

# Insurance | Actuarial.

## Optimising Life Reinsurance

Nfq | 13th March 2025







# About Nfq

# About us / Overview

We are a Spanish consulting group that provides professional services in multiple industries and geographies covering the E2E needs of our clients. We were founded in 2010 and the Insurance area started in 2015.

## 8+20 Geographies

Our Headquarters is located in Spain, but we also have offices and teams in Europe, UK, USA, Mexico and Latin America.  
, México y Latinoamérica



Onshore / Nearshore / Offshore

## +150 customers

We work with more than 150 clients from different sectors and industries, with our core business being financial services.

### Insurers



### Financial Institutions



### Asset Managers

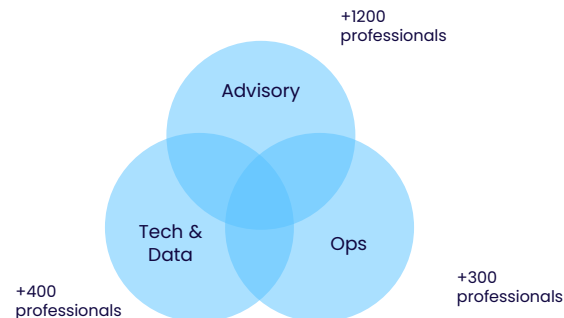


### Real Estate & Industries



## +2000 professionals

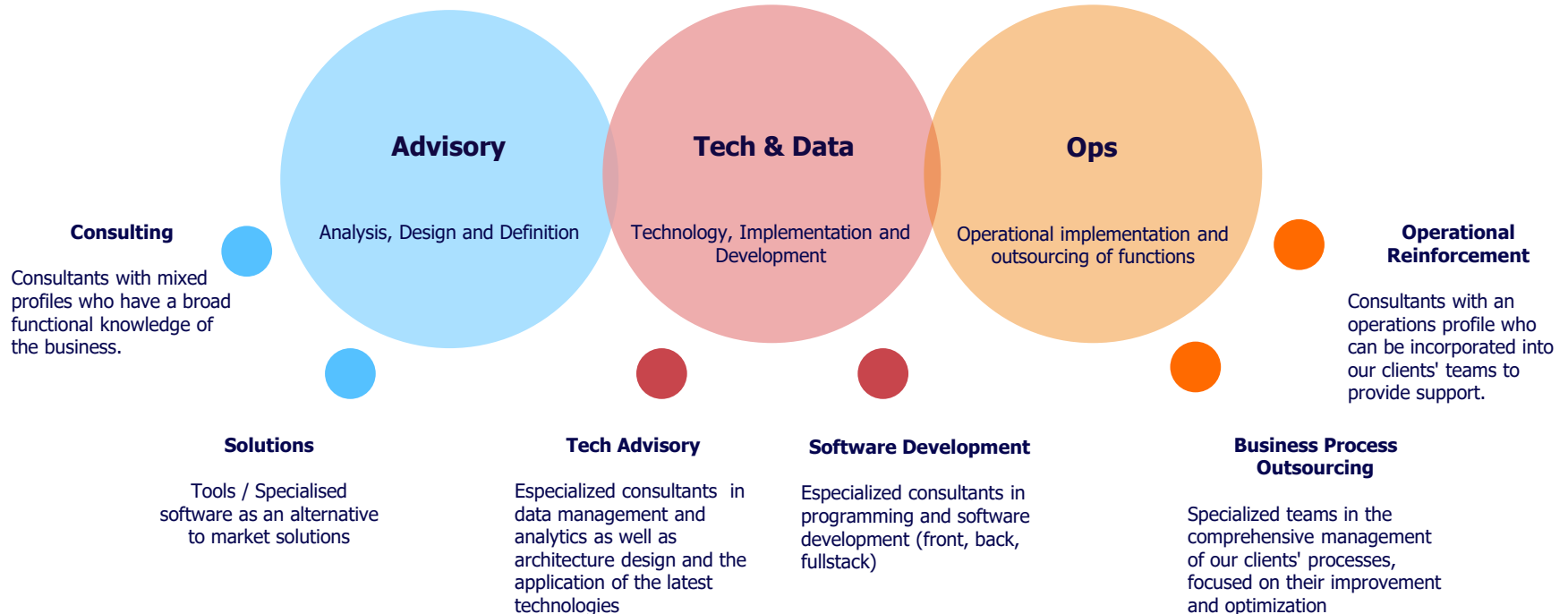
We have over 1,800 highly specialized professionals providing services across 3 main service lines



**+105M**  
FY24 Revenue

# About us / Service Lines

We have 3 main service lines that we combine in a unique way to offer our clients the best team and capabilities needed to achieve their objectives:












# About us/ Some of our clients



# Nfq | Insurance / Our areas of expertise in Insurance

Our practice combines a deep understanding of the insurance business with differentiated technological capabilities.

CORE 	TECH 	FINANCE & RISK 	ACTUARIAL AND REINSURANCE $t P_X$	IA + DATA 	CLIENTS/cus tomers 	Our service offering is based on four main pillars
We support our clients in the <b>modernization of their core systems</b> , providing expert advice on the implementation of <b>market solutions and custom developments</b>	We have a high level of expertise in <b>technological architecture and software development</b> on all types of platforms.	We are experts in <b>financial management, risk management and actuarial function</b> , leading regulatory <b>reporting projects</b> in major insurance companies.	We have a team of <b>actuaries</b> and professionals specialised in <b>Pricing, Reserving</b> , and Product Development for both Life and Non-Life products. We have our own tools for reinsurance optimisation.	We cover <b>100% of the data management needs</b> of insurance companies: from the definition of the <b>strategy</b> to the design and implementation of new platforms.	We are experts in providing an <b>end-to-end Single Customer View service</b> , having implemented more than <b>20 projects</b> in the main Spanish insurance companies.	<div>  <b>Business knowledge</b>            Our teams have a <b>high level of business knowledge</b> in all lines of business, with relevant experience in large transformational projects for insurance companies.         </div> <div>  <b>Applied architecture</b>            We have a <b>technological architecture</b> team with extensive experience in the design of <b>advanced solutions</b> that respond to the challenges of the insurance sector.         </div> <div>  <b>Centres of excellence</b>            We rely on our <b>nearshore and offshore</b> centres of excellence to provide <b>highly specialised</b> and highly scalable service models.         </div> <div>  <b>Global coverage</b>            We can <b>support our clients in their international strategy</b> thanks to our local presence in Latin America, Europe and North America.         </div>
LIFE						
HEALTH						
AUTO INSURANCE						
GENERAL INSURANCE						
FUNERAL INSURANCE						
REINSURANCE						





# Contenido

- **Introduction**
- **Proposed Methodology**
- **Re[Nfq]**



## IMPROVEMENT STUDY

### Example :

'In our production line we have reduced production costs by 10%'

Is this the maximum possible reduction?

