



Institute  
and Faculty  
of Actuaries

# Practical Issues in Deploying First Loss Curves and Increased Limit Factors

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15 October 2015



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# Practical Issues in Deploying First Loss Curves and ILF's

Common problems and suggested approaches

Artise  
Mentorship  
Thought leadership  
Progress  
Community  
Sessional Meetings  
Education  
Working parties  
Volunteering  
Research  
Shaping the future  
Networking  
Professional support  
Enterprise and risk  
Learned society  
Opportunity  
International profile  
Journals  
Support

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## Agenda

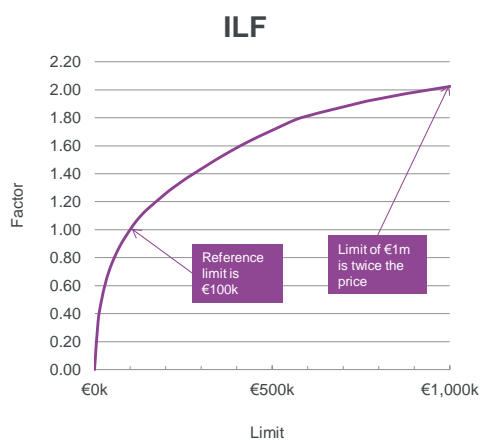
- Welcome
- What are they and how are they used?
- Practical issues and problems
- Communicating on FLC's and ILF's with underwriters
- Questions and Comments

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## What is an Increased Limit Factor?

- Used in Casualty rating
- ILF shows premium for different limits relative to a reference layer
- It is only a means of expressing a claims severity distribution
  - $LEV[x]/LEV[r]$
- Severity range *unlimited*, just like liability claims (in theory).



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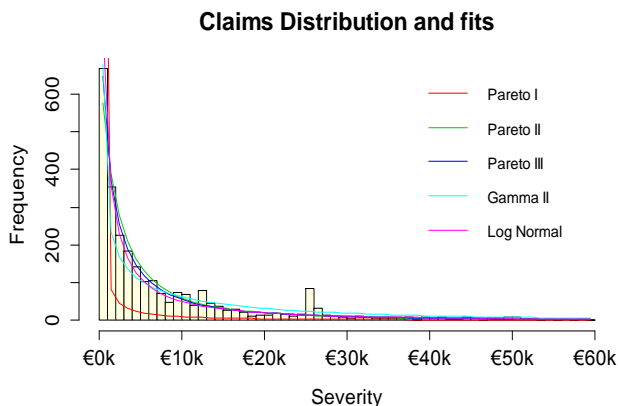
## Properties of ILF curves

- $Premium_{Reference\ Layer} * \frac{dy}{dx} = Rate\ on\ line$
- $\frac{dy}{dx} \geq 0$  Rate on line can't be negative so neither can gradient
- $\frac{d^2y}{dx^2} \leq 0$  Rate on line can't increase at higher layers so second differential can't be positive
- $x \geq 0$  Range is positive.

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## Increased Limit Factor Derivation

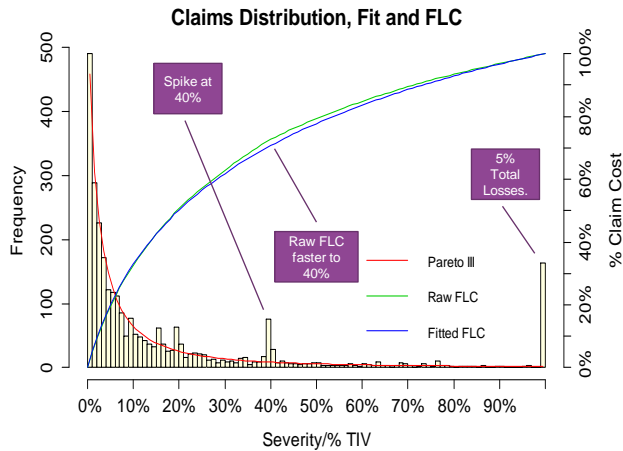


- Various curves fitted to adjusted data
- Pareto III preferred fit for body and tail characteristics
- ILF derived by sampling from fitted distribution.

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## What is a First Loss Curve?



