Thriving on Change

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Casualty Reinsurance Exposure Rating

Moving into the stochastic realm

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Casualty Exposure Rating

- Exposure rating is the development of Primary pricing based on the various exposure of the underlying risks
- It requires a methodology to allocate premiums to various bands of a given risk
- It is of value when:-
  - Claims data is sparse
  - The risk is small or new
  - The loss size may be considered remote
  - As a check on any experience rating undertaken

Increased Limits Factor (ILFs)

- The premium for a policy with a given limit is a multiple of the premium for a primary limit

- Why are increased limits factors used? Why not just calculate rates or loss costs at every desired limit of insurance?

  – There usually is not enough data at higher loss sizes to calculate higher limit loss costs in a fine level of detail (e.g. by Limit, cover, location and trade etc..)

  – ILFs are usually at broader groupings than the base rates, but getting the “right” ILFs is important to avoid anti selection

Calculation Method

- E(Cost of Claims at desired limit)/E(Cost of Claims at basic limit)
- Assume claims frequency is independent of claim severity

$$\text{Increased Limits Factor}\left(y\right)=\frac{E\left[f\left(x;y\right)\right]\times E(n)}{E\left[f\left(x;L\right)\right]\times E(n)}=\frac{E\left[f\left(x;y\right)\right]}{E\left[f\left(x;L\right)\right]}=\frac{E\left[\min\left(X,y\right)\right]}{E\left[\min\left(X,L\right)\right]}$$

Key ILF Properties

- ILF values are non decreasing.
  - Any scale of ILFs should always increase.
- ILF values are asymptotically constant.
  - Any scale of ILFs should always approach a constant value.
- ILF curves are concave down.
  - Any scale of ILFs should increase at a decreasing rate.

Property Violation

Probability of exceeding $1m & $2m is the same!

Limit	ILF	First Order Difference	Second Order Differences
$1,000,000	1.000	**2.00E-7**	**+0 00E0**
$2,000,000	1.200	**2.00E-7**	-1.50E-7
$3,000,000	1.400	***5.00E-8***	***+2.70E-8***
$4,000,000	1.450	***7.70E-8***	-2.03E-9
$5,000,000	1.527	6.63E-8	
$6,000,000	1.602		

More likely to exceed $4m than $3m !

Various parameterisations

- Riebesell

$$ILF_R(y) = \left(\frac{y}{L}\right)^{\log(1+z,2)}$$

- Pareto

$$ILF_P(x) = \left(\frac{x}{b}\right)^{(1-\beta)}$$

- Mixed Exponential

$$ILF_E(x) = \frac{1-\exp\{-x/\lambda\}}{1-\exp\{-L/\lambda\}}$$

Practical Values

- When estimating parameters from actual placed layers
- Values estimated from real commercial data can vary significantly
- For certain industries the pricing for high limits can become almost linear (equivalent to a reibsel z factor of 100%) – in some cases even above 100%!

Whats going on…

- What happens commercially is that you glide imperceptibly, from a layer that's recognisably priced in relation to the risk of loss, into a layer that's priced only in relation to the cost of the capital deployed.

- Also supply and demand can move prices significantly away from technical.

- Important to know where this is happening and modify your exposures accordingly

ILF methodology – To price reinsurance

- Layer Rate Difference (LRD) Formula
  - We can apply the formula to each individual policy or by risk profile
  - Each individual policy can have its own categorisation (e.g. High, medium or Low) for ILFs
  - The result of the formula gives the amount of premium exposed to losses in the reinsurance layer

$$\frac{\left[\mathrm{ILF}\left\{\min\left\langle Excess(P)+Limit(P), Excess(P)+Excess(R)+Limit(R)\right\rangle\right\}-\mathrm{ILF}\left\{\min\left\langle Excess(P)+Limit(P), Excess(P)+Excess(R)\right\rangle\right\}\right]}{\{\mathrm{ILF}(\mathrm{Limi}(\mathrm{P})+\mathrm{Excess}(\mathrm{P}))-\mathrm{ILF}(\mathrm{Excess}(\mathrm{P})\}}\times POLPREM$$

Stochastic Implementation - Freq

- Key ILF Result, can be used to calculate the frequency above a threshold

$$1-\mathrm{P}\{Y \le y\} = 1-F(y) = E\left[(\min(X,L)\right] \times ILF'(y)$$

- E(number of losses above the threshold y) =

$$E\left(\tilde{N}\right) = E\left(N\right) \times P\left\{X > y\right\}$$
$$= E\left(N\right) \times E\left[\min\left(X,y\right)\right] \times ILF'\left(y\right)$$
$$= E\left(S\right) \times \frac{ILF'\left(y\right)}{ILF\left(L\right)}$$