What has been the impact on product quality?

### Typology

- A single variable is improved, not several, and not from the point of view of finding the Pareto Optimum.
- In reinsurance analysis, it corresponds to a statistical and not a mathematical approach.



## OPTIMISATION

### Example:

'In our production line we have the minimum production costs that allow us to comply with international standards and the ISOs that we have validated'.

### Typology

- Several problems or equations are balanced to reach an equilibrium point of the Pareto Optimal type.
- It usually corresponds to the formulation or mathematical approach of a Linear Programming problem.

# Preliminary questions

**We expect to answer these questions during the presentation**

**What is the probability of loss of my Life portfolio?**

**What is the reinsurer's loss probability?**

**What is the expected result?**

**And its expected outcome?**

**And the standard deviation of the result?**

**And its expected outcome?**

**What is the probability of ruin?**

**How much would a stop loss hedge cost me?**

**And what is the tolerable risk for my entity?**

**How much would it cost me to include pandemic cover?**



# Life reinsurance | Introduction. Features

## Life Reinsurance Typology

### Proportional

- The premiums received by the reinsurer and the loss ratio are in proportion to each other.
- Types: Quota share and excess
- Utility:
  - risk management,
  - financial optimisation (financing, SII ratio)

### Not proportional

- Premiums received by the reinsurer and the loss ratio are not proportional.
- Types : stop loss, working XL, excess of loss, CAT
  - Utility:
    - risk management,
    - financial optimisation (SII ratio)

- High and static transfer volumes
- High reinsurance returns (>30%)
- Absence of market modelling tools

ASYMMETRIC INFORMATION

INEFFICIENCIES

# Life reinsurance | Introduction. Features

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## Environment

Reinsurance knowledge is highly specialised and limited outside the framework of reinsurers and reinsurance brokers.

Solution and consultancy providers linked to reinsurance are the same as those involved in the underwriting process.

The development of customised tools or solutions for a small entity is not a priority for current suppliers.

Current providers only offer reinsurance-based solutions, without considering other options.

Ceding company's dependence on reinsurer/broker in risk management tools and technical reports

Existing suppliers do not have the technical capacity in Tech and Data required for new developments in advanced computing.

# Life reinsurance | Introduction. Environment and necessity

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## Consequences

Absence of an independent provider of reinsurance services in the field of consultancy.

Difficulty in getting support for the development of customised Reinsurance solutions or tools

Lack of a reinsurance solutions provider with high technical competences in information processing and management and in the development of Cloud solutions, AI...

## Lack

Lack of an independent reinsurance consultant, with the necessary technical skills for the development of customised tools and high technical competences in the processing and management of information and in the development of Cloud solutions, AI...

## Target

Develop from scratch a tool for the optimisation of life reinsurance programmes, based on a methodology different from the current one and accessible to the whole market.

# Life reinsurance | Introduction. Environment and necessity: Objective

Develop from zero a tool for the optimisation of life reinsurance programmes, based on a methodology different from the current one and accessible to the whole market.

## Insurer needs

Independent provider focused in reinsurance consultancy that can provide you with customised tools for reinsurance modelling and optimisation.

## Present methodology

- Based on Excel
- Intensive in consultant hours
- ¿Obsolete? YES

- Inefficient
- ~~Expensive~~

**VERY EXPENSIVE**

## Alternatives

**YES**

Abundant academic literatura  
Almost infinite computing power: Cloud

## Differential capabilities

### NFQ | Insurance TEAM

More than 200 developers, Cloud Engineers, programmers, actuaries, statisticians, mathematicians, physicists, data scientists...

# Life reinsurance | Methodology

## Theoretical / academic approach

It approaches reinsurance optimisation as a linear programming problem, optimising an objective function subject to a set of restrictions. It seeks the Pareto optimum.

The traditional restriction is the institution's risk aversion, modelled by surveys, meetings, questionnaires, etc., which makes it possible to determine the institution's 'acceptable' probability of ruin.

There are several works of this type from the Complutense University of Madrid by professors Gil Fana, Heras and Vilar Zanón:

- "Study of the behaviour of the probability of ruin in a quota share reinsurance case with several sub-portfolios."
- "Rational decisions in reinsurance".

Not used in practice. Mathematical modelling is complex.

## Current / Traditional statistical methodology

This is the practical approach currently used by reinsurers, brokers and reinsurance areas.

They model risk in one or more combined distribution functions. Usually, one for quantity and one for frequency.

They calculate the probability of ruin and the probability of loss of insurance and reinsurer.

In practice, they do not represent a 'real' optimisation, as they are approached as an improvement process without the calculation of a Pareto optimum.

Good fit to a Poisson distribution for the number of claims. Problem of "information loss" when adjusting the amount to a distribution. In any case, correlation coefficient  $< 1$

Consumes many hours of consultancy. Slow and expensive.

# Life Reinsurance| Methodology: Re[Nfq]

## Our solution to the reinsurance modelling problem

Technically, closer to the traditional approach (but avoiding the mathematical solution.) By solving the problem through a multitude of simulations, the histograms are converted into density functions: Monte Carlo.

By not modelling by approximating distributions (as is done in practice today), the problem of information loss due to  $r < 1$  is avoided.

The traditional constraint of the academic approach is modelled: the institution's risk aversion. The 'tolerated' probability of ruin is obtained by inferring it from the institution's objective solvency ratio (or similar) as reflected in its SFCRs. Subjectivity, interviews and questionnaires are avoided.

The massive cost of consultant hours (actuary specialising in reinsurance) is replaced by Cloud Computing hours. Project time is reduced from weeks (or months) to just a few days.

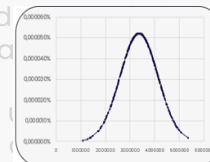
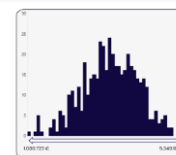
The calculations performed are fully traceable and replicable, providing individual-level data outputs that can be cross-checked and audited.

La salida de datos es un Excel, lo que permite personalizar herramientas de visualización y análisis.



Re[Nfq]

actual



**LOSS OF DATA**

~~**SUBJECTIVITY**~~

~~**REDUCED COST**~~

**TRANSPARENCY**

**PERSONALISATION**



# Life Reinsurance | Methodology : Re[Nfq]. Stages



Re[Nfq]

## STAGES OF REINSURANCE OPTIMISATION

### PHASE I: Claims Analysis

This stage is similar in nature to the 'traditional' approach.

