Practical Solutions to Reserving Problems

2010 CAS Casualty Loss Reserve Seminar

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Speakers and Topics

- Julie Joyce: Moderator
- Scott Kaminski: Minimum Bias LDFs
- Tom Toce: Deriving Tail Factors
- Susan Forray: A Hindsight Analysis of Common Reserving Methodologies

What is Minimum Bias?

- An iterative method to determine relativities for multiple dimensions
- It is easily **verifiable** and **auditable** - forecast error equals zero
- Lacks a **formal** test of a variable's statistical significance
  - However, an informal test will be proposed

What is Minimum Bias? (continued)

The minimum bias iterative formula reduces down to:

$$\text{Dim } x_G = \frac{{}_G\Sigma\ (\text{Pure premium})_{GT}\ (\text{Exposures})_{GT}}{{}_G\Sigma\ (\text{Base})\ (\text{Exposures})_{GT}\ \ (\text{Dim } y_T)}$$

Steps

- "Prime the pump"
- Repeat!

TRAVELERS

Weighted Average Loss Development Factors

The weight assigned to each link ratio equals losses at age 3

AY	Age (Month) 3	6	Link Ratio	Weight	Diff. between Proj & Actual
2006	264	345	1.31	0.25	130
2007	500	1,014	2.03	0.48	(114)
2008	274	509	1.86	0.26	(16)
	1,038	1,868		1.00	(0)

Weighted average link ratio 1.80
(also computed as 1,868/1,038)

TRAVELERS

Minimum Bias LDFs

Let's revise our original formula:

$$\text{Dim } x_G = \frac{{}_G\Sigma(\text{Pure Premium})_{GT}\,(\text{Exposures})_{GT}}{{}_G\Sigma(\text{Base})(\text{Exposures})_{GT}\,(\text{Dim } y_T)}$$

Step 1: Replace (Pure Premium) with an incremental LDF

Step 2: Exposures is the "weight" assigned to an observation.

To compute the wtd. avg. LDF, (Exposures) = Losses

$$\text{Dim } x_G = \frac{{}_G\Sigma(\text{Age to age factor} - 1)_{GT}\,(\text{Losses})_{GT}}{{}_G\Sigma(\text{Losses})_{GT}\,(\text{Dim } y_T)}$$

Minimum Bias LDF Model

First, update the model with loss data

AY	AQ	AGE	DIM1	DIM2	DIM3	DIM4	INCURREDS
1991	1	3	AUTO	LIABILITY	CA	N	23,906
1991	1	3	AUTO	LIABILITY	MN	N	3,054
1991	1	3	AUTO	LIABILITY	MN	N	625
1991	1	3	AUTO	LIABILITY	MN	N	5,656
1991	1	3	AUTO	PROPERTY	CA	N	30,369
1991	1	3	AUTO	PROPERTY	MN	N	27,107
1991	1	3	HOME	LIABILITY	MN	N	4,649
1991	1	3	HOME	PROPERTY	MN	N	37,891
1991	2	3	AUTO	LIABILITY	CA	N	4,952

Minimum Bias LDF Model

Second, make initial selections for each of the factors.

INITIAL VALUES

AGE	Factor
3	1.00
6	0.70
9	0.49
12	0.34
15	0.24
18	0.17
21	0.12
24	0.08
27	0.06

DIM1	Factor
Auto	1.10
Home	0.90

DIM2	Factor
LIABILITY	1.20
PROPERTY	0.80

DIM3	Factor
MN	1.00
CA	1.00

DIM4	Factor
N	1.00

This is the incremental LDF (Age-to-Age LDF – 1.00).

How does it work?

