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Measuring Loss Reserve Uncertainty

ASTIN 2005

- What is Loss Reserve Uncertainty (LRU)?
- Why is it important to measure LRU?
- What are the pitfalls in measuring LRU?
- How can these pitfalls be avoided?
- How does our method work?
- How do we know that it is accurate?
- What are the advantages of this method?
- What are the limitations of this method?

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1. What is Loss Reserve Uncertainty (LRU)?

- **Loss Reserves**: <u>estimates</u> of the <u>total future payments</u> needed to settle claims on accidents that have <u>already occurred</u>

- **LRU**: a measure of <u>potential loss reserve development</u> – paying out more (or less) than was estimated
  - Includes both **process risk** and **parameter risk**

- **The Proposed Measure of LRU**: the <u>coefficient of variation</u> of the reserve = the standard deviation of the reserve as a percent of the estimated reserve

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2. Why is it important to measure LRU?

Issues	Audiences
• Estimating surplus adequacy	• Management • Rating agencies and regulators • Analysts and investors
• Capital allocation and pricing	• Management: actuary, CFO, CEO
• Managerial feedback: is this deviation significant?	• Management
• Reinsurance	• Management

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3. What are the pitfalls in measuring LRU?

- **Data**: paid loss triangles

Pitfall 1: **Correlated disturbances** created by cumulative data

Development year

	0	1	2	. . . .
Acc Yr:	$A+e_a$	$A+e_a+B+e_b$	$A+e_a+B+e_b+C+e_c$	. . . .
:				
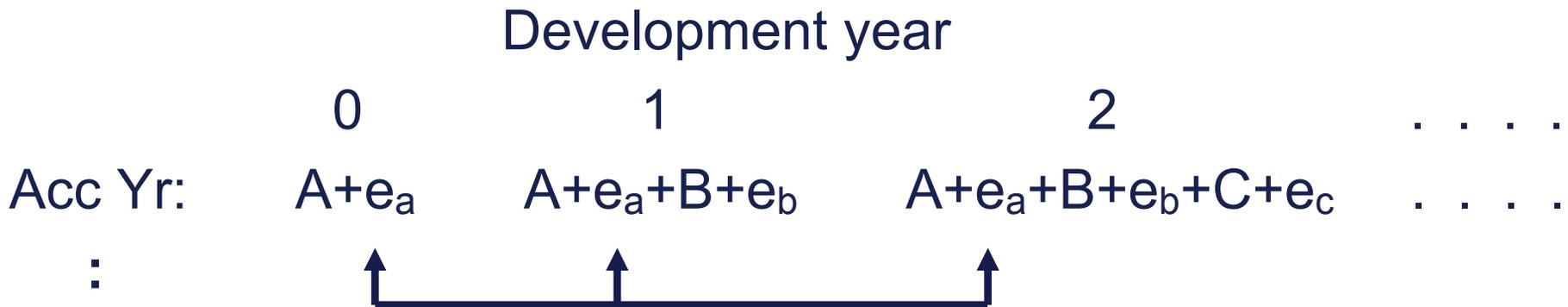
Pitfall 2: **Heteroskedasticity**: $\sigma(e_a) \neq \sigma(e_b) \neq \sigma(e_c)$

These pitfalls may have little effect on estimates of reserves, bu
they **totally distort estimates of LRU**

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4. How can these pitfalls be avoided?

- Avoid **Correlated disturbances** by **decumulating data**
  - Incremental paid losses make DY's independent of one another
- Avoid **Heteroskedasticity** (unequal error σ's) by **analyzing development years separately**

  - Alternative approaches make strong and unverifiable assumptions about development year standard deviations

  - The risk in doing so is assuming what we are trying to measure

- Other pitfalls are addressed in the paper

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5. How does our method work?

Table 3: Accident Year x Development Year Incremental Paid Losses

Accident Year	Development Year									
	0	1	2	3	4	5	6	7	8	9
0	**624**	971	**471**	300	193	126	80	53	42	35
1	**695**	808	**473**	319	201	135	96	57	47	
2	**668**	809	**491**	295	184	115	83	63		
3	**696**	844	**515**	302	194	148	107			
4	**770**	900	**555**	358	239	162				
5	**690**	825	**536**	384	231					
6	**544**	777	**537**	332						
7	**563**	792	**497**							
8	593	823								
9	621									

- Start with an Acc Yr x Dev't Yr <u>incremental</u> paid loss triangle
- Use DY0 to fit and forecast paid losses in future dev't years
- Use Salkever (standard textbook) method to forecast each future loss payment and its standard error, and to estimate variance-covariance matrix of forecast errors for each DY
- Aggregate results to obtain LRU by Dev't Yr, Cal. Yr, & Total

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Validation Procedure:

- We simulated (to ultimate) 10,000 stochastic loss reserve triangles, for each of several specified sets of parameters
  - Exponential decay for paid losses
  - Specified σ's of losses for each development year

- We applied our method (automatically) to each triangle to generate estimates of reserves and of LRU

- **The estimates obtained were (on average) virtually identical to the known parameters of the simulation, both for estimated reserves and for loss reserve uncertainty**

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7. What are the advantages of this method?

- It is **dramatically simpler** than most rival methods. (The paper includes critical Excel code)
- It **avoids severe statistical problems** with rival methods
- It is **based on a standard econometric method,** in use for thirty years, that is advocated by leading textbooks
- It has been **thoroughly validated** via simulation
- It **enables comparisons of different lines of business within a firm**
- It **enables comparisons of a line of business across multiple firms**
- It is **scalable**, so that LRU can be applied to reserves estimated by other methods

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- The method permits a gradual speedup or slowdown in payme patterns over time, but otherwise **assumes a stable past and future environment** with regard to
  - Underwriting criteria
  - Exposure types
  - Reinsurance parameters
  - Legal and Regulatory environments

- **Estimating the tail is difficult** with this method as with others

- It necessarily **relies on public data**, and so **does not reflect claims-level data** available only to the firm

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9. How can I learn more about this method?

Send me an email at

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