It basically consists of calculating the loss ratios (alphas) that will be used later in the simulations.

They are constructed from the institution's historical experience.

Ideally, we will calculate an alpha per coverage, but it is possible to group if the claims experience is very low (e.g.:  $\alpha_1 = FCC$ ;  $\alpha_2 = \text{complementary}$ ).

In the case of a low loss experience, we can solve this by applying Credibility Theory.

### PHASE II: Modelling and Simulation

At this stage we take a completely different approach to solving a mathematical problem without resorting to traditional statistical modelling.

Monte Carlo, through billions of individual simulations, constructs sample distribution curves

We only approximate statistical distributions for PHASE III, visualisation.

The solution is calculated without loss of information.

Intensive in machine hours utilisation.

### PHASE III: Optimum and Visualisation

This stage differs from the 'traditional' approach by posing the search for a Pareto Optimum.

The linear programming problem to be used is not unique.

It requires a suitable algorithm to filter the results and discard possible false positives.

# Life Reinsurance | Methodology : Re[Nfq]. Phase I

Re[Nfq]

## PHASE I: Claims Analysis: Credibility Theory

### PHASE I: Claims Analysis

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In the case of a low loss experience, we can solve this by applying Credibility Theory.

El tamaño de una cartera o lo reducido de su histórico no es problema para el cálculo de los alfas, más allá de la no mejora de las tasas de mortalidad.

El objetivo de este apartado es poder solucionar la problemática de una cartera pequeña, es decir, dotar de un  $\alpha$  o ratio de siniestralidad más realista en función de los datos históricos de los que dispone la cedente, y para ello utilizaremos la Teoría de la Credibilidad y el Teorema Central del Límite.

Mediante la aplicación de la Teoría de la Credibilidad en función de la experiencia de la cartera, podremos hallar el ratio de  $S(\alpha)$  que vamos a utilizar respecto a las tablas de orden 2 correspondientes al riesgo.

#### Aplicación práctica de teoría de la credibilidad

Por un lado, tenemos una cartera pequeña que aplicando el TCL supondremos que las prestaciones que se deben pagar por dicha cartera se comportan de forma aproximada a una distribución normal

$$Y = X_1 + X_2 + \dots + X_n \approx N\left(\sum_{i=1}^n C_i q_{xi}, \sqrt{\sum_{i=1}^n q_{xi}(1 - q_{xi}) C_i^2}\right)$$

Donde:

$X_i$ : Distribución Bernoulli( $q_{xi}$ )

$C_i$ : Capital o Suma Asegurada de la póliza del asegurado  $i$

$q_{xi}$ : Probabilidad de fallecimiento del asegurado  $i$

La distribución de  $Y$  no presenta cambios característicos significativos a lo largo de los años. Suponiendo unas primas puras constantes  $P$  y con lo visto anteriormente se obtiene el alfa siniestral de la entidad.

$$\alpha_i = \frac{\bar{S}}{P} + (1 - Z) \frac{E[Y]}{P}$$

Donde:

$Z$ : credibilidad asignada a la información individual (histórico de siniestralidad de la cartera)

$(1 - Z)$ : credibilidad asignada a la información general (tablas orden 2 correspondientes al riesgo)

Siendo el estimador  $\bar{S}$

$$\bar{S} = \frac{1}{m} \sum_{i=1}^m Y_i$$

Y la credibilidad  $Z$

$$Z = \frac{\sum_{i=1}^n C_i q_{xi}}{\sqrt{\sum_{i=1}^n q_{xi}(1 - q_{xi}) C_i^2}} \times \frac{\theta \sqrt{m}}{\phi^{-1}\left(\frac{1 + \beta}{2}\right)}$$

#### CREDIBILITY THEORY

Its correct application requires the fulfilment of a series of hypotheses..

Basically, we must analyse the behaviour of the variables that define the portfolio (average age, M/F mix, average capital) and check with the institution whether its medium-term stability is foreseeable.

We must be aware of purchases/splits in the portfolio, marketing campaigns, potential regulatory changes... in short, any change that significantly affects the basic characteristics of the portfolio.

# Life Reinsurance | Methodology: Re[Nfq]. Stages. Phase II

Re[Nfq]

## PHASE II: Modelling and Simulation

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At this stage we take a completely different approach to solving a mathematical problem without resorting to traditional statistical modelling.

Monte Carlo, applied to billions of individual simulations, 'paints' sample distribution functions.

We only approximate statistical distributions for PHASE III, visualisation.

The solution is computed without loss of information..

Intensive in terms of machine hours.

#### CLASSIC PROBLEM: ACADEMIC APPROACH

Function Objective: Result of the insurance company

Objective: Maximise

Restriction : Probability of ruin < target entity

Basically, we model all possible proportional reinsurance programmes and run simulations for each of them.

For a solvency ratio of 200%, we will run 10,000 scenarios for each type of programme.

#### Objective Function: Insurer's performance

Maximising it means minimising the cost of the reinsurance programme.

The obvious solution would be not to reinsure, but we want to keep the entity's risk within the parameters set by its risk policy.

The probability of ruin of the institution is defined by the institution's Target Solvency Ratio.

#### Other approaches:

Minimise the probability of ruin, subject to a maximum reinsurance cost (absolute or proportional).

Minimise the volatility of the entity's result subject to a probability of failure < entity objective.

RS	Riesgo impago	
	norma	extendido
95%	1,20%	1,20%
100%	0,50%	0,50%
122%	0,24%	0,24%
125%	0,20%	0,20%
150%	0,10%	0,10%
175%	0,05%	0,05%
200%	0,01%	0,01%
250%	0,01%	0,004%
300%	0,01%	0,001%

# Life Reinsurance | Methodology: Re[Nfq]. Stages. Phase III

Re[Nfq]

## PHASE III: Optimum and Visualisation

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This stage differs from the 'traditional' approach by posing the search for a Pareto Optimum.

The linear programming problem to be used is not unique.

It requires a suitable algorithm to filter the results and discard possible false positives.

Depending on the Solvency Ratio of the institution, the probability of ruin will be higher, and will require more simulations.

We initially run 10,000 scenarios per type of reinsurance programme, in total more than 130,000 scenarios. (130.000 o 140.000)

The developed algorithm locates the optimal ones, and we run a new sweep of 40,000' scenarios for each of the 14 initial solutions.

