the treaty priority.

P: the liability of the reinsurer.

l : the treaty limit.

S_i^{\wedge} : the adjusted sinister.

2.4 calculation of Burning Cost average (BCM):

- The annual burning cost is calculated according to the following form:

$$BCA_k = \frac{EC_k^{\wedge}}{P_k^{\wedge}}$$

With :

EC_k^{\wedge} : adjusted excess of loss charge of the year k

P_k^{\wedge} : adjusted premium base for the year k.

- The average burning cost is calculated according to the following form:

$$BCM = \frac{\sum_{i=1}^n EC_i^{\wedge}}{\sum_{i=1}^n P_i^{\wedge}}$$

EC_i^{\wedge} : adjusted excess of loss charge of the year i.

P_i^{\wedge} : adjusted premium base for the year i.

2.5 Premiums Determination

➤ risk premium calculation:

The risk premium is obtained by multiplying the BCM by the estimated premium base of the contractual year (the year of realization of the treaty):

$$P_R = BCM * P_t^{\wedge}$$

With:

P_t^{\wedge} : adjusted premium base of the contractual year t.

➤ pure premium calculation

CHAPTER 3: INTRODUCING EXCESS OF LOSS PRICING METHODS

The safety load (loading for uncertainty) is justified by the fact that the risk premium is based on estimates inevitably loaded with errors.

In practice, the safety load does not exceed 25% of the risk premium. The pure premium is calculated according to a safety factor (c). The latter is given by the following formula :

$$C = mBCA + (\rho * \sigma BCA)$$

With :

$mBCA$: the average of annual BC.

ρ : the normal law fractile $N(0.1)$ at the confidence level $\alpha.4$

σBCA : standard deviation of annual BC.

The pure premium corresponds to the increase in the risk premium by the security load and is obtained according to the following formula:

$$P_p = P_R * (1 + c)$$

With:

P_R : risk premium.

c : the safety margin rate.

➤ market premium calculation:

the market premium is obtained after the application (increase) of the brokerage ,management fees and the profit margin on the pure premium.

the brokerage commission is generally 10% of the market premium. For management fees and profit, reinsurers generally apply a flat rate of 15% on the pure premium.

The market premium is calculated as follow :

$$P_M = \frac{P_p}{(1 - BF)(1 - (MF + PM))}$$

With:

CHAPTER 3: INTRODUCING EXCESS OF LOSS PRICING METHODS

BF: brokerage fees.

MF: management fees.

PM: profit margin .

SECTION 02: THEORETICAL ASPECTS OF PRICING BY THE PARETO METHOD:

The Pareto method offers answers to the shortcomings of the "Burning-Cost" approach. In practice, the deterministic approach of "Burning-Cost", and like all deterministic methods, is always criticized for its subjective side. It represents a real dilemma for the reinsurer as for the cedant when they do not have a claim history which does not contain a sufficient number of claims which fall under reinsurance cover, because without knowing the amounts of claims exceeding the priority, Burning-Cost cannot be calculated.

In fact, it is essential to measure the frequency of major claims that affected the reinsurance treaty when listing. Which has led us to use more adequate methods based on actuarial approaches, the Pareto method is often used in the pricing of a reinsurance treaty in excess of claims.

In this section, we will present the different stages of the pricing process using the "Pareto" method.

2.1 The method basis :

The Pareto distribution is traditionally used by reinsurers in excess of loss due to its interesting mathematical properties, in particular the simplicity of the formulas and therefore of its application.

the advantage of using the Pareto model for the pricing of excess of loss treaties has a significant advantage, since it is applicable even in the case where the claim statistics are insufficient in other words when the claim does not affect the covers to be priced (non working covers).

2.2 The function:

The density function of claims is given by the following formula:

CHAPTER 3: INTRODUCING EXCESS OF LOSS PRICING METHODS

$$f(x) = \alpha * \frac{x_0^\alpha}{x^{\alpha+1}}$$

The distribution function of the claim amounts is given by the following formula:

$$F(x) = 1 - \left(\frac{x_0}{x_i}\right)^\alpha$$

With

x_i : the amount of claims discounted.

x_0 : the amount of the smallest observed loss,

α : the Pareto parameter.

2.3 Determination of α :

Once the X_0 is fixed, generally it is equal to 2 out of 3 of the priority, we apply the likelihood method and we obtain.

$$\alpha = \frac{n}{\sum_{i=1}^n \ln\left(\frac{x_i}{x_0}\right)}$$

With :

N :the number of claims .

Some remarks on the Pareto parameter:³

- for fire cases, alpha risk is between 1 and 2.5.
- for industrial risks alpha is around 1.2.
- for simple risks, alpha is generally between 1.80 and 2.50.
- for catastrophic perils, it is generally equal to 1.

³ L .Adelhadi 34th promotion IFID . The PARETO model in property reinsurances, M. Schmutz & .R.Doeer, Swiss RE.