AGE	Factor
3	1.02
6	0.18
9	0.16
12	0.11
15	0.08
18	0.07
21	0.06
24	0.07
27	0.04

DIM1	Factor
Auto	1.11
Home	0.89

DIM2	Factor
LIABILITY	1.34
PROPERT	0.61

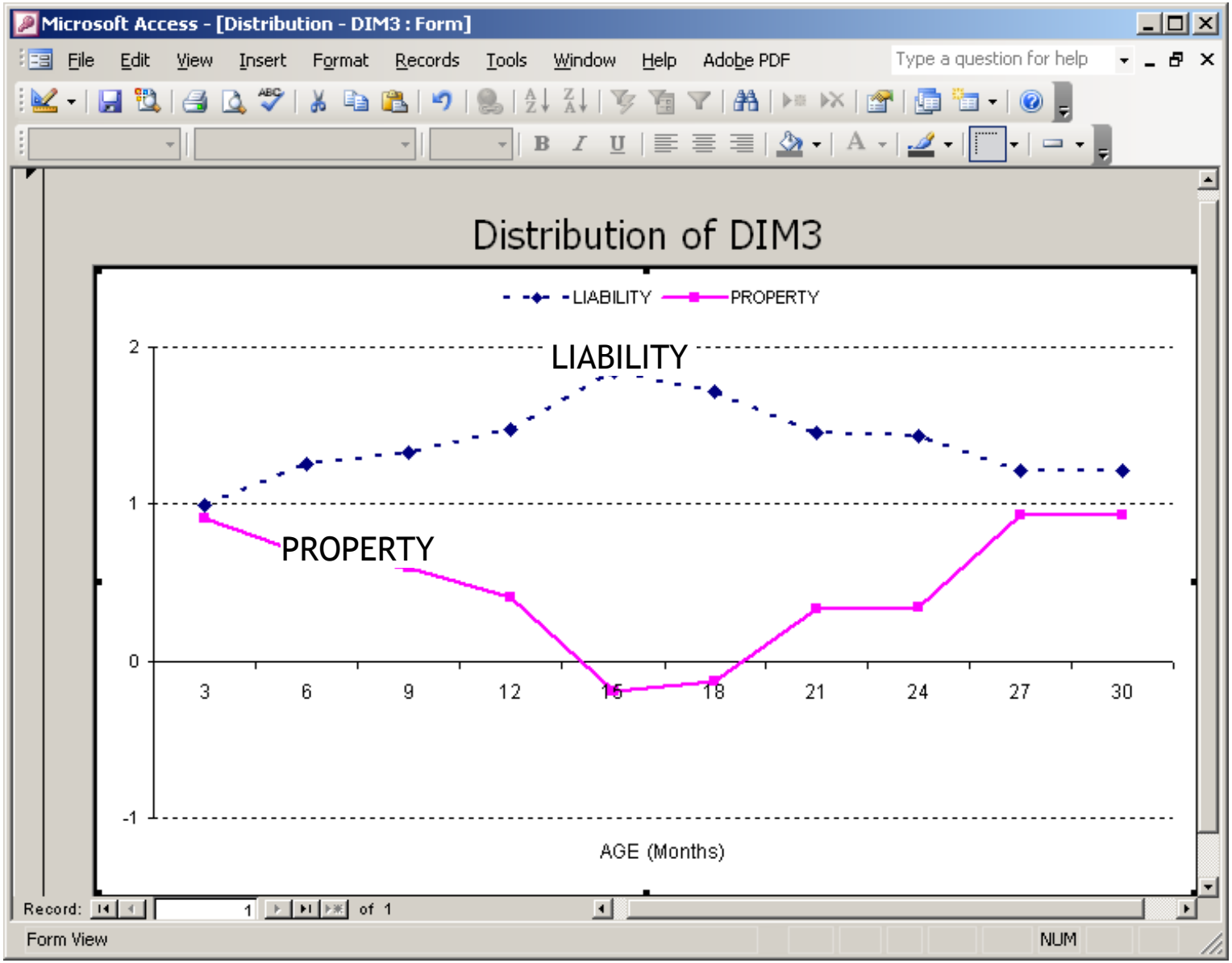
DIM3	Factor
MN	1.00
CA	1.01

Our example will assume:
Age: 3
State: MN
Covg. type: Liability
Coverage: Auto

Multiplying all the factors equals:
1.02 x 1.00 x 1.34 x 1.11 = 1.52

Since this is the incremental factor, we add one. The final minimum bias LDF is then 2.52.

