Actuarial Perspectives on Reserve Risk

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TransRe

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Agenda

- What is Reserve Risk?
- Standard Actuarial vs Stochastic Model
- Problems Estimating Reserve Risk
- When Triangles Fail
- Actuary in a Box
- AY, CY, and Dev Age – 3- "trends"
- Stochastic Model Challenges and Looking Ahead

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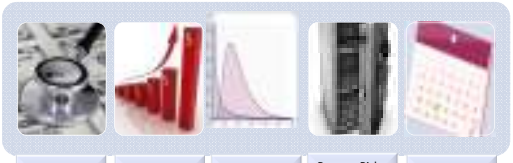
What is Reserve Risk?



Loss Development Volatility	Future Unknown	Distribution of Unpaid Loss	Reserve Risk	One year Risk
• Incomplete information • Hard to estimate costs to repair property and cover medical care	• Real IBNR • Cost Inflation • Social trends • Demographics - longevity	• Mean • Stnd Dev • 99th Percentile	• Adverse Deviation from Mean (Best Estimate)	• Amount recognized in one year

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Standard Actuarial vs Stochastic Methods

Standard Actuarial Methods

point estimates

Judgmental range

Chain Ladder
Bornheutter-Ferguson
Cape-cod
Benktander

Stochastic Methods

Estimates of variance and percentiles

- **Mack – chain-ladder variance formula**
- **Bootstrap and Markov Chain Monte Carlo results simulation**
- **Structural options and assumptions about cells or ATA dependence on AY, Age, CY and correlation**

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Actuarial View of Statistical Approaches

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Statistical View of Actuarial Methods

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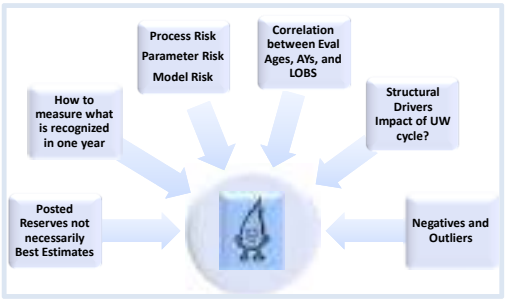
Problems in Estimating Reserve Risk



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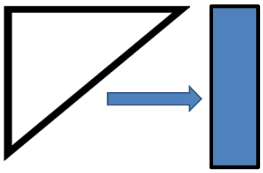
When Might Triangle Analysis Fail?

Triangle Analysis

- *Assumes patterns manifest in triangle from prior years are predictive of the future*



Exceptions

- *Changes in Technology*
- *Changes in coverage/limits*
- *CATs*
- *Mass torts (asbestos)*
- *Long-duration/Surety*

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Actuary in a Box Estimates

Actuary in a Box

- Define a method and use it consistently
- Data driven – no judgment
- Study A-E error in predicting next diagonal

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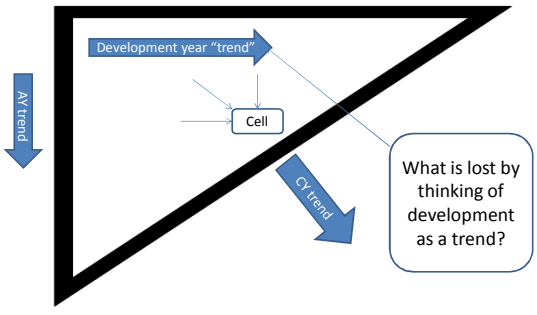
3-"trends" Model



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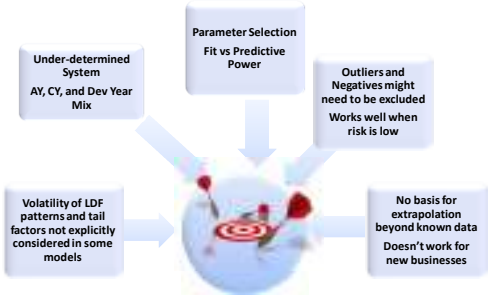
Stochastic Model Challenges



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A Simple Closed-Form BF Extension Model

$$R(t) = L * Q(t)$$

*Unpaid = Ultimate*Tail Pct*

$$E[R_{AY}(t)] = E[L_{AY}] * E[Q(t)]$$

*E[Unpaid$_{AY}$(t)] = E[Ult$_{AY}$]*Tail Pct(t)*

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Variance of AY Unpaid via extended BF Formula

$$Var(R_{AY}(t)) =$$

$$Var(L_{AY}(t)) \cdot Var(Q(t))$$

$$+(E[L_{AY}])^2 \cdot Var(Q(t))$$

$$+ Var(L_{AY}(t)) \cdot (E[Q(t)])^2$$

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Variance of AY Unpaid – Example One Year

	E[ ]	CV	SD
L= Ult	500.0	20%	100.0
Q= tail	30.0%	33%	9.999%
R= LQ= Unpaid	150.0	39%	59.2

$$59.2^2 = 3500$$
$$= 100^2 \cdot 10\%^2$$
$$+500^2 \cdot 10\%^2 + 100^2 \cdot 30\%^2$$
$$= 100^2 \cdot 10\%^2 \cdot (1 + 25 + 9)$$

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Variance of AY Unpaids – Example

AY	Initial E[Ult]	ATU	E[Tail %]	E[R]	CV of Initial E[Ult]	CV of E[Tail %]	SD(Ult)	SD tail	SD(R)	CV of R
2013	500	1.250	20.0%	100.0	15%	41%	75.0	8.2%	44.1	44.1%
2014	500	1.429	30.0%	150.0	15%	32%	75.0	9.6%	53.5	35.7%
2015	600	1.900	47.4%	284.2	15%	25%	90.0	11.8%	83.5	29.4%
2016	600	3.000	66.7%	400.0	15%	20%	90.0	13.3%	100.7	25.2%
Total				934.2					207.5	22.2%
Independent total				934.2					148.1	15.9%

Unpaid Loss Correlation Matrix

AY\AY	2013	2014	2015	2016
2013	100%	50%	25%	15%
2014	50%	100%	50%	25%
2015	25%	50%	100%	50%
2016	15%	25%	50%	100%

Variance/Covariance matrix

AY\AY	2013	2014	2015	2016
2013	1,944	1,179	921	666
2014	1,179	2,862	2,235	1,347
2015	921	2,235	6,980	4,207
2016	666	1,347	4,207	10,144

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Looking Ahead

Stat-Actuarial Synthesis

Relate stat model and standard actuarial parameters

More focus on tail factor uncertainty

Better separation of process vs parameter risk

More Robust Models

Handle negatives and outliers

Incorporate Structural Drivers

Adaptable to New Business

LOBs where Triangles fail

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