Stochastic Implementation - Severity

- We can also calculate the Severity of losses directly from the ILF curve

$$P\left(\min\left(X,L\right)>x\middle|X>y\right)=\frac{P\left\{\min\left(X,L\right)>x\right\}}{P\left\{X>y\right\}}=ILF'\left(x\right)/ILF'\left(y\right)$$

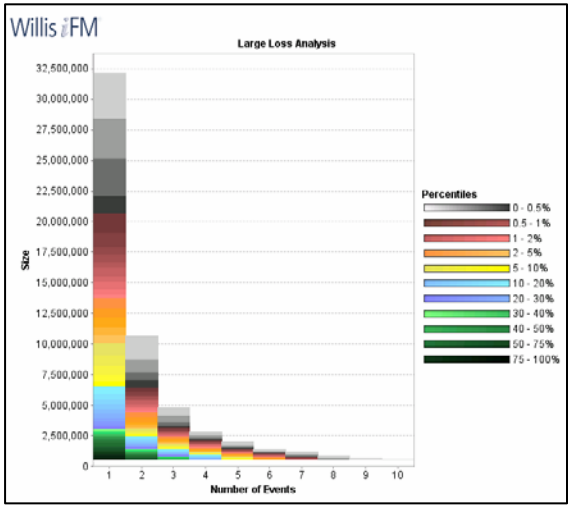
Why Bother?

- Increased insight into primary pricing that can:-
  - Assist in achieving enhanced clarity in communicating reinsurance assumptions with cedants
  - Allows insurers to challenge and test the pricing ILFs in use, which may help them to better understand and price certain classes of liability perhaps enhancing competitive advantage through improved knowledge
  - Helps to achieve consistent reinsurance pricing, thus manage reinsurance costs

Incorporated into modeling output

– Improved visualisation of output in financial modeling results

- Can visualise the expected number and size of losses you would expect from specific risk profiles, using direct pricing ILFs
  - This can be compared with experience and assist in reserving and scheme pricing, and sense check
  - Particularly useful on PIDO classes



Limitations to an ILF approach

- Underlying risks are far more heterogeneous that the ILFs categorisation allows for:-
  - Occupations with a D&O policy
  - Regional variations
  - Different practice areas even in the same general occupation (e.g. Accountants may do auditing, Mergers and Acquisitions, Tax advice, etc..)
- Sparse data particularly at higher limits means ILFs have less credibility here
  - Market pricing at this level may not be consistent with theoretical ILFs, due to supply and demand impacts
  - Inflationary impacts can distort ILFs curves and will be at different levels for different risk classes and loss sizes

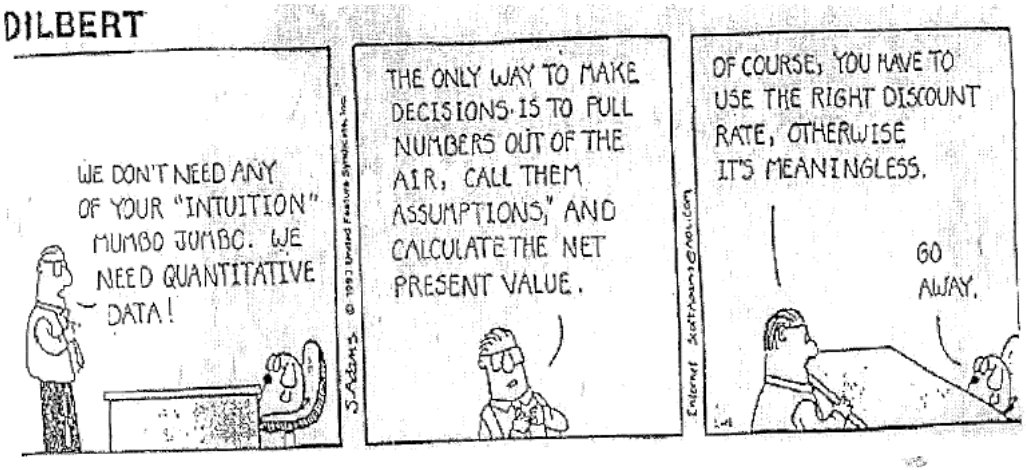
Other Adjustments

- Loss Ratio
- Discounting
- Need to think about how to treat ALAE
- Parameter error load = higher for higher limits
- Risk load = higher for higher limits
- Profits and expenses

Summary / Conclusion

- Consider the market factors and sensitivities to the “true” ILFs
- Ensure the base premiums are adequate as ILF’s build upon the base
- Don’t forget market supply and demand issues, this can move actual prices charged higher than theoretically suggested.
- Looking at risk in more than one way is often beneficial, as there is no right answer.
- The other adjustments (particularly the ULR) are crucial

Any Questions



Deep down, most assumptions are about human behaviour and/or its consequences