CHAPTER 3: INTRODUCING EXCESS OF LOSS PRICING METHODS

2.4 extrapolation of the frequency of claims:

From the knowledge of the number of claims which are greater than x_0 , the certain value $f(x_0)$ corresponds to the average of the number of annual claims exceeding X_0 is estimated according to the following formula:

$$f(x_0) = \frac{n_{x_0}}{n}$$

With:

n_{x_0} : claim exceeding X_0

n : number of years of occurrence.

Thereafter the estimate of the frequency of claims $f(x)$ greater than the priority f is obtained using the following formula:

$$f(x) = f x_0 * (x_0/f)^\alpha$$

2.5 estimation of claims' charges

f : the treaty priority.

P : the liability of the reinsurer.

l : the treaty limit.

We calculate the expected loss load exceeding the priority according to the following formula:

$$EC = \frac{f}{1-\alpha} * \left\{ \left(\frac{f+p}{f} \right)^{1-\alpha} - 1 \right\}, \text{ for } \alpha \neq 1$$

$$EC = f * \ln \left(\frac{f+p}{f} \right), \text{ for } \alpha = 1$$

2.6 Premiums determination

➤ Risk premium

the risk premium and therefore is equal to

$$p_R = f(x) * EC$$

CHAPTER 3: INTRODUCING EXCESS OF LOSS PRICING METHODS

$$P_R = \frac{n_{x_0}}{n} * \left(\frac{x_0}{f}\right)^\alpha * \frac{f}{1-\alpha} \left\{ \left(\frac{f+p}{f}\right)^{1-\alpha} - 1 \right\}; \quad \text{for } \alpha \neq 1$$

$$P_R = \frac{n_{x_0}}{n} * \left(\frac{x_0}{f}\right)^\alpha * f * \ln\left(\frac{f+p}{f}\right) = \frac{n_{x_0}}{n} * x_0 * \ln\left(\frac{f+p}{f}\right); \quad \text{for } \alpha = 1$$

➤ Calculation of the pure premium:

By loading the risk premium already calculated by a safety factor, the corresponding pure premium is obtained:

$$P_p = P_R * (1 + c)$$

such as:

c: safety margin rate .

➤ Calculation of the market premium :

The market premium is obtained after the application of brokerage and management fees and the profit margin to the pure premium and this according to the following formula:

$$P_M = \frac{P_p}{(1 - BF)(1 - (MF + PM))}$$

With:

BF: brokerage fees.

MF: management fees.

PM: profit margin .

CHAPTER 04: EMPIRICAL STUDY

CHAPTER 4 : EMPIRICAL STUDY

CHAPTER FOUR:EMPIRICAL STUDY

SECTION 01 : PRESENTATION OF THE SAA COMPANY

1.1 About the Company:

SAA, Public Economic Company, joint stock Company active on the market for 56 years. It is one of the oldest insurance companies. Approved to practice all branches of damage insurance as well as reinsurance. It has more than 520 points of sale, including 227 general agents and bank counters within the framework of the “bancassurance” agreements concluded with three public banks, the BADR, the BDL and the BNA.

It has an expert subsidiary and holds stakes in several companies including AMANA providing personal insurance, created in partnership with MACIF, BADR and BDL.

SAA retains the lead in the property insurance market in 2018 and remains the leading insurer in the market with a 21.96% market share.

With its 3,986 employees, half of whom work in the core business; SAA offers individuals, businesses constantly adapted, and competitive insurance solutions.

The SAA portfolio, despite the encouraging results recorded in terms of diversification, remains dominated by the car insurance branch with more than 70%. This portfolio continues to suffer from the fallout from the economic climate characterized in particular by the virtual stagnation of the insurable pool due to the cessation of imports decided in recent years.

Thanks to a decrease in the frequency of claims for the second consecutive year, combined with the improvement of its management indicators, SAA has managed to maintain these operational performances and consolidate its profitability.

1.1.1 Market situation for property insurance

The overall achievements of the market, for the 2018 financial year, are summarized in the following:

Emissions from the non-life insurance segment amounted to 126,046 million DZD, an increase of 3.22%, against a growth of 1.98% in 2017/2016.

The automobile sector is the one that has recorded the most significant growth (+ 5.2%), i.e. 3,391 Million DZD. The “I.R.D” branch experienced an increase of 1.62%, ie a new

CHAPTER 4 : EMPIRICAL STUDY

contribution of 745 Million DZD. The "Fire" sub-branch, which represents more than 70% of the branch's portfolio, is the main source of this growth, knowing that it has grown by more than 14%.

The “Cat. Nat”, up 66.50% thanks to the new pricing, also contributed to this development.

On the other hand, the branches linked to "Agricultural" & "Transport" insurance showed regressions, respectively, of 6% and 1%.

