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 alwyas to terms [...], and Other Conditions of this policy
What does this mean?

Excess = min(A,B)
A= underlying limit
B= underlying remaining aggregate

Programme

<table>
<thead>
<tr>
<th>Layer</th>
<th>Each loss limit</th>
<th>Aggregate</th>
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<tbody>
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<td>SIR</td>
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<td>$15m$15m</td>
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<tr>
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Programme diagram
Wheel of misfortune

The wheel of misfortune

<table>
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<tr>
<th>Loss</th>
<th>SIR</th>
<th>XS</th>
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<tr>
<td>20</td>
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<tr>
<td>200</td>
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<td>150</td>
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</table>

176 – 150 = 26

SIR: 200 limit and 400 in agg
XS: 300 limit and 300 in agg

Paws for thought...
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

\[ E(x) = e(x|a) \times pr(a) + e(x|b) \times pr(b) \]
\[ E(L) = e(L|\text{no drop}) \times pr(\text{no drop}) + e(L|\text{drop}) \times pr(\text{drop}) \]
\[ (1-\zeta) \times \text{pure excess} + \zeta \times \text{cost of drop down} \]
Pricing the excess layer

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

Cost of pure excess

Pricing the excess layer

$$(1-\zeta) \times \text{pure excess} + \zeta \times \text{cost of drop down}$$
Expected Excess Burn Loss Cost

Approximation:
\[ \text{xSBurn} = N \times \text{Average Claim in layer} \]

Where

\[ N = \# \text{ claims to blow layer} \]
\[ = \text{Aggregate} \div \text{Average Loss in SIR} \]

Drop Down Loss Cost

- \[ \text{Drop agg} = (\text{xs agg limit} - \text{xSBurn}) \]
- Calculated from Aggregate Loss Distribution
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

<table>
<thead>
<tr>
<th>Component</th>
<th>Derived from</th>
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<tbody>
<tr>
<td>Pure XS Loss Cost</td>
<td>XS Aggregate Dn</td>
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<tr>
<td>XS Burn</td>
<td>Unlimited Severity Dn</td>
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<td>DD Agg</td>
<td>Modified SIR Aggregate Dn</td>
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<tr>
<td>(\zeta) Prob exhausting SIR</td>
<td>SIR Aggregate Dn</td>
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Example 1 – The calculation

\[
(1-\zeta) \times \text{pure excess} + \zeta \times (\text{xSBurn} + \text{ddAgg})
\]
Example 2 – varying the SIR Agg

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<th>(1)</th>
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<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
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<th>(7)</th>
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<td>Post Exh Cost</td>
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Example 2 – varying the SIR Agg

Example 2 – varying the SIR Agg

Supplementary tools/methods

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

- Workers Compensation / Aggregate Loss Distributions
  - Workers Compensation (4th Edition), Gillam, W.R.
  - Workers Compensation (5th Edition), Gillam, W.R.
  - Fundamentals of Aggregate Loss Distributions, National Council on Compensation Insurance
  - The California Table L, Skurnick, D.
  - Table M Construction, Brosius, J.E.

- Aggregate Loss Distributions
  - The Calculation of Aggregate Loss Distributions from Claim Severity and Claim Count Distributions, Weatherman
  - Faster Algorithms for Aggregate Excess, Venter, G.
  - Aggregation Algorithms for Heavy-Tailed, Moderate and Lightly Tail-Heavy Risks, Wang, S.S.
  - Aggregation of Aggregate Excess Loss Distributions Using the Generalized AGEG Approach, Lee, Y.S.
  - The Mathematics of Excess of Loss and Retrospective Rating, Lee, Y.S.

- Fast Fourier Transform
  - FFT and Inverse FFT, Bourke, P.

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

Tetris – another analogy!