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Pricing Excess Aggregate Limits for Large Professional Indemnity Programmes

GIRO Convention 2007
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What we will do…

- Setting the scene
  - Objectives
  - Hospital Medical Liability Insurance (HPL)
  - Limits and Aggregates
  - Top & Drop...?
  - Policy Limits
- Pricing Drop down policies
- Example/summary
- References

Objectives

Understand :

- Drop down clauses
- How to price for a Drop Down clause
- Impact of aggregate SIRs on the excess programme

The Insured

- Large US Hospitals
- Claims >$100m
- Large Retentions

Limits and Aggregates

- Limit
  - maximum amount payable each Loss
- Aggregate
  - maximum amount payable for each Annual Period

Drop Down - The wording

Underlying Amounts

In the event of reduction or exhaustion of any Underlying Amount for which an aggregate is stated, this Policy, subject to its terms,[...] and Other Conditions, shall;

1. in the event of reduction pay the excess of such reduced Underlying Amount

2. in the event of exhaustion apply in place of the exhausted Underlying Amount subject always to terms [...], and Other Conditions of this policy

What does this mean?

Excess = min(A,B)

A= underlying limit
B= underlying remaining aggregate

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Programme

Layer	Each loss limit	Aggregate
SIR	$3m	$15m
1xs	$10m	$10m
2xs	$5m	$5m
3xs	$5m	$5m

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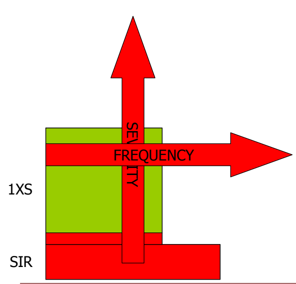
Programme diagram



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Wheel of misfortune

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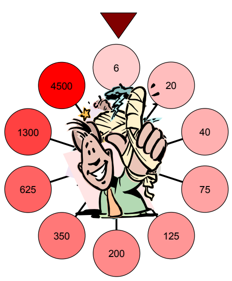
The wheel of misfortune



Loss	SIR	XS
20	20	0
200	200	0
350	200	150
6	6	0

176 – 150 = 26

SIR: 200 limit and 400 in agg
1xs : 300 limit and 300 in agg

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Paws for thought...

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Pricing approach

1. Estimate basic limits loss cost
2. ILF calculated from frequency severity modelling
3. Apply ILF to calculate excess loss cost

Pricing the primary excess

- 2 components
  - The pure excess layer
  - The drop down layer

Conditional Probability

E(x) = e(x|a) x pr(a) + e(x|b) x pr(b)

E(L) = e(L|no drop) x pr(no drop) + e(L|drop) x pr(drop)

$(1-\zeta)$ x pure excess + ζ x cost of drop down

Pricing the excess layer

(1-ζ) x pure excess + ζ x cost of drop down

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Cost of pure excess

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Pricing the excess layer

(1-ζ) x pure excess + ζ x cost of drop down

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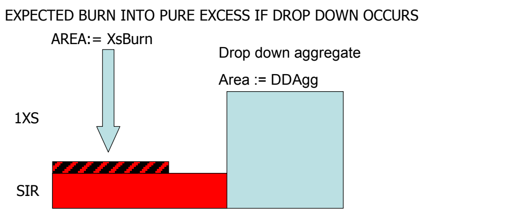
Programme diagram



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Expected Excess Burn Loss Cost

Approximation:
xsBurn = N x Average Claim in layer

Where

N = # claims to blow layer
= Aggregate ÷ Average Loss in SIR

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Drop Down Loss Cost

- Drop agg=(xs agg limit – xsBurn)
- Calculated from Aggregate Loss Distribution

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Pricing the excess layer

$(1-\zeta) \times \text{pure excess} + \zeta \times \text{cost of drop down}$

=

$(1-\zeta) \times \text{pure excess} + \zeta \times (\text{xsBurn} + \text{ddAgg})$

Summary

Component	Derived from
Pure XS Loss Cost	XS Aggregate Dn
XS Burn	Unlimited Severity Dn
DD Agg	Modified SIR Aggregate Dn
ζ = Prob exhausting SIR	SIR Aggregate Dn

Example 1 – The calculation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Layer	Each Loss Limit	Agg Limit	Pure Agg Cost	Prob Exhausting SIR Agg	XS Burn	DD agg	Cost of drop down	Total Cost
SIR	3m	15m	11.5m					11.5m
1 XS	10m	10m	1.7m	20%	2.3m	0.6m	2.9m	1.94m

$(1-\zeta) \times \text{pure excess} + \zeta \times (\text{xsBurn} + \text{ddAgg})$

(8) = (3) x [1- (4)] + (4) x [(5) + (6)]

Example 2 – varying the SIR Agg

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SIR AGG	Each Loss Limit	Agg Limit	Pure Agg Cost	Prob Exhausting SIR Agg	XS Burn	DD Agg	Cost of drop down	Total Cost
3m	10m	10m	1.7m	100%	0.5m	7.8m	8.3m	8.3m
6m	10m	10m	1.7m	98%	0.9m	5.6m	6.5m	6.4m
9m	10m	10m	1.7m	79%	1.4m	3.2m	4.6m	4.0m
12m	10m	10m	1.7m	45%	1.9m	1.4m	3.3m	2.4m
15m	10m	10m	1.7m	20%	2.3m	0.6m	2.9m	1.9m
18m	10m	10m	1.7m	7.5%	2.9m	0.1m	3m	1.8m
21m	10m	10m	1.7m	2.6%	3.3m	0.1m	3.4m	1.7m

(8) = (3) x [1- (4)] + (4) x [(5) + (6)]

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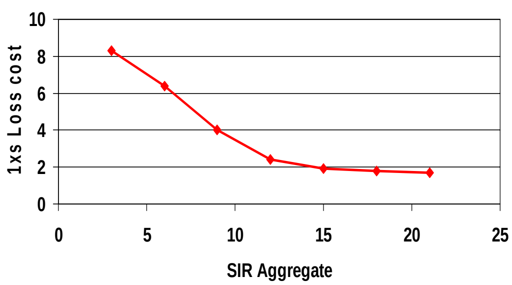
Example 2 – varying the SIR Agg



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Supplementary tools/methods

- US workers comp table M and table L
- Simulation
- Fast Fourier Transforms
- Heckman Meyers convolution
- Wang convolution

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References

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  - Fundamentals of Individual Risk Rating , Gillam W.R
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  - Easier Algorithms for Aggregate Excess, Venter G
  - Aggregation of Correlated Risk Portfolios: Models and Algorithms, Wang SS
  - The Mathematics of Excess of Loss Coverages and Retrospective Rating-A Graphical Approach, Lee YS
  - Loss Models: From data to decisions, Klugman, Panjer, Wilmot

- **Fast Fourier Transform**
  - DFT and FFT, Bourke P

Searching via Google and/or visiting the CAS site www.casact.org will enable you to access these papers.

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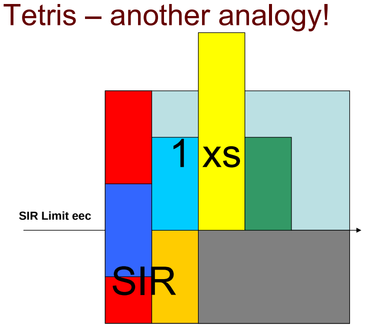
Tetris – another analogy!



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