1.1.2 Market shares by branch:

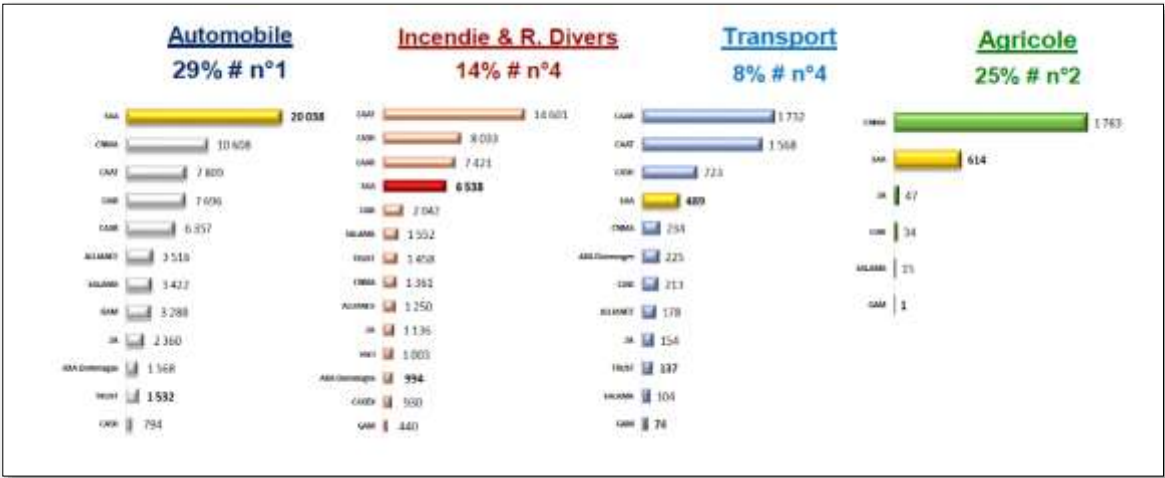
Table 1: Market shares by branch

Branch	SAA		Evolution		secteur			Evolution		2018
	2018	2017	values	%	2018	2017	valeurs	%		
Obligatory risks	3 641	3 396	244	7.20%	14 603	13 296	1 307	9.83%	24.93%	
facultatifs Risques	16 398	16 235	162	1.00%	54 385	52 301	2 084	3.98%	30.15%	
Automobile	20 038	19 631	407	2.07%	68 988	65 597	3 391	5.17%	29.05%	
P&C	6 453	5 993	460	7.67%	46 611	45 867	745	1.62%	13.84%	
Agriculture	614	492	122	24.78%	2 474	2 624	- 151	-5.75%	24.82%	
transport	489	405	83	20.53%	5 828	5 887	- 60	-1.02%	8.38%	
Credit insurance,	85	5	80	15,97	2 145	2 136	9	0.44%	3.96%	
Total Dommage insu	27 679	26 527	1 152	+4.34%	126 046	122 111	3 934	+3.22%	21.96%	

Source: SAA’s Management Report 2018

1.1.3 Positioning of SAA by branch

Figure 4: positioning of SAA by branch



Source: SAA’s Management Report 2018

CHAPTER 4 : EMPIRICAL STUDY

1.1.4 Evolution of the industrial risk branch

Table 2.: Evolution of the industrial risk branch

Branch	Segment	Emissions 2018		Emissions 2017		evolution		part	
	Fire	Number	Amount	number	Amount	Number %	Amount %	2018	2017
Industrial risks	Business Liability	2 532	1 589	2 295	1 572	10.33%	1.07%	5.74%	5.93%
	divers	711	106	683	120	4.10%	-11.35%	0.38%	0.45%
	Nat-cat	3 037	457	3 871	404	-21.54%	13.04%	1.65%	1.52%
	R. Operation	10 485	2 596	12 629	2 331	-16.98%	11.38%	9.38%	8.79%
	Construction	2 513	936	2 199	1 012	14.28%	-7.51%	3.38%	3.82%
	Construction Liability	790	209	750	305	5.33%	-31.34%	0.76%	1.15%
	R. Realization	3 303	1 145	2 949	1 317	12.00%	-13.03%	4.14%	4.96%
	Total	13 788	3 742	15 578	3 648	-11.49%	2.56%	13.52%	13.75%

Source: SAA's Management Report 2018.

1.2 Reinsurance activity

1.2.1 Evolution of retention limits

The 2017 retention limits were revised upwards in 2018 for:

- the "Fire" & "TRC / TRM" branches;
- Inclusion of PE / incendie business interruption in the "Fire" section.

Table 3.: Evolution of retention limits

Branch	Retention Limit	
	2017	2018
FIRE	200 000 000	300 000 000
Business interruption /FIRE	80 000 000	300 000 000
BDM	100 000 000	100 000 000
Business interruption / BDM	80 000 000	80 000 000
CAR/EAR	200 000 000	300 000 000
Liability	50 000 000	20 000 000

Source: SAA's Management Report 2018.