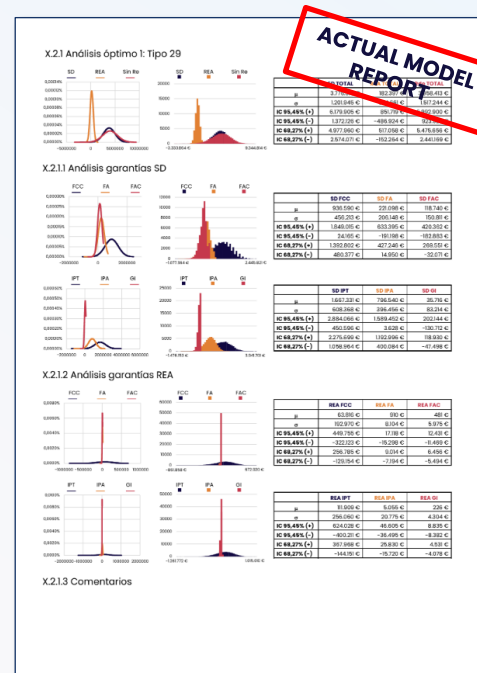
False positives are discarded and a set of 1 optimum and 8-10 sub-optimals is obtained.

The results obtained are sorted and presented as part of the optimisation report .

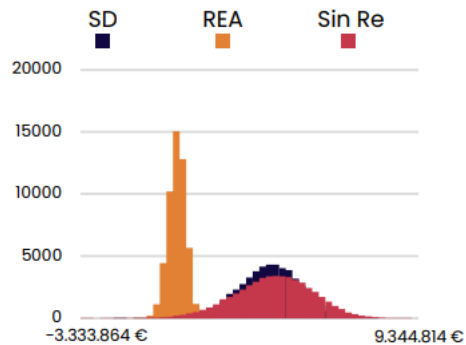
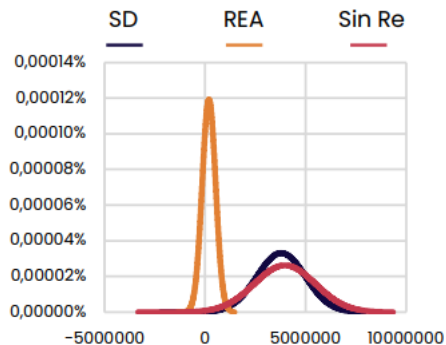
In total, more than 500,000 scenarios for a solvency ratio of 200%.

### 'Solution Validation

For a solvency ratio of 200%, with an associated probability of ruin of 1/10,000, the probability of a false positive is  $0,9999^{10.000}=36,79\%$ . Therefore, an additional 40,000 scenarios must be validated for each type of programme, which reduces the probability of a false positive to  $0,9999^{50.000}=0,67\%$

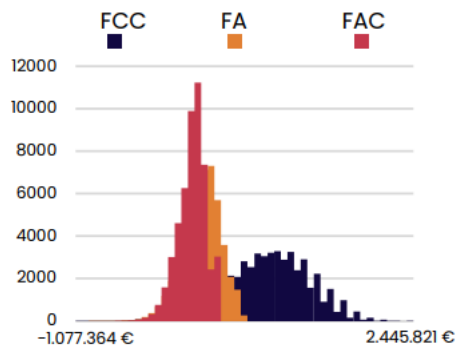
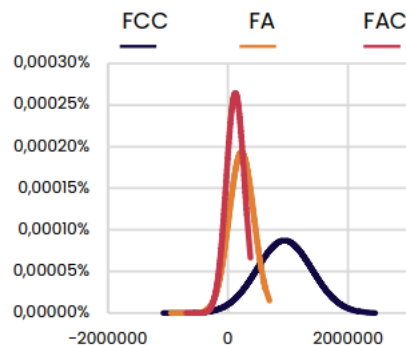


## X.2.1 Análisis óptimo 1: Tipo 29

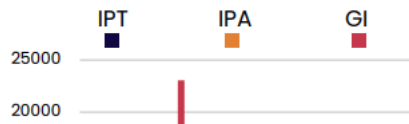
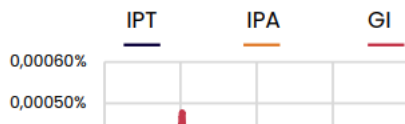


	SD TOTAL	REA TOTAL	Rdo TOTAL
$\mu$	3.776.015 €	182.397 €	3.958.413 €
$\sigma$	1.201.945 €	334.661 €	1.517.244 €
IC 95,45% (+)	6.179.905 €	851.719 €	6.992.900 €
IC 95,45% (-)	1.372.126 €	-486.924 €	923.925 €
IC 68,27% (+)	4.977.960 €	517.058 €	5.475.656 €
IC 68,27% (-)	2.574.071 €	-152.264 €	2.441.169 €

### X.2.1.1 Análisis garantías SD



	SD FCC	SD FA	SD FAC
$\mu$	936.590 €	221.098 €	118.740 €
$\sigma$	456.213 €	206.148 €	150.811 €
IC 95,45% (+)	1.849.015 €	633.395 €	420.362 €
IC 95,45% (-)	24.165 €	-191.198 €	-182.883 €
IC 68,27% (+)	1.392.802 €	427.246 €	269.551 €
IC 68,27% (-)	480.377 €	14.950 €	-32.071 €



	SD IPT	SD IPA	SD GI
$\mu$	1.667.331 €	796.540 €	35.716 €

# Life Reinsurance | Methodology: Re[Nfq]. Conclusions

Re[Nfq]

Conclusions

## Differences : Re[Nfq] Vs traditional

**Re[Nfq]** does a mathematical modelling of the solution based on Montecarlo. It replaces modelling hours with machine hours.

No loss of information. No correlation coefficient ( $r < 1$ ).

Data output in Excel:

The insurance company has the details of each simulation at the insured level.

## IMPLICATIONS

### EFFICIENCY

Traditional: 90% modelling and 10% análisis

Re[Nfq]: 10% Modelling and 90% Analysis

### TECHNICALLY SUPERIOR SOLUTION

### TRANSPARENCY

### CUSTOMIZATION

### Cargar Excel de Base de Datos

Descargar Plantilla

Seleccionar archivo | Ningún archivo seleccionado

Procesar Excel

0%

### Formulario de inputs

Cálculo 1

Cálculo 2

Cálculo 3

Cerrar Sesión

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# Life Reinsurance | Methodology: Re[Nfq]



Re[Nfq]

## Main Objectives

**Cost Reduction:** Identify the most efficient reinsurance structure to minimise costs based on the risk aversion defined by the institution.

**Risk Management:** Ensure that the probability of ruin and potential losses are aligned with the risk profile.

**Advanced Analysis:** Provide key insights into claims experience, volatility, and reinsurance behavior under different scenarios.