- Another means of expressing a severity distribution, this time in terms of location value
- Range limited 0%-100% as claims shouldn't go any higher.

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## Properties of First Loss curves

- $\frac{\text{Premium}_{\text{Full Value}}}{\text{TIV}} * \frac{dy}{dx} = \text{Base Rate} * \frac{dy}{dx} = \text{Rate on line}$
- $\frac{dy}{dx} \geq 0$  Rate on line can't be negative so neither can gradient
- $\frac{d^2y}{dx^2} \leq 0$  Rate on line can't increase at higher layers so second differential can't be positive
- $0 \leq x \leq 1$  Range is between zero and one.

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## First Loss Curves for varying Sum Insured

- Compare a block of flats to small house
  - Fire can spread across building, just as for single dwelling
  - Severity should be similar in terms of value, *all else being equal..?*

### RT1: FLC Severity by location value

- Would the distribution of losses be the same for a larger building?
  - If not, why not?



Round  
table  
discussion

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## First Loss Curves for varying Sum Insured

- Compare a block of flats to small house
  - Fire can spread across building, just as for single dwelling
  - Severity should be similar in terms of value, *all else being equal..?*
  
- Maybe, but in the real world all else is not equal...
  - Fire protection better for higher values, construction, sprinklers, fire doors etc.
  - Higher values have *less severe* curves, as shown in PSOLD.

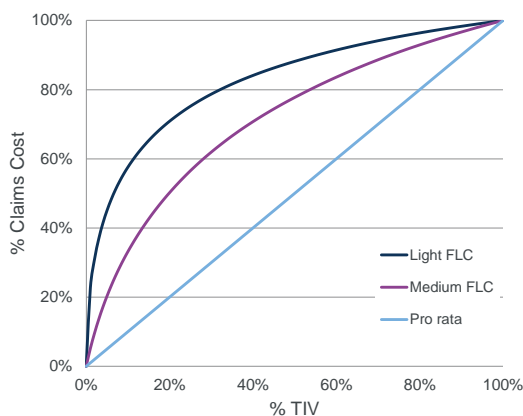
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## First Loss Curve Severity

Different curve severity



- Light curve has lowest average severity
- Medium is more severe, with higher average
- Pro rata curve has maximum 100% severity.

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## Risk rates for varying Sum Insured

- Compare a block of flats to small house
  - Frequency will be higher than for small house
  - More people, more electrical wiring, more chip pans..?

### RT2: Risk rate by location value

- Would the risk rate (claim cost per value) increase or decrease for a larger building?
  - Why?

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## Risk rates for varying Sum Insured

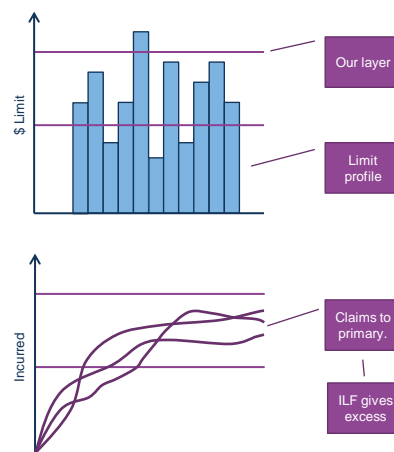
- Compare a block of flats to small house
  - Frequency will be higher than for small house
  - More people, more electrical wiring, more chip pans..?
- Frequency *is* higher in general but...
  - Severity effect dominates
  - Rates for higher values tend to be *lower*.

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## How are techniques used in practice in the London Market?

- Property D&F
  - First Loss Curve applied to “limit profile” of risks to exposure rate our layer
- Casualty Treaty
  - In combination with experience rating, an Increased Limit Factor used to price higher layers with scant experience.