1.2.2 Subscription capacities

Table 4.: Subscription capacities

Branch	Retention limit	
	2017	2018
FIRE	5 200 000 000	6 300 000 000

CHAPTER 4 : EMPIRICAL STUDY

Business interruption /FIRE	560 000 000	6300 000 000
BDM/TREC/TRO	1 100 000 000	1 300 000 000
Business interruption /BDM	320 000 000	480 000 000
CAR /EAR	5 200 000 000	6 300 000 000
Liability	500 000 000	500 000 000
Transport cargo	800 000 000	800 000 000

Source: SAA's Management Report 2018.

1.2.3 Cession by reinsurance method

Table 5:. Cession by reinsurance method

Cessions	2018	2017	Evolution	
			Value	%
Conventional	3 014 421	2 022 796	991 625	49%
facultative	1 079 376	1 000 900	78 476	8%
Total	4 093 797	3 023 696	1 070 101	35%

Source: SAA's Management Report 2018.

1.2.4 Cession by mode and by branch

Table 6: Cession by mode and by branch

Branch	Conventional cessions		facultative Cessions		Cessions total	
	Ceded premiums	%	Ceded premiums	%	ded premium	%
FIRE	708 305,00	0,56	517 791,00	0,11	1 256 099,00	0,31
Facultative	256 989,00	1	-	-	256 989,00	0,06
Nat Cat	956 206,00	0,99	12 232,00	0,01	968 438,00	0,24
Liability	51 164,00	0,75	17 009,00	0,25	68 173,00	0,29
Agriculture	180 373,00	0,86	-	0,14	210 550	0,05
Marine/ Transport	1 055,00	1	-	-	1 055,00	0.03%
Facultative liability	149 355,00	0,86	30 178,00	0,14	210 550,00	0,05
Transport	178 823,00	0,77	52 673,00	0,23	231 496,00	0,06
Engineering	533 791,00	0,56	116 299,00	0,11	950 093,00	0,23
Aviation	-	-	2 264,00	1	2 264,00	-

Source: SAA's Management Report 2018.

CHAPTER 4 : EMPIRICAL STUDY

1.2.5 Cession evolution of 2017/2018

Table 7:. Cession evolution of 2017/2018

Branch	National Cession		international Cession		total Cessions
	National Cession	%	Ceded Premium	%	Ceded Premium
FIRE	655 363,00	0,52	600 736,00	0,18	1 256 099,00
Nat Cat	968 138,00	1		-	968 138,00
Liability	45 465,00	0,67	22 706,00	0,33	68 177,00
Consumer credit	978	1	-	0,11	928
Agriculture	165 457,00	0,79	45 097,00	0,21	210 220,00
C.L Decennial	149 355,00	1		-	149 355,00
Transport	183 311,00	0,79	48 189,00	0,21	231 496,00
Cargo	149 570,00	0,79	40 059,00	0,21	189 639,00
Hull	33 712,00	0,81	8 115,00	0,19	11 857,00
Engineering	801 589,00	0,85	145 501,00	0,15	950 093,00
Aviation	-	-	2 261,00	1	2 261,00

Source: SAA's Management Report 2018.

1.2.6 Cession by reinsurance market

Table 8:. Cession by reinsurance market

Branch	National Cession		international Cession		total Cessions
	Ceded Premium	%	Ceded Premium	%	Ceded Premium
FIRE	655 363,00	0,52	600 736,00	0,18	1 256 099,00
Nat Cat	968 138,00	1		-	968 138,00
Liability	45 465,00	0,67	22 706,00	0,33	68 177,00
Consumer credit	978	1	-	0,11	928
Agriculture	165 457,00	0,79	45 097,00	0,21	210 220,00
C.L Decennial	149 355,00	1		-	149 355,00
Transport	183 311,00	0,79	48 189,00	0,21	231 496,00
Cargo	149 570,00	0,79	40 059,00	0,21	189 639,00
Hull	33 712,00	0,81	8 115,00	0,19	11 857,00
Engineering	801 589,00	0,85	145 501,00	0,15	950 093,00
Aviation	-	-	2 261,00	1	2 261,00

Source: SAA's Management Report 2018

CHAPTER 4 : EMPIRICAL STUDY

Section 02: application of pricing models.

2.1 preparing the data

We have data on the total claims incurred in the period 2015-2019 per insured as well as the annual premiums issued for this same period. Shares of premium and claims ceded to facultative covers are ignored in this work because of missing information of insured values.

We are going to price a reinsurance program in excess of loss by risk (XS) on the Fire branch, this program is composed of four layers.

- ✓ Layer 01 : 90 000 000 DA XS 10 000 000 DA
- ✓ Layer 02 : 200 000 000 DA XS 100 000 000 DA
- ✓ Layer 03 : 300 000 000 DA XS 300 000 000 DA
- ✓ Layer 04 : 600 000 000 DA XS 600 000 000 DA

After having created an As If statistic, we are interested in the pricing of this treatise by two methods: a deterministic method of Burning Cost and a probabilistic method using the Pareto model.

2.1.1 The calculation of the statistic As If

The purpose of setting up the As If statistic is to create a homogeneous base on the Period from 2015 to 2019 from the revaluation coefficients calculated on the basis Annual inflation rate.