## Reinsurance Optimisation

**Re[Nfq]:** Our tool is designed to optimize reinsurance programs for life/accident lines and complementary coverages, adapting to the entity's risk profile. It uses advanced modeling and simulations to identify reinsurance structures that minimize costs without compromising financial stability.

## Cargar Excel de Base de Datos

## Formulario de inputs

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## Innovative Components

**Calculation in the Cloud.** : Increases efficiency and enhances real-time analysis

**Modular Approach:** Allows modelling of different guarantees such as accidental death or road traffic accidents.

**Pareto Optimisation:** Balances risk and profitability in an optimal way for the entity.

## Optimised Workflow

### Claims Analysis:

- Review of claims history.
- Identification of patterns and volatilities.

### Simulation and modelling:

- Generation of portfolios and claims scenarios.
- Evaluation of results.

### Determination of the Optimal Programme:

- Configuration of retentions and cessions.
- Evaluation of impact on costs and volatility.

Autoguardado

Plantilla Base de datos (8) (1)

Buscar

Comentarios

Compartir

Archivo

Inicio

Insertar

Dibujar

Disposición de página

Fórmulas

Datos

Revisar

Vista

Automatizar

Programador

Ayuda

A1

sexo

	A	B	C	D	E	F	G	H	I	J	K	L
1	sexo	edad	fechaNacimiento	fechaEmision	fechaFinVigencia	capital_FCC	capital_FA	capital_FAC	capital_IPT	capital_IPA	capital_GI	
2	H	25	01/01/1968	01/01/2025	01/01/2026	10.000,00	10.000,00	10.000,00	10.000,00	10.000,00	10.000,00	
3	M	43	01/01/1993	01/01/2025	01/01/2026	10.000,00	10.000,00	10.000,00	10.000,00	10.000,00	10.000,00	
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Six guarantees are available. Default: FCC, FA, FAC, IPT, IPA, GI.

FCC: Death from any cause  
FA: Death due to accident  
FAC: Death due to driving accident  
IPT: Total Permanent Disability  
IPA: Absolute Permanent Disability  
GI: Severe Disability

Typical tables are preloaded in the tool, but additional tables can be loaded and memorised for each user. Therefore, the six coverages to be analysed are customisable by modifying the rates.

Sheet1

Accesibilidad: todo correcto

Configuración de visualización

205 %

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Re[Nfq]

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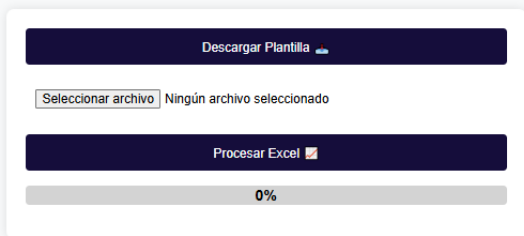
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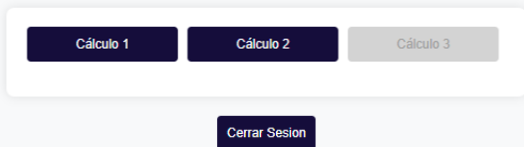
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## Innovative Components

**Calculation in the Cloud.** : Increases efficiency and enhances real-time analysis

**Modular Approach:** Allows modelling of different guarantees such as accidental death or road traffic accidents.

**Pareto Optimisation:** Balances risk and profitability in an optimal way for the entity.

# Life Reinsurance | Methodology: Re[Nfq]

## Notable Benefits

- **Scalable Simulation:** Performs millions of individual simulations on hundreds of different models to analyse loss scenarios and reinsurance structures.
- **Risk Modelling:** Integrates deterministic approaches for a practical representation of loss probability. No loss of information or accuracy in fitting distributions by not doing statistical modelling. Based entirely on Monte Carlo.
- **Customised Optimisation:** Adjusts the parameters of the reinsurance programme (retention, cession, structure...) to obtain the best financial result. The optimal programme is obtained by matching the probability of ruin with the risk profile derived from its target solvency ratio.

## Benefits for the Entity

**Data-Driven Decisions:** Enables strategic decision making by providing detailed analysis and scenario simulations.

**Flexibility and Adaptability:** Scalable to adapt to portfolios of different sizes and complexities.

**Savings and Stability:** Reduces the cost of reinsurance while improving financial forecasting and portfolio sustainability.

## Multiple Approaches

**Cost optimisation:** We can minimise the cost of reinsurance (from a Pareto-optimal point of view) conditional on a maximum probability of loss or ruin limit.

**Risk optimisation:** We can minimise the probability of ruin (from a Pareto optimal point of view) conditional on a maximum cost of the reinsurance programme.

**Other approaches:** It is also possible to minimise the cost of the programme, subject to a minimum profitability for the reinsurer or any combination we can think of.

Re[Nfq]

### Formulario de inputs

Cálculo 1

Cálculo 2

Cálculo 3

G. Gestion Interna

0,08

G. Gestion Externa

0,07

Siniestralidad FCC ( $A_1$ )

0,8

Siniestralidad FA ( $A_2$ )

0,8

Siniestralidad Muerte Acc. Circulación ( $A_3$ )

0,8

Siniestralidad IPT ( $A_4$ )

0,8

Siniestralidad IPA ( $A_5$ )

0,8

Siniestralidad GI ( $A_6$ )

0,8

Comisión de Reaseguro

0,25

Nº de simulaciones

5.000.0000

☐ Calcular PB

Descargar Excel de Escenarios

Descargar Excel de Simulaciones

Descargar Ambos

0%

**The data in the file at the insured level includes:**

- Simulation number
- Premium for each of the retention guarantees
- Premium for each of the guarantees of the cession
- Cession rates
- Rates for each of guarantees
- Amount of the claims
- Lambda for each insured

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**Flexibility and Adaptability:** Scalable to adapt to portfolios of different sizes and complexities.

**Savings and Stability:** Reduces the cost of reinsurance while improving financial forecasting and portfolio sustainability.

## Múltiples Enfoques

**Optimización del coste:** Podemos minimizar el coste reaseguro (desde un punto de vista de optimo de Pareto) condicionado a un umbral máximo de probabilidad de pérdida o de ruina.

**Optimización del riesgo:** Podemos minimizar la probabilidad de ruina (desde un punto de vista de optimo de Pareto) condicionado a un coste máximo del programa de reaseguro.

**Otros enfoques:** también es posible minimizar el coste del programa, sujeto a una rentabilidad mínima para el reasegurador o cualquier combinación que se nos ocurra.

