Beyond Boundaries

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AFIR/ERM | IAA FINANCIAL RISKS AND ERM SECTION
SECTION DES RISQUES FINANCIERS ET GRE DE L'AAI

"Improvements Made To The Methods For Estimating Premium Risk and Counterparty Risk In The Mexican QIS1"

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Introduction

- The draft insurance bill, "Ley de Instituciones de Seguros y Fianzas" sets a regulatory framework for Mexican insurance companies under the principles of the Solvency II Directive.
- The Mexican Association of Insurance Companies (AMIS) performed a first quantitative impact study for the insurance industry in 2009 based on the methods employed in the European QIS4

Introduction

- Voluntary exercise
- 28 insurance firms
- Market share of 83.5%
- Financial support for this project was provided by the same companies through AMIS

Introduction

Mexican QIS1

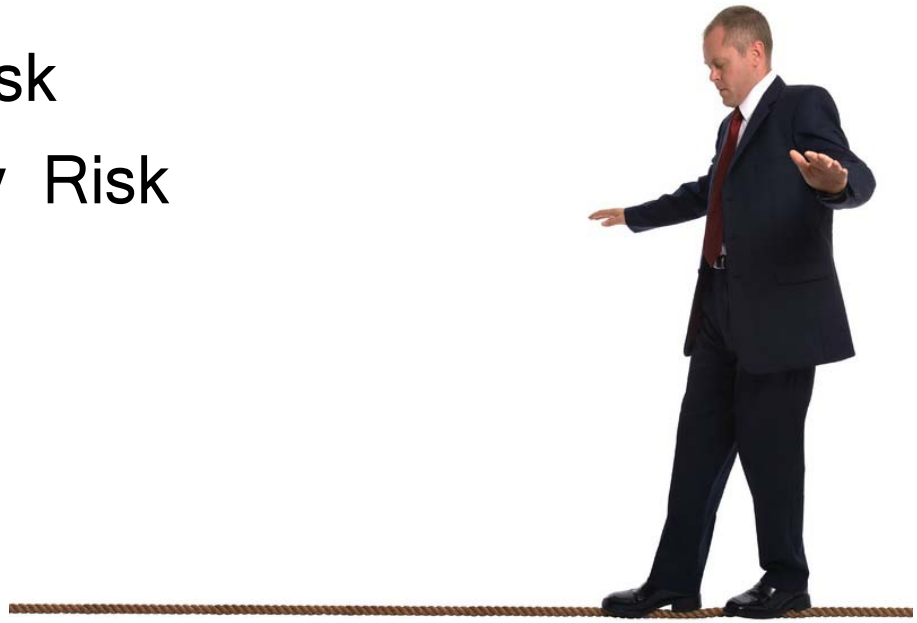
- life insurance underwriting risks
- non-life underwriting risks
- market risks
- Counterparty
- operational risks

Were estimated by methods employed in the European QIS4 with parameters in accordance to the Mexican market and by methods specifically devised by AMIS' Solvency II Committee.

Improvements to the methods

After this first impact study, AMIS has continuously worked on further improvements, not only to the methods thus proposed, but also to their calibration.

- Premium Risk
- Counterparty Risk



Premium Risk

Premium risk corresponds to the possibility that insurance risk premiums will be insufficient to cover future total claims arising from a portfolio, with a probability of 99.5% over the following year.

It is necessary to model the future aggregate losses of the insurance portfolio as a random variable by means of the Collective Risks Model.

Premium Risk

It was decided to estimate premium risk using a compound distribution (Poisson, binomial or negative binomial) for aggregate losses.

Frequency distribution

- moderate claims
- severe claims
- Poisson, binomial, negative binomial

Severity distributions

- continuous distributions
- lognormal, gamma, Pareto, Weibull, Burr, and exponential

Proposed modification

Premium Risk – Frequency Distribution

Proportion of moderate claims:

Number of moderate claims divided by the total number of claims

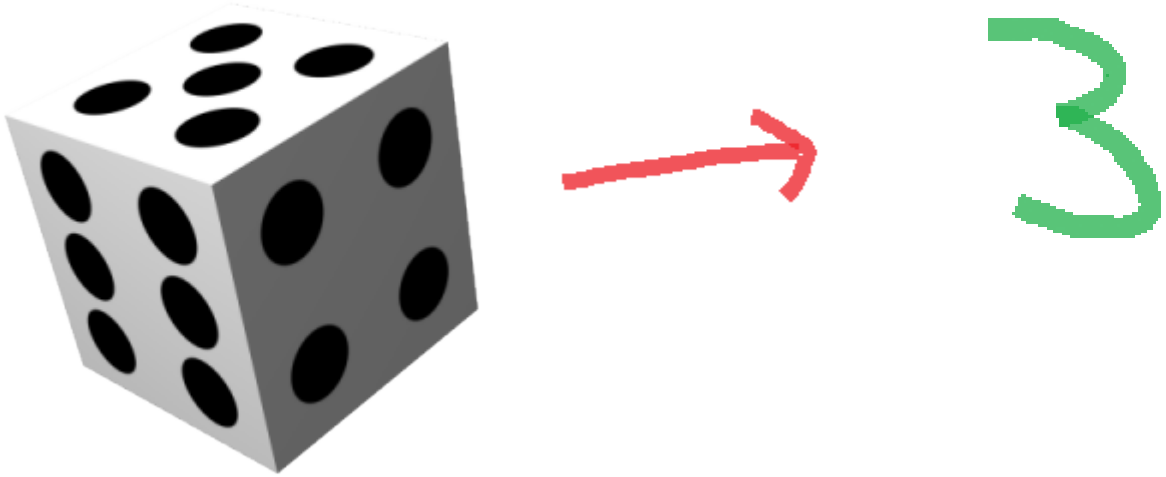
Proportion of severe claims:

Number of severe claims divided by the total number of claims

The frequency distribution in both instances is the same, but different severity distributions are employed to model moderate claims and severe claims.

Proposed modification
Premium Risk

1. Simulated claim numbers are obtained from the Poisson distribution
2. For each claim, a uniform random number in the interval $(0,1)$ is produced to represent whether the claim is moderate or severe



Proposed modification

Premium Risk

3. If the value obtained is greater than zero and less than the proportion of moderate claims, a simulated value from the distribution of moderate claims will be produced, otherwise a simulated value from the severe claim amount will be generated
4. Finally, all claim amounts are added to produce a simulated value of aggregate claims
5. This procedure is repeated until the results converge

Comparison of SCR

Fictitious companies

Solvency Capital Requirement for Premium Risk
Company A

	Mexican QIS1					Simulating Claim Types Method				
LoB	Moderate	Severe	SCR	λ moderate	λ severe	Moderate	Severe	SCR	Δ vs Mex QIS1	λ
Third-party liability	Lognormal	Gamma	1,825,691.83	38	2	Lognormal	Gamma	2,347,634.04	28.59%	71
Marine & Transport	Lognormal	Pareto	6,298,691.69	31	5	Lognormal	Pareto	6,191,028.40	-1.71%	29
Fire	Lognormal	Pareto	2,267,819.06	155	17	Lognormal	Pareto	1,840,423.51	-18.85%	126
Miscellaneous	Lognormal	Lognormal	10,481,281.27	278	2	Lognormal	Lognormal	10,803,315.51	3.07%	356

Solvency Capital Requirement for Premium Risk
Company B

	Mexican QIS1					Simulating Claim Types Method				
LoB	Moderate	Severe	SCR	λ moderate	λ severe	Moderate	Severe	SCR	Δ vs Mex QIS1	λ
Personal Accidents	Lognormal	Lognormal	473,353.94	218	15	Lognormal	Lognormal	501,972.15	6.05%	328
Medical expense	Lognormal	Pareto	3,518,743.77	2,158	1	Lognormal	Pareto	2,996,110.34	-14.85%	2,775
Third-party liability	Lognormal	Lognormal	4,004,996.33	361	5	Lognormal	Lognormal	3,820,292.18	-4.61%	208
Marine & Transport	Lognormal	Lognormal	10,241,758.80	121	7	Lognormal	Lognormal	7,956,950.61	-22.31%	85
Fire	Lognormal	Lognormal	45,070,664.50	68	3	Lognormal	Lognormal	41,155,366.83	-8.69%	57
Miscellaneous	Lognormal	Lognormal	10,245,330.24	718	6	Lognormal	Lognormal	8,730,519.49	-14.79%	508