Year	2015	2016	2017	2018	2019	2020
inflation index	176,08	188,33	197,62	202,96	207,9	209,6
revaluation coefficients	1,19036801	1,11294005	1,06062139	1,03271581	1,00817701	1

The revaluation coefficients are calculated as follows:

$$J_j = \frac{I_n}{I_j}, j = 1, \dots, n.$$

Jj : the revaluation coefficient for the jth period;

In: inflation index of the quotation year (2019);

Ij : inflation index of the jth period.

CHAPTER 4 : EMPIRICAL STUDY

2.1.2 Revaluation of written premiums

The revaluation of the premium bases is done using the following formula:

$$a(As\ If)_j = a_j * J_j$$

year	premium base	revaluation index	indexed premium
2015	1 002 390 464,73	1,190368015	1 193 213 547,29
2016	1 011 740 213,17	1,112940052	1 126 006 205,49
2017	965 458 122,99	1,060621395	1 023 985 540,83
2018	1 004 416 466,37	1,032715806	1 037 276 760,70
2019	1 060 379 022,59	1,008177008	1 069 049 750,53

2.1.2 Revaluation of claim charges

The revaluation of the amounts of claims is made by the same index used in the revaluation of the premium bases. Significant claims (beyond 5,000,000 DA) revalued are calculated in the table below:

Year	amount of claims	revaluation index	indexed amount
2015	114 035 847,42	1,190368015	135 744 625,28
2016	768 707 067,91	1,112940052	855 524 884,16
2017	37 485 331,72	1,060621395	39 757 744,81
2018	32 981 051,23	1,032715806	34 060 052,91
2019	22 844 237,99	1,008177008	23 031 035,51

2.2 Pricing by the deterministic method (Burning Cost)

In this method, we will calculate the reinsurance premium for the year 2020 for each XS layer of the reinsurance program using:

- The history of claims exceeding the priority for the period 2015-2019;
- Premiums issued for the same period.
- **The calculation of the load for the first layer:**

CHAPTER 4 : EMPIRICAL STUDY

The individual claims charges are deducted from the application of the priority and the limit of the XS layer on the amounts of claims revalued in excess of 50% of the priority. (Tables in appendices).

- **Determination of the average Burning Cost**

The annual Burning Cost are presented as following:

layer	BCM
90 000 000 DA XS 10 000 000 DA	5,47%
200 000 000 DA XS 100 000 000 DA	5,14%
300 000 000 DA XS 300 000 000 DA	5,51%
600 000 000 DA XS 600 000 000 DA	1,10%

For the first layer We must cede 5.47% of our premium collection in 2020 for the purchase of 90,000,000 DA XS 10,000,000 DA cover.

- **Determination of the risk premium**

The risk premiums are calculated as follow

$$P_R = BCM * P_t^{\wedge}$$

layer	p_R
90 000 000 DA XS 10 000 000 DA	54 717 389,92
200 000 000 DA XS 100 000 000 DA	51 386 276,10
300 000 000 DA XS 300 000 000 DA	55 050 600,81
600 000 000 DA XS 600 000 000 DA	10 980 320,21

- **Determination of the pure premium.**

$$P_p = P_R * (1 + c)$$

In general the security load does not exceed 25% of the risk premium but we choose to calculate it with three different propositions

layer	pure premium		
	c=25%	c=30%	c=35%
90 000 000 DA XS 10 000 000 DA	68 396 737,40	71 132 606,89	73 868 476,39
200 000 000 DA XS 100 000 000 DA	64 232 845,13	66 802 158,94	69 371 472,74
300 000 000 DA XS 300 000 000 DA	68 813 251,01	71 565 781,06	74 318 311,10
600 000 000 DA XS 600 000 000 DA	13 725 400,26	14 274 416,27	14 823 432,28

CHAPTER 4 : EMPIRICAL STUDY

- **Determination of market premium**

$$P_M = \frac{P_p}{(1 - BF)(1 - (MF + PM))}$$

$$P_M = \frac{P_p}{(1 - 10\%)(1 - 15\%)}$$

With

BF=5%

MF+PM= 15%.

layer	Market premium		
	c=25%	c=30%	c=35%
90 000 000 DA XS 10 000 000 DA	89 407 499,87	92 983 799,86	96 560 099,85
200 000 000 DA XS 100 000 000 DA	83 964 503,44	87 323 083,58	90 681 663,71
300 000 000 DA XS 300 000 000 DA	89 951 962,11	93 550 040,60	97 148 119,08
600 000 000 DA XS 600 000 000 DA	17 941 699,69	18 659 367,67	19 377 035,66

2.3 Pricing by the Pareto method.

In this method, we will calculate the reinsurance premium for the year 2020 for each layer of the reinsurance program using:

- The history of claims exceeding the **X₀= 2/3* priority**, for the period 2015-2019;
- Premiums issued for the same period.

We will detail the calculation of the Pareto method for the first layer of the reinsurance program considered, then we proceed in the same way for the other layers.