Re[Nfq]

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G. Gestion Externa		
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Siniestralidad GI ( $A_6$ )		
0,8		
Comisión de Reaseguro		
0,25		
Nº de simulaciones		
5.000.000		
<input type="checkbox"/> Calcular PB		
Descargar Excel de Escenarios		
Descargar Excel de Simulaciones		
Descargar Ambos		
0%		

Re[Nfq] Allows modeling of 10 years of PB with configurable loss carryforward



Configuración de visualización     85 %

Autoguardado		Escenarios2020		Buscar		AS																															
Archivo		Inicio		Insertar		Dibujar		Disposición de página		Fórmulas		Datos		Revisar		Vista		Automatizar		Programador		Ayuda															
C1		fx		Pr. Com. FAC Total																																	
Pr. Com. FAC Total		Pr. Com. IPT Total		Pr. Com. IPA Total		Pr. Com. GI Total		Pr. Com. G Total		Pr. Cedula FCC Total		Pr. Cedula FA Total		Pr. Cedula FAC Total		Pr. Cedula IPT Total		Pr. Cedula IPA Total		Pr. Cedula GI Total		Pr. Cedula Total		Pr. Retenida FCC Total		Pr. Retenida FA Total		Pr. Retenida FAC Total		Pr. Retenida IPT Total		Pr. Retenida IPA Total		Pr. Retenida GI Total		Pr. Retenida G Total	
299,374.18		5,558,234.88		2,502,434.64		111,587.19		12,146,357.17		1,273,544.96		291,890.35		157,170.90		2,275,757.15		1,313,778.45		58,583.07		5,370,724.88		1,845,199.80		264,091.15		142,207.52		3,282,477.66		1,188,656.29		1,188,656.29		1,188,656.29	
299,374.18		5,558,234.88		2,502,434.64		111,587.19		12,146,357.17		1,273,544.96		291,890.35		157,170.90		2,275,757.15		1,313,778.45		58,583.07		5,370,724.88		1,845,199.80		264,091.15		142,207.52		3,282,477.66		1,188,656.29		1,188,656.29		1,188,656.29	
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C1 Pr. Com. FAC Total

C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Pr. Com. FAC Total	Pr. Com. IPT Total	Pr. Com. IPA Total	Pr. Com. GI Total	Pr. Com. total	Pr. Cedula FCC Total	Pr. Cedula FA Total	Pr. Cedula FAC Total	Pr. Cedula IPT Total	Pr. Cedula IPA Total	Pr. Cedula GI Total	Pr. Cedula Total	Pr. Retenida FCC Total	Pr. Retenida FA Total	Pr. Retenida FAC Total	Pr. Retenida IPT Total	Pr. Retenida IPA Total	Pr. Retenida
299.374,18	5.558.234,88	2.502.434,64	111.587,19	12.146.357,17	1.273.544,96	291.890,35	157.170,90	2.275.757,15	1.313.778,45	58.583,07	5.370.724,88	1.845.199,80	264.091,15	142.207,52	3.282.477,66	1.188.656,29	
299.374,18	5.558.234,88	2.502.434,64	111.587,19	12.146.357,17	2.228.385,87	416.986,12	224.530,59	3.976.331,28	1.876.825,94	83.689,81	8.806.749,61	890.358,92	138.995,36	74.843,59	1.581.903,60	625.608,70	

## Scenario level data include:

- Number of claims per guarantee
- commercial premium per guarantee
- Ceded premium per guarantee
- Retained premium per guarantee
- Benefits per guarantee
- Benefits ceded by guarantee
- Retained guarantee benefits
- Direct insurance results
- Reinsurer's results
- Probability (0.1) reinsurer's loss
- Probability (0.1) loss of the cedant
- Reinsurance modality
- Modality retention
- Ceding modality ratio

Multiplied x 30,000 simulations....

Re[NFq]

## Análisis Individual

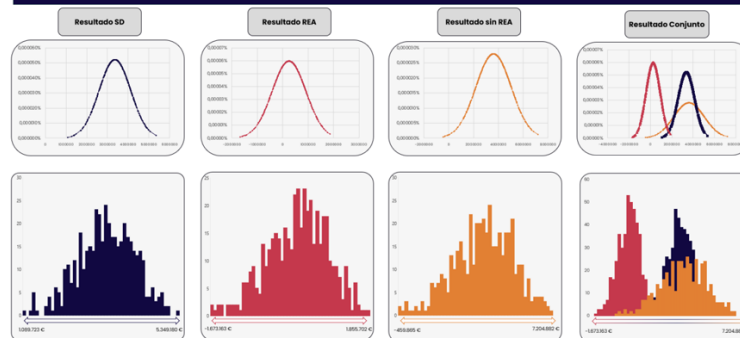
Óptimo Resultado SD Sub-Óptimo  
Óptimo Prob. Pérdida Resto