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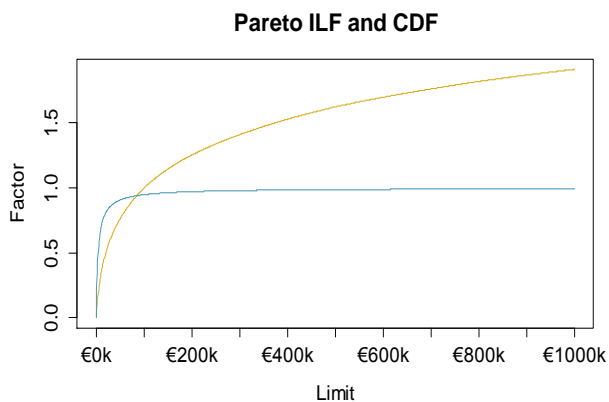
## Practical Issues and Common Problems

- Data: Sparse data, free cover and treatment of outliers
- Data manipulation: ILF claims on-levelling and other adjustments
- Data basis/richness: Obtaining TIV/Limit data for FLC derivation
- Rating: Provenance of curve data for “market” curves
- Rating tool parameterization: Curve selections often crude
- Rating tool method: Curves used to set *rates* in models
- Communicating with underwriters and management
- TAS 100 requirements potentially problematic...

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## Sparse data: Pareto CDF and ILF



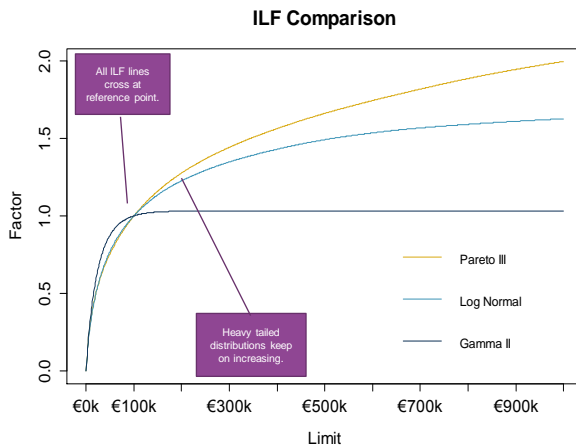
- Note how much faster CDF tails off
  - ILF keeps on increasing because large claims still represent material proportion of total
- Data is next to useless beyond €100k..!
  - Judgement essential for appropriate tail.

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## Sparse data: ILF Comparison

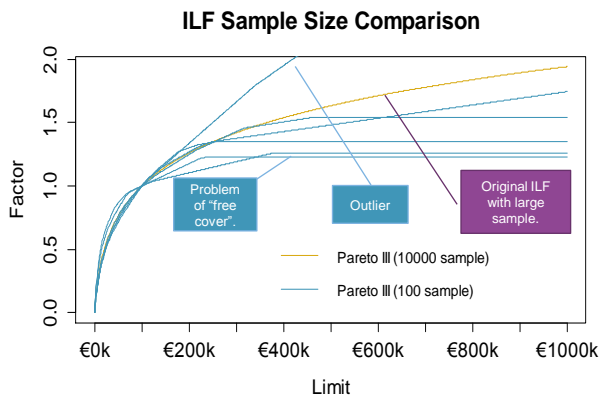


- Heavy-tailed distributions show marked difference in ILF
  - Curves fitted to the same claims data
  - Wrong tail means higher layers grossly mispriced
- Use underwriter advice to parameterize, e.g. capacity or market rate.

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## Sparse data: Free cover and outliers



- Sparse data gives problems in the tail
  - Free cover where experience is benign
  - Over-priced when experience is heavy because of outlier(s).

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## RT3: Data limitations

- How do you cope with scant data?
- How did you communicate the limitations/assumptions to underwriters/management?
- How did users of the tools/report react to limitations?



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## RT3: Data limitations

- Suggested approaches:
  - Use underwriter expertise
  - Use market rates
  - Fit tail to sensible capacity rate
  - Compare across classes
- Approach should be proportionate:
  - Data availability
  - Underwriting large profiles of risks
  - Post bind rating.



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## Data manipulation: adjustments

- Data may be spread over an extended time period
- On-levelling is difficult:
  - Inflation uncertain
  - Changes in cover
  - Changes in mix
  - Changes in limit profile
- Adjustments for claims development
- On-levelled dataset may be distorted, especially in the tail.

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## Rating: curve provenance and selection

- Lloyd's market curves often of unknown provenance
  - Is dataset appropriate for this class?
  - Is curve still current?
  - Modern, globalised era, more concentrations, bigger risks, inflation, medical advancements, increased litigiousness – are higher layers underpriced?
- Curve selections in models are often crude
  - Light, medium or heavy first loss curve options
  - Limited consideration of individual locations.