- **calculating the α parameter :**

$$\alpha = \frac{n}{\sum_{i=1}^n \ln\left(\frac{x_i}{x_0}\right)}$$

n: number of claims = 17

$x_0 = 2/3 * \text{priority} = 6\,666\,666,67$ DA (for the first layer)

CHAPTER 4 : EMPIRICAL STUDY

$$\sum_{i=1}^{17} \ln\left(\frac{x_i}{x_0}\right) = 16,61837469 \text{ (for the first layer)}$$

Thus

$$\alpha = 1,02$$

As for the rest of layers :

layer	α
90 000 000 DA XS 10 000 000 DA	1,02
200 000 000 DA XS 100 000 000 DA	2,15
300 000 000 DA XS 300 000 000 DA	3,70
600 000 000 DA XS 600 000 000 DA	3,70

- calculating $f(X_0)$

$$f(x_0) = \frac{n_{x_0}}{n}$$

Layer	n_{x_0}	$f(x_0)$
90 000 000 DA XS 10 000 000 DA	16	3,2
200 000 000 DA XS 100 000 000 DA	2	0,4
300 000 000 DA XS 300 000 000 DA	1	0,2
600 000 000 DA XS 600 000 000 DA	1	0,2

- calculating $f(X)$

$$f(x) = f x_0 * (x_0/f)^\alpha$$

layer	$f(x)$
90 000 000 DA XS 10 000 000 DA	2,11
200 000 000 DA XS 100 000 000 DA	0,166990458
300 000 000 DA XS 300 000 000 DA	0,04
600 000 000 DA XS 600 000 000 DA	0,04

- calculating claim charges EC:

$$EC = \frac{f}{1-\alpha} * \left\{ \left(\frac{f+p}{f} \right)^{1-\alpha} - 1 \right\}, \text{ for } \alpha \neq 1$$

$$EC = f * \ln\left(\frac{f+p}{f}\right), \text{ for } \alpha = 1$$

CHAPTER 4 : EMPIRICAL STUDY

layer	EC
90 000 000 DA XS 10 000 000 DA	22 427 674,96
200 000 000 DA XS 100 000 000 DA	62 255 533,68
300 000 000 DA XS 300 000 000 DA	94 017 046,36
600 000 000 DA XS 600 000 000 DA	188 034 092,7

- **Determination of the risk premium**

$$p_R = f(x) * EC$$

layer	p_R
90 000 000 DA XS 10 000 000 DA	47 402 276,89
200 000 000 DA XS 100 000 000 DA	10 396 080,06
300 000 000 DA XS 300 000 000 DA	4 195 063,37
600 000 000 DA XS 600 000 000 DA	8 390 126,75

- **Determination of the pure premium**

$$P_p = P_R * (1 + c)$$

layer	pure premium		
	c=25%	c=30%	c=35%
90 000 000 DA XS 10 000 000 DA	59 252 846,11	61 622 959,95	63 993 073,80
200 000 000 DA XS 100 000 000 DA	12 995 100,07	13 514 904,07	14 034 708,08
300 000 000 DA XS 300 000 000 DA	5 243 829,22	5 453 582,39	5 663 335,55
600 000 000 DA XS 600 000 000 DA	10 487 658,43	10 907 164,77	11 326 671,11

- **Determination of the Market premium**

$$P_M = \frac{P_p}{(1-10\%)(1-15\%)}$$

layer	Market premium		
	c=25%	c=30%	c=35%
90 000 000 DA XS 10 000 000 DA	77 454 700,79	80 552 888,83	83 651 076,86
200 000 000 DA XS 100 000 000 DA	16 987 058,92	17 666 541,27	18 346 023,63
300 000 000 DA XS 300 000 000 DA	6 854 678,71	7 128 865,86	7 403 053,01
600 000 000 DA XS 600 000 000 DA	13 709 357,43	14 257 731,73	14 806 106,02

CHAPTER 4 : EMPIRICAL STUDY

3.3 Comparing both pricing method

After using the two pricing methods we will compare the two Market premiums on the first layer with a security load of 25% $\alpha = 1.02$ we see that the Pareto market premium is less than that of BC , as under this latter actual losses incurred are used to determine the cost .

	Pm BC	Pm Pareto
90 000 000 DA XS 10 000 000 DA	89 407 499,87	77 454 700,79

Conclusion:

In case that there have been claims that have exceeded the priority, we proceed to pricing based on experience to calculate the price of the XS treaty from the history of claims taking into account the main factors likely to influence the loss experience in this method we use two types of approaches: Burning cost and the Pareto model.

Results from both methods show that the level of premiums paid to the reinsure should not exceed 90 000 00 Da .However, SAA's ceded premiums on a proportional basis for the year 2019 was estimated up to 1 789 173 000 Da. Although the results should be reviewed because data for insured values were not available, thus claims exceeding the treaty limit and reinsured by facultative covers, were not taken into consideration. Still the significant gap illustrates the need of adopting non-proportional treaty for the fire portfolio especially that this latter registered a very limited number of important claims during the five year period.