Comparison of SCR

Fictitious companies

Solvency Capital Requirement for Premium Risk Company C										
	Mexican QIS1					Simulating Claim Types Method				
LoB	Moderate	Severe	SCR	λ moderate	λ severe	Moderate	Severe	SCR	Δ vs Mex QIS1	λ
Personal Accidents	Lognormal	Pareto	14,974,754.47	19,457	249	Lognormal	Pareto	7,704,481.00	-48.55%	4,993
Medical expense	Lognormal	Pareto	144,296,025.06	883	36	Lognormal	Pareto	108,722,140.57	-24.65%	778
Third-party liability	Lognormal	Lognormal	47,655,638.86	439	36	Lognormal	Lognormal	52,094,519.74	9.31%	486
Marine & Transport	Lognormal	Lognormal	45,365,344.39	1,402	77	Lognormal	Lognormal	38,816,523.57	-14.44%	1,330
Fire	Lognormal	Gamma	47,609,937.99	37	15	Lognormal	Gamma	58,249,466.91	22.35%	82
Diversos	Lognormal	Gamma	80,574,198.16	984	20	Lognormal	Gamma	96,452,275.33	19.71%	1,412
Motor	Lognormal	Gamma	11,647,201.23	887	122	Lognormal	Gamma	7,764,974.41	-33.33%	744

Comparison of SCR

- For Company A, the highest increments in SCR correspond to third-party liability, with an increase in 28.59%. One of the causes is the value of the parameter lambda, since it is 78.3% higher than the sum of the Poisson parameters for the cases of moderate and severe claims in the original Mexican QIS1.
- The greatest decrease in SCR corresponds to Company C in Personal Accidents insurance, with a decrement of 48.55%. This change is due to a reduction in 74.66% of the parameter lambda with respect to those obtained in the Mexican QIS1.

Counterparty Risk

Counterparty risk arises from the failure to meet contractual obligations such as reinsurance and coinsurance contracts, derivatives, deposits, and any other credit exposure.

Thus, counterparts risk must include all potential losses caused by either default or a downgrade in the credit scores of counterparties and debtors.

Counterparty Risk

The Mexican QIS1 estimated Counterparty Risk by means of an Expected-Loss Model. This method consists of two parts: a best estimate and the effect of reinsurance on the Capital Requirement for Underwriting Risk.

$$EL = Exp \times Sev \times PD$$

$EL = ExpectedLoss$

$Exp = Exposure$

$Sev = Severity$

$DP = Default\ \Pr obability$

Proposed modification Counterparty Risk

Consists in the calculation of the best estimate of each one of the counterparties introducing a transition matrix, that incorporates a more risk sensitive approach, and a stochastic simulation procedure, providing a more dynamic risk measurement process to estimate the SCR of counterparty risk.

Once the BEL is thus estimated, the SCR is calculated under the same method as in the Mexican QIS1.

Proposed modification Counterparty Risk

We define the model's elements and the proposed modifications to the estimation of both the default probability and the loss severity.

Exposure (Exp): is the maximum unrecoverable amount in case of counterparty default.

$$Exp_i = BEL_i - Collateral_i$$

BEL_i: best estimate of the counterparty i

$Collateral_i$: the guarantee or reserve to cover the potential losses related to counterparty i

Proposed modification Counterparty Risk

Probability Of Counterparty Of Debtor Default (PD): probability that the counterparty fails to meet its contractual obligations, and it is based on its credit score

The proposed modification to the estimation procedure of default probabilities of default consists in employing a Monte Carlo simulation approach, employing the cumulative probabilities from the transition matrix corresponding to each counterparty credit score.

Proposed modification Counterparty Risk

Transition Matrix (pesos)							
Ratings	AAA	AA	A	B	C	D	Total
AAA	97.99%	1.34%	0.67%	0.00%	0.00%	0.00%	100.00%
AA	2.39%	92.05%	4.17%	1.19%	0.20%	0.00%	100.00%
A	0.46%	2.59%	92.53%	3.51%	0.91%	0.00%	100.00%
B	0.00%	0.89%	3.45%	83.63%	3.57%	8.45%	100.00%
C	0.00%	0.00%	0.00%	0.00%	68.75%	31.25%	100.00%
D	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%

- Represents the potential changes in the financial strength ratings through time.
- Is the same as the one used in the Mexican QIS1 to estimate the SCR of the spread risk.