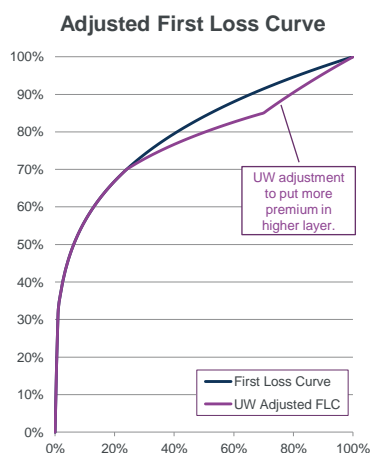
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## Rating tool methods: rates not claims

- Curves typically used to set *rates* rather than loss costs
- Curve is based on loss costs
  - Decoupling from loss costs undermines variation of margin by layer
  - Same loss ratio across programme is not always appropriate
- Curves subject to inappropriate manual adjustment...



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## RT4: Varying margins by layer

- How do you deal with varying margins by layer?
  - Do your FLC/ILF rating tools treat rates and claim costs explicitly?
  - Do your FLC/ILF rating tools use *rate* curves?
- Are users relaxed about variance in achieved versus technical by layer?
- Do you encourage underwriters to move up the programme if capital efficient? How?

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## RT4: Varying margins by layer

- Suggested approaches:
  - Treat claims cost and cost of capital separately in full technical pricing allocation
  - Develop market rate curves and label them as such
- Proper treatment addresses problem of variance by layer, encouraging underwriter buy-in and pre-bind model usage.




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## Communicating with underwriters and management

- Clear understanding of derivation and properties
  - Base premium might be inadequate
  - An ILF or FLC alone tells us *nothing* about frequency
  - Curves are often based on sparse or unsuitable claims data
  - Claims alone may not be appropriate for rate setting – *margins vary by layer*
  - Curve basis can vary: Value, Limit or PML; Contents and BI
- The importance of testing and pricing analytics
  - Reviewing rates by layer, ideally using *risk rate on line*
  - Implied total loss proportion and average severity
  - Analytics can show actual versus expected by layer – *are our curves OK?*

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## RT5: Communications

- Being very familiar with technical workings can make it hard to remember what is more widely understood and what is not
- What did you think was understood that turned out not to be..?
  - Underwriters or management or wider business
- What explanation do you give that non-actuarial colleagues find useful or compelling?



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## RT5: Communications

- Useful explanations:
  - A CDF is a different thing (also PDF etc)
  - ILF's and FLC's are the *same idea*
  - Curves are just severity distributions
  - Curve implies an average severity
  - Steepness of curve relates to rate on line
  - Curves tell us nothing about frequency
  - Curves tell us nothing about profitability
  - Curves can be unreliable if source claims data differs from target risk.



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## TAS 100

- Data Principle
  - Data used in actuarial work shall be sufficient and reliable for the purpose of that work and subject to sufficient scrutiny and checking so that users can rely on the resulting actuarial information.
- Provisions
  - 2.1. Data shall be relevant to the entity.
  - 2.2. If data is insufficient or unreliable it shall be improved by adjusting or supplementing it to the extent that is proportionate.
  - 2.3. Data used in actuarial work shall be documented.
  - 2.4. Communications shall describe the data used in the actuarial work, the source of the data, the checks and controls that have been applied, the actions taken to improve insufficient or unreliable data, any uncertainty in the data, and the approach taken to deal with that uncertainty.

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## References and further reading

- About us: Insight Risk Consulting
 
  - Small consultancy working across pricing, reserving and capital
  - Clients in London Market, Commercial and Personal Lines
  - [matthew.evans@insightriskconsulting.co.uk](mailto:matthew.evans@insightriskconsulting.co.uk)
  - [www.insightriskconsulting.co.uk](http://www.insightriskconsulting.co.uk)
- Clarke Basics of Reinsurance Pricing paper
  - <https://www.casact.org/library/studynotes/clark6.pdf>
- Bernegger ASTIN paper MBBEFD First Loss Distributions
  - <https://www.casact.org/library/astin/vol27no1/99.pdf>

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Questions



Comments

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