General Conclusion

GENERAL CONCLUSION

The contribution of reinsurance, in terms of increased underwriting capacities and protection of commitments, contribute to improving turnover and profitability. However, this reliance on reinsurance comes at a cost, For an insurance company, this means combining the imperative of optimal protection of its commitments and the reduction of the cost of the reinsurance operation.

As such, SAA cannot avoid the need for a study of its risk portfolio, with the aim of highlighting the advantages and disadvantages of the current approach, which is based on the preference given to proportional reinsurance for the branches subject to this technique.

An optimal reinsurance strategy must precisely define the practices and reinsurance risk management procedures, particularly with regard to the choice of a reinsurance program that complies with the specific characteristics of the insurance activity within the company (branches of insurance practiced, level of exposure to risks , .., etc.). This consists of the combination of several types of reinsurance treaties, namely:

Proportional reinsurance treaties and non-proportional reinsurance treaties.

In our work, we were interested in non-proportional reinsurance treaties and more specifically excess of loss reinsurance treaties as an attempt to introduce this cover for the Fire branch, a branch that originally cover by a proportional Surplus treaty.

We wondered at the beginning of this work about which pricing method was more adequate to optimize the price of excess of loss reinsurance for the Fire branch We have seen that there are several approaches to achieve this, namely the experience-based approach represented by "Burning Cost" and "Pareto".

The objective of this work was to propose several decision-making approaches to optimize the price of excess of loss reinsurance for the Fire branch of SAA insurance. Therefore, we hope these actuarial techniques are to be taken into consideration and developed in the future strategy of the company. Optimizing the price of this form of cover is very important as it allows insurers to minimize their exposure to the risk of reinsurance cost on the one hand, and to avoid accepting commitments that exceed their financial capacity.

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TUNISRE wordings



APPENDICES

Appendix 01 : BC retained claims layer 01

Layer 01 : 90 000 000 DA XS 10 000 000 DA										
year	sinister refrence	sinister load	revalued sinister	priority	EC	liability	EC(reinsurer)	indexed premium	BCA	
2015	120022	6767797,7	8056169,911	10 000 000	0	90 000 000	0			
2015	120026	7268049,72	8651653,915	10 000 000	0	90 000 000	0			
2015	120033	50000000	59518400,73	10 000 000	49 518 401	90 000 000	49518400,73			
2015	120034	50000000	59518400,73	10 000 000	49 518 401	90 000 000	49518400,73			
2015							99036801,45	1193213547	8,30%	
2016	120013	6553372,05	7293510,23	10 000 000	0	90 000 000	0			
2016	120004	7513993	8362623,76	10 000 000	0	90 000 000	0			
2016	120033	592877938,9	659837604,2	10 000 000	649 837 604	90 000 000	90000000			
2016	120034	161761763,9	180031146	10 000 000	170 031 146	90 000 000	90000000			
2016							180000000	1126006205	15,99%	
2017	120003	9000000	9545592,551	10 000 000	0	90 000 000	0			
2017	120006	5907135	6265233,762	10 000 000	0	90 000 000	0			
2017	120010	22578196,72	23946918,49	10 000 000	13 946 918	90 000 000	13946918,49			
2017							13946918,49	1023985541	1,36%	
2018	120001	7699347,71	7951238,077	10 000 000	0	90 000 000	0			
2018	120011	6761780,94	6982998,054	10 000 000	0	90 000 000	0			
2018	120046	11783881,98	12169401,18	10 000 000	2 169 401	90 000 000	2169401,178			
2018	120013	6736040,6	6956415,598	10 000 000	0	90 000 000	0			
2018							2169401,178	1037276761	0,21%	
2019	120041	10026065	10108048,22	10 000 000	108 048	90 000 000	108048,2155			
2019	120005	12818172,99	12922987,3	10 000 000	2 922 987	90 000 000	2922987,295			
2019							3031035,511	1069049751	0,28%	
BCA							298184156,6	5449531805	5,47%	