Proposed modification Counterparty Risk

Rating	Probability of Default QIS4
AAA	0.01%
AA	0.01%
A	0.24%
BBB	0.24%
BB	30.51%
B	30.51%
CCC or lower, unrated	30.51%

- The default probabilities are the same as the ones used in the Mexican QIS1, which in turn were proposed by EIOPA for QIS4.

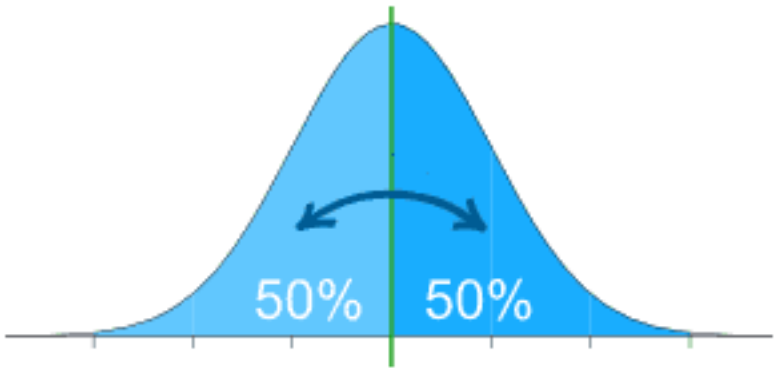
Proposed modification Counterparty Risk

Severity (Sev): It is the percentage actually lost in case of default.

The proposed modification to estimate the recovery rate associated with the severity consists in employing a simulation approach based on a normal distribution with a mean of 0.5 and a standard deviation of 0.1.

Proposed modification Counterparty Risk

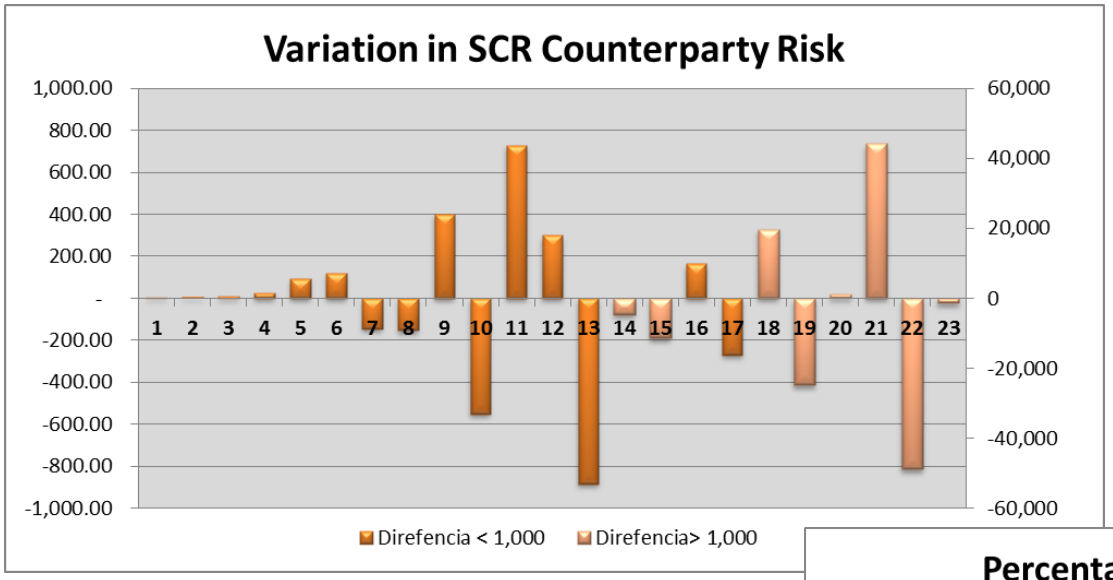
The expected-loss for each counterparty is then obtained as the 50th percentile of 20,000 simulations. These estimates are then aggregated (without considering possible correlations among reinsurers or counterparties) to obtain the SCR for the counterparty risk of each insurance firm.