Actualizar gráficos

Los gráficos actuales hacen referencia a la modalidad de recesgado

19

### Distribución Resultado



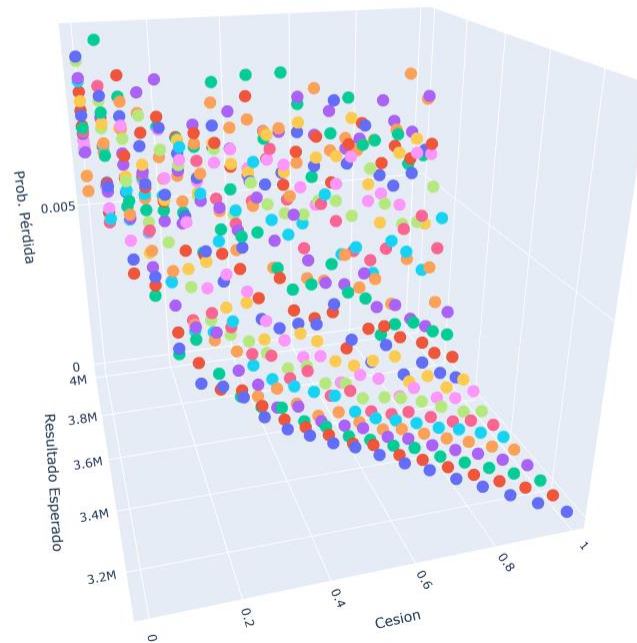
### Otros gráficos



Escenarios



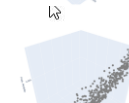
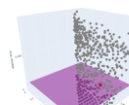
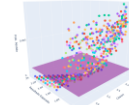
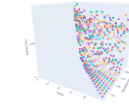
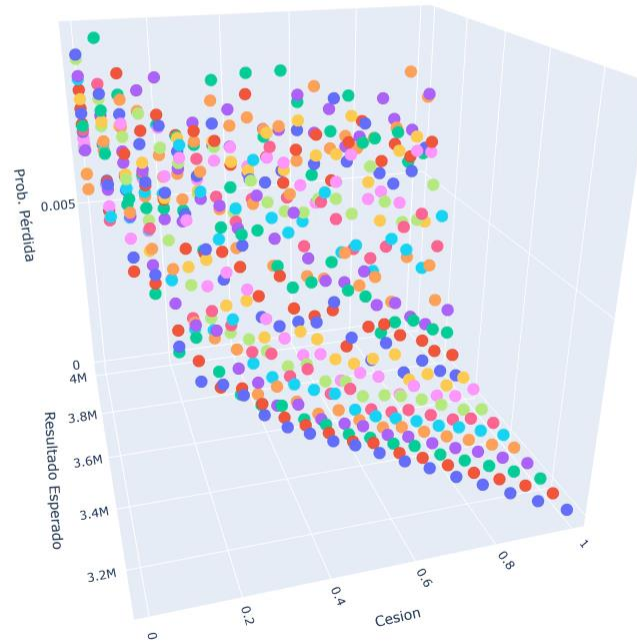
# Life Reinsurance | Methodology: Re[Nfq]



- Retencion 0k
- Retencion 10k
- Retencion 20k
- Retencion 30k
- Retencion 40k
- Retencion 50k
- Retencion 60k
- Retencion 70k
- Retencion 80k
- Retencion 90k
- Retencion 100k
- Retencion 110k
- Retencion 120k
- Retencion 130k
- Retencion 140k
- Retencion 150k
- Retencion 160k
- Retencion 170k
- Retencion 180k
- Retencion 190k
- Retencion 200k
- Retencion 210k
- Retencion 220k
- Retencion 230k
- Retencion 240k

INICIAL

# Life Reinsurance | Methodology: Re[Nfq]



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- Retención 20k
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- Retención 200k
- Retención 210k
- Retención 220k
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# Life Reinsurance | Methodology: Re[Nfq]

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We can minimize the reinsurance cost (from a Pareto optimality perspective) subject to a maximum threshold for the probability of loss or ruin.

### Risk Optimization:

We can minimize the probability of ruin (from a Pareto optimality perspective) subject to a maximum allowable cost for the reinsurance program.

### Other Approaches:

It is also possible to minimize the program cost subject to a minimum required profitability for the reinsurer or any other combination we may conceive.

Re[Nfq]

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0,8

Siniestralidad IPA ( $A_5$ )

0,8

Siniestralidad GI ( $A_6$ )

0,8

Comisión de Reaseguro

0,25

Nº de simulaciones

5.000.0000

☐ Calcular PB

Descargar Excel de Escenarios

Descargar Excel de Simulaciones

Descargar Ambos

0%

# Life Reinsurance | Methodology: Re[Nfq]

## Cálculo 1

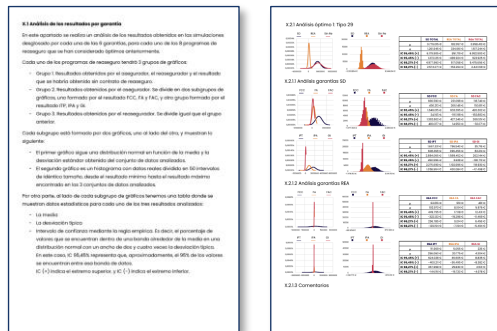
Calculation 1 allows modeling any reinsurance modality among Quota Share, Surplus, QS-Surplus, and Surplus-QS.

The variables to be defined are:

- Internal and external management costs,
- Loss ratio:  $a_1, a_6$ ,
- Retention and cession at guarantee level,
- Reinsurance commission
- Number of simulations

During the execution of the calculations, the tool has a bar that indicates the approximate time to completion.

Calculation 1 is the perfect tool to support the Actuarial Function in its reinsurance analysis.



## Re[Nfq]

Formulario de inputs

☒ Cálculo 1 ☐ Cálculo 2 ☐ Cálculo 3

G. Gestión Interna

G. Gestión Externa

Sinestralidad FCC ( $A_1$ )

Sinestralidad FA ( $A_2$ )

Sinestralidad Muerte Acc. Circulación ( $A_3$ )

Sinestralidad IPT ( $A_4$ )

Sinestralidad IPA ( $A_5$ )

Sinestralidad GI ( $A_6$ )

Retención FCC

Retención FA

Retención FAC

Retención IPT

Retención IPA

Retención GI

Cesión FCC

Cesión FA

Cesión FAC

Cesión IPT

Cesión IPA

Cesión GI

Comisión de Reaseguro

Nº de simulaciones

☐ Calcular PB

9%

Expenses

$a_1, \dots, a_6$

Technical parameters

Reinsurance commission

# Life Reinsurance | Methodology: Re[Nfq]

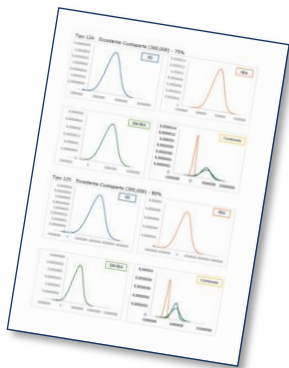
## Cálculo 2

Calculation 2 makes a sweep of 131 types of reinsurance of the 4 modes in order to make sufficient simulations to obtain the optimum.

The variables automatically modified by Calculation 2 to obtain the universe of solutions are Modality, Cession, Retention (that is why they do not appear in the front end).

The rest of the variables are fixed for all simulations and must be specified in the data entry.

For all these reasons, Calculation 2 has the simplest interface of the three calculation modes. It is the tool with which we make a first sweep in a reinsurance optimisation.