Appendix 02 : BC retained claims layer 02

Layer 02 : 200 000 000 DA XS 100 000 000 DA									
year	sinister refrence	sinister load	revalued sinister	priority	EC	liability	EC(reinsurer)	indexed premium	BCA
2015	120022	6767797,7	8056169,911	100 000 000	0	200 000 000	0		
2015	120026	7268049,72	8651653,915	100 000 000	0	200 000 000	0		
2015	120033	50000000	59518400,73	100 000 000	0	200 000 000	0		
2015	120034	50000000	59518400,73	100 000 000	0	200 000 000	0		
2015							0	1193213547	0,00%
2016	120013	6553372,05	7293510,23	100 000 000	0	200 000 000	0		
2016	120004	7513993	8362623,76	100 000 000	0	200 000 000	0		
2016	120033	592877938,9	659837604,2	100 000 000	559 837 604	200 000 000	200000000		
2016	120034	161761763,9	180031146	100 000 000	80 031 146	200 000 000	80031145,97		
2016							280031146	1126006205	24,87%
2017	120003	9000000	9545592,551	10 000 000	0	200 000 000	0		
2017	120006	5907135	6265233,762	10 000 000	0	200 000 000	0		
2017	120010	22578196,72	23946918,49	10 000 000	0	200 000 000	0		
2017							0	1023985541	0,00%
2018	120001	7699347,71	7951238,077	10 000 000	0	200 000 000	0		
2018	120011	6761780,94	6982998,054	10 000 000	0	200 000 000	0		
2018	120046	11783881,98	12169401,18	10 000 000	0	200 000 000	0		
2018	120013	6736040,6	6956415,598	10 000 000	0	200 000 000	0		
2018							0	1037276761	0,00%
2019	120041	10026065	10108048,22	10 000 000	0	200 000 000	0		
2019	120005	12818172,99	12922987,3	10 000 000	0	200 000 000	0		
2019							0	1 069 049 750,53	0,00%
BCA							280031146	5449531805	5,14%

Appendix 03 : BC retained claims layer 03

Layer 02 : 200 000 000 DA XS 100 000 000 DA									
year	sinister refrence	sinister load	revalued sinister	priority	EC	liability	EC(reinsurer)	indexed premium	BCA
2015	120022	6767797,7	8056169,911	100 000 000	0	200 000 000	0		
2015	120026	7268049,72	8651653,915	100 000 000	0	200 000 000	0		
2015	120033	50000000	59518400,73	100 000 000	0	200 000 000	0		
2015	120034	50000000	59518400,73	100 000 000	0	200 000 000	0		
2015							0	1193213547	0,00%
2016	120013	6553372,05	7293510,23	100 000 000	0	200 000 000	0		
2016	120004	7513993	8362623,76	100 000 000	0	200 000 000	0		
2016	120033	592877938,9	659837604,2	100 000 000	559 837 604	200 000 000	200000000		
2016	120034	161761763,9	180031146	100 000 000	80 031 146	200 000 000	80031145,97		
2016							280031146	1126006205	24,87%
2017	120003	9000000	9545592,551	10 000 000	0	200 000 000	0		
2017	120006	5907135	6265233,762	10 000 000	0	200 000 000	0		
2017	120010	22578196,72	23946918,49	10 000 000	0	200 000 000	0		
2017							0	1023985541	0,00%
2018	120001	7699347,71	7951238,077	10 000 000	0	200 000 000	0		
2018	120011	6761780,94	6982998,054	10 000 000	0	200 000 000	0		
2018	120046	11783881,98	12169401,18	10 000 000	0	200 000 000	0		
2018	120013	6736040,6	6956415,598	10 000 000	0	200 000 000	0		
2018							0	1037276761	0,00%
2019	120041	10026065	10108048,22	10 000 000	0	200 000 000	0		
2019	120005	12818172,99	12922987,3	10 000 000	0	200 000 000	0		
2019							0	1 069 049 750,53	0,00%

Appendix 04: BC retained claims layer 04

Layer 03 : 300 000 000 DA XS 300 000 000 DA									
year	sinister refrence	sinister load	revalued sinister	priority	EC	liability	EC(reinsurer)	indexed premium	BCA
2015	120022	6767797,7	8056169,911	300 000 000	0	300 000 000	0		
2015	120026	7268049,72	8651653,915	300 000 000	0	300 000 000	0		
2015	120033	50000000	59518400,73	300 000 000	0	300 000 000	0		
2015	120034	50000000	59518400,73	300 000 000	0	300 000 000	0		
2015							0	1193213547	0,00%
2016	120013	6553372,05	7293510,23	300 000 000	0	300 000 000	0		
2016	120004	7513993	8362623,76	300 000 000	0	300 000 000	0		
2016	120033	592877938,9	659837604,2	300 000 000	359 837 604	300 000 000	300000000		
2016	120034	161761763,9	180031146	300 000 000	0	300 000 000	0		
2016							300000000	1126006205	26,64%
2017	120003	9000000	9545592,551	300 000 000	0	300 000 000	0		
2017	120006	5907135	6265233,762	300 000 000	0	300 000 000	0		
2017	120010	22578196,72	23946918,49	300 000 000	0	300 000 000	0		
2017							0	1023985541	0,00%
2018	120001	7699347,71	7951238,077	300 000 000	0	300 000 000	0		
2018	120011	6761780,94	6982998,054	300 000 000	0	300 000 000	0		
2018	120046	11783881,98	12169401,18	300 000 000	0	300 000 000	0		
2018	120013	6736040,6	6956415,598	300 000 000	0	300 000 000	0		
2018							0	1037276761	0,00%
2019	120041	10026065	10108048,22	300 000 000	0	300 000 000	0		
2019	120005	12818172,99	12922987,3	300 000 000	0	300 000 000	0		
2019							0	1069049751	0,00%