Comparison of SCR

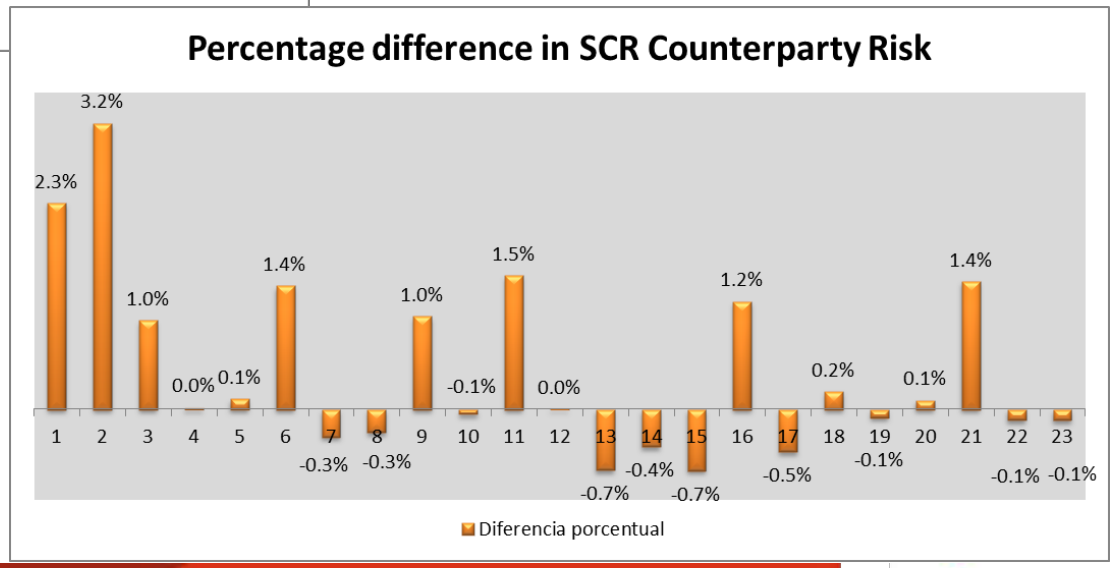
Company	SCR Mexican QIS 1		Alternative Method	
	SCR Mexican QIS 1	%Default	SCR Alternative	%Default
1	298.25	0.01%	305.05	0.17%
2	258.31	0.24%	266.48	1.96%
3	1,239.85	0.01%	1,252.06	0.10%
4	125,889.94	0.20%	125,917.82	0.87%
5	80,451.99	23.80%	80,546.79	23.82%
6	8,888.76	0.01%	9,010.23	0.09%
7	46,912.06	0.19%	46,767.29	0.67%
8	59,411.24	30.51%	59,258.35	30.51%
9	39,003.16	0.01%	39,404.37	0.09%
10	1,024,724.27	0.02%	1,024,174.07	5.47%
11	49,266.01	0.06%	49,994.34	0.57%
12	6,236,826.35	28.88%	6,237,125.77	28.89%
13	131,718.83	0.23%	130,834.37	0.44%
14	1,131,259.76	0.21%	1,126,560.37	0.52%
15	1,686,933.40	0.09%	1,675,521.60	0.39%
16	13,687.22	0.16%	13,850.63	0.95%
17	57,174.58	0.11%	56,905.33	0.27%
18	9,936,820.97	0.13%	9,956,597.56	2.41%
19	27,289,578.00	11.95%	27,264,809.36	8.87%
20	1,143,022.30	0.87%	1,144,181.17	1.06%
21	3,128,670.16	0.16%	3,172,952.48	1.44%
22	41,039,946.86	2.32%	40,991,134.49	4.78%
23	1,174,096.75	0.25%	1,172,667.05	0.33%
Total	**94,406,079.02**	**6.45%**	**94,380,037.04**	**6.98%**

Comparison of SCR



Most companies exhibit a SCR increase with respect to the one calculated in the Mexican QIS1; nevertheless, such increase is never higher than 3%.

When considering the SCR on an aggregate basis for all companies, the requirement is actually reduced in 0.03%



Conclusions

- The Mexican QIS1 proved to be decisive in making the participating companies aware of the alternative methods that are available to model.
- Nevertheless, we consider necessary to further improve the modeling methods in order to better capture the nature of each risk, which is fundamental to improving their management.

Conclusions

- The proposed changes in the methods to estimate Premium Risk and Counterparty Risk incorporate randomness in elements that were considered deterministic under the Mexican QIS1.
- This approach is intended to reduce variances between company's estimates and the reality, since those models based exclusively on historic data do not usually consider changes in the firm's risk profile, as well as changes in economic, political, and social environments.

Conclusions

- Changes in the methods produce variances in capital requirements of different magnitudes for each portfolio, and that in some instances are even negative. This was to be expected, given the distinct risk profiles and exposures.

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Thank You !!!!

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