## Re[Nfq]

### Formulario de inputs

Cálculo 1	Cálculo 2	Cálculo 3
G. Gestion Interna		
0,08		
G. Gestion Externa		
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0,8		
Siniestralidad GI ( $A_6$ )		
0,8		
Comisión de Reaseguro		
0,25		
Nº de simulaciones		
5.000.000		
<input type="checkbox"/> Calcular PB		
Descargar Excel de Escenarios		
Descargar Excel de Simulaciones		
Descargar Ambos		
0%		

# Life Reinsurance | Methodology: Re[Nfq]

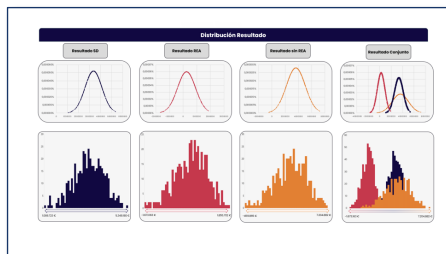
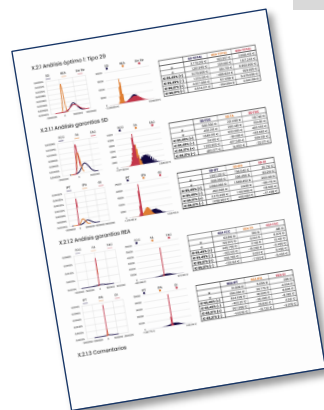
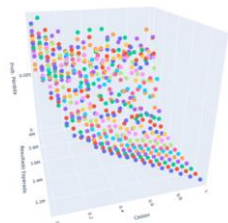
## Cálculo 3

Calculation 3 is similar to Calculation 2, with the particularity that it allows customisation of the types of reinsurance programme to be modelled.

The idea is to be able to map specific areas of the solution universe once the optimal potentials have been identified.

The user defines the cession and retention ranges in which he/she wants to work and the tool automatically calculates only those of the modalities defined in Calculation 2 that fall within those ranges.

Calculation 3 is designed to be used to validate optimums and sub-optimums, to analyse specific regions of the universe of solutions and, in general, to avoid consuming machine resources when we already know in which area the solution can be found.



## Re[Nfq]

### Formulario de inputs

Cálculo 1

Cálculo 2

Cálculo 3

G. Gestion Interna

0,08

G. Gestion Externa

0,07

Siniestralidad FCC ( $A_1$ )

0,8

Siniestralidad FA ( $A_2$ )

0,8

Siniestralidad Muerte Acc. Circulación ( $A_3$ )

0,8

Siniestralidad IPT ( $A_4$ )

0,8

Siniestralidad IPA ( $A_5$ )

0,8

Siniestralidad GI ( $A_6$ )

0,8

Cesión Mínima

Ej: 0.5 (50%)

Cesión Máxima

Ej: 0.5 (50%)

Retención Mínima

Ej: 0.5 (50%)

Retención Máxima

Ej: 0.5 (50%)

Comisión de Reaseguro

0,25

Nº de simulaciones

5

☐ Calcular PB

Descargar Excel de Escenarios

Descargar Excel de Simulaciones

Descargar Ambos

0%

# Life Reinsurance | Methodology: Re[Nfq]: Other applications

Re[Nfq]

## Pandemic Modelling. Methodology:

We generate two sets of scenarios:

1. **Non-pandemic scenarios:** we have already seen how. 100,000 or 500,000 scenarios
2. **Pandemic scenarios:** stressing mortality. Three options
  - Using stressed alphas
  - Generating new 'pandemic' mortality tables"
  - Models not based on Re[Nfq].

We combine 1 and 2 with Excel, in whatever proportions we consider generating sets where 1/50 simulations is pandemic, or 1/100 or 1/200. These combinations can have up to 1,000,000 elements.

We draw random sets of these combinations, of about 10,000 elements each.

With the results we can now paint sampling distribution functions for each pandemic probability (1/50, 1/100, 1/200...).

The cost of including pandemics would be approximately the difference of the reinsurer's expected result without including it and including it.

## Claims Analysis

As we have seen, **Re[Nfq]** provides us with results at the insured level. We can make an analysis of the cost of reinsurance by age bracket, by gender, by Quota-Share (if we cross-reference this information with the data outputs).

## Calculation of reserves

We can convert deterministic reserves into stochastic reserves by running simulations without reinsurance and analysing the expected outcomes and how likely they are to be negative, generating confidence intervals...

## Non-proportional reinsurance

To the extent that we can calculate the distribution functions of the outcome, we can know with what probability the losses generated by our portfolio would be above a certain level.

## FRS 17, CSM, Accrual pattern

By modelling contracts, we could modulate the impacts of the CSM accrual pattern.

This issue could be the subject of another webinar...

# Re[Nfq] | Service Options

Necesidad	Solución	Implementación	Servicio
PROJECT (INSURANCE COMPANY / MUTUAL PROVIDENT SOCIETY)	Optimisation of the reinsurance programme	Optional support and development for claims analysis and visualisation and dashboard.	Licence after project Calculation 1, 2 and 3 according to portfolio size
	Actuarial Function Support Report	Optional claims analysis support and development	Licence after project Calculation 1, depending on portfolio size
LICENSING (INSURANCE COMPANY / MUTUAL PROVIDENT SOCIETY)	Optimisation of the reinsurance programme	Optional support and development for claims analysis and visualisation and dashboard.	The type of licence required is analysed on a case-by-case basis.
	Actuarial Function Support Report	Optional claims analysis support and development	
"ON DEMAND"	Generation of simulations according to the entity's indications.	Optional support and development for claims analysis and visualisation and dashboard.	NOT RELEVANT
COLLABORATION (BROKERS, CONSULTANTS, REINSURERS, UNIVERSITIES...)	Case-by-case analysis	NOT RELEVANT	The type of licence required is analysed on a case-by-case basis.



# Re[Nfq] | Licence Type

Type	Solution	Capacity	Application
TYPE I	CALCULATION 1	100.000 Scenarios	Actuarial Function Support Report
TYPE II	CALCULATION 1 CALCULATION 2	1.000.000 Scenarios	Reinsurance Programme Study
TYPE III	CALCULATION 1 CALCULATION 2 CALCULATION 3	5.000.000 Scenarios	Reinsurance Programme Optimisation

# Preliminary Questions

**We hope to have answered these questions during the presentation.**

**What is the probability of loss of my Life portfolio?**

**What is the reinsurer's loss probability?**

**What is the expected result?**

**And its expected outcome?**

**And the standard deviation of the result?**

**And its expected outcome?**

**What is the probability of ruin?**

**How much would a stop loss hedge cost me?**

**And what is the tolerable risk for my entity?**

**How much would it cost me to include pandemic cover?**



Very often innovation does not come from revolution or disruptive change, but from the simple evolution of an idea....

The wheel: 3.500 BC, Mesopotamia

The travelling suitcase: 1.850, United Kingdom

The wheeled suitcase: 1.970s, Bernard Sadow

The wheeled suitcase with telescopic handle: 1.987, Robert Plath



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## Do you want to know more about Re[Nfq]?

[Contact](#)

Contact us and we will analyse your needs without commitment.

If you are a reinsurer or reinsurance broker and you want to improve the service you provide to your clients, we will be happy to talk to you.

# Re[Nfq]

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# Re [Nfq]

[Re]Thinking [Re]Insurance