Distribution of Minimum Bias Factors



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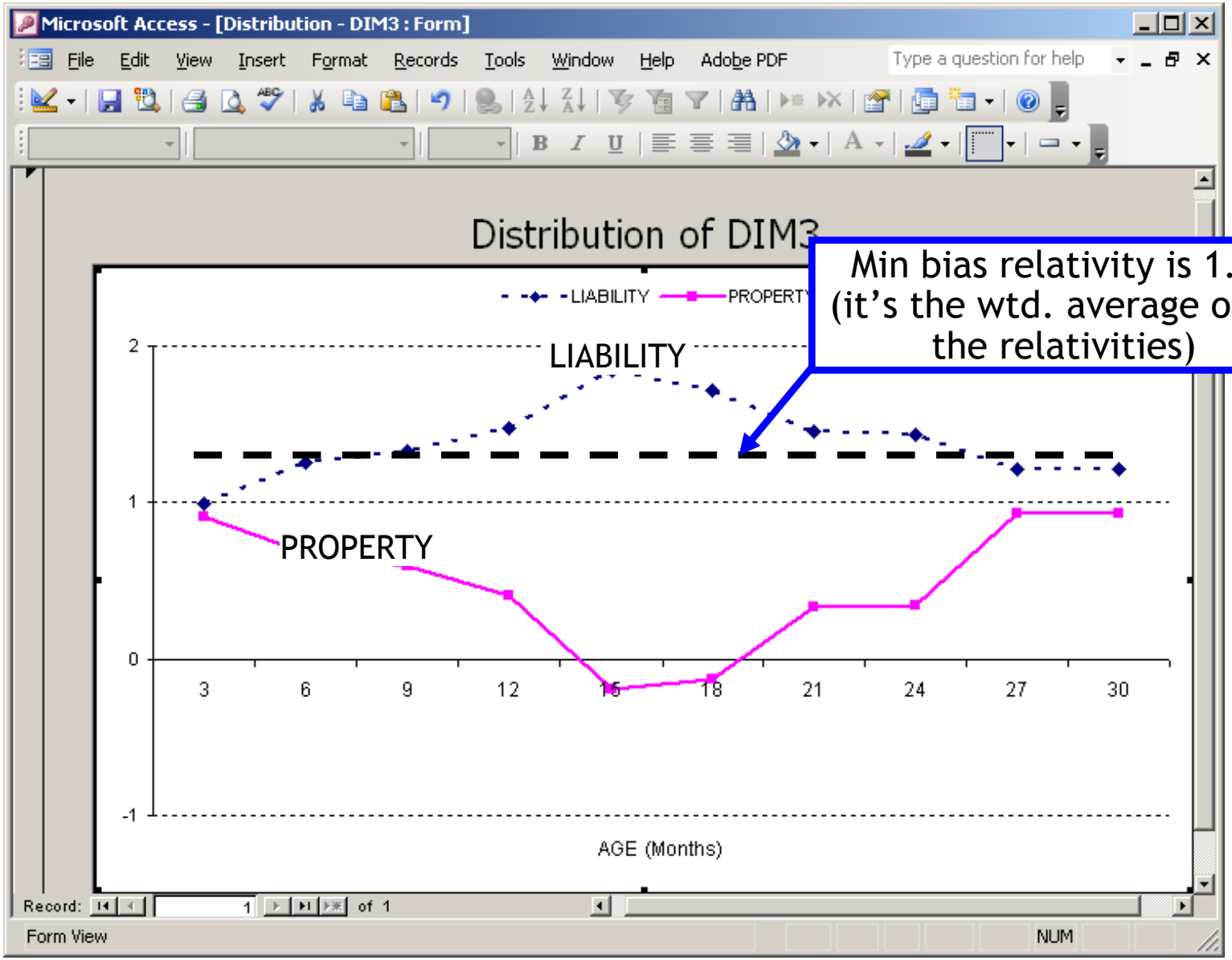


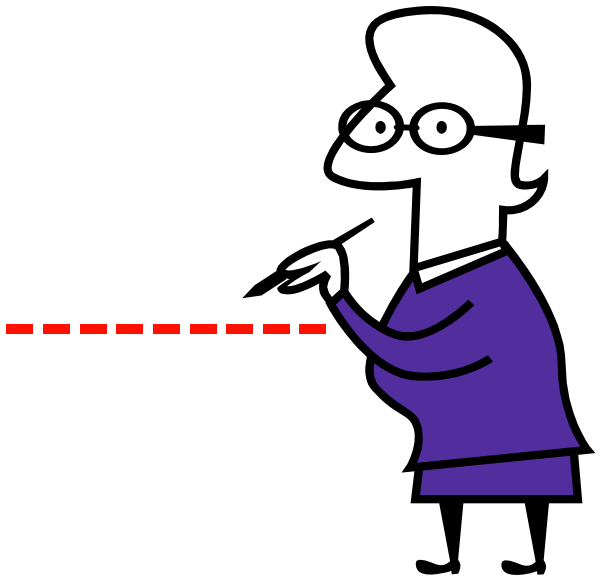
Min bias relativity is 1.34 (it's the wtd. average of all the relativities)

Applications and Benefits

- A thoughtful way to reflect the unique development of a dimension which lacks credibility

- Allows you to create loss development patterns in line with the dimensions used in pricing

- Readily auditable and explainable



It assumes each dimension develops the same as the ‘countrywide’ curve.

Losses have to be greater than zero at each age

References

Anderson, et. al., "A Practitioner's Guide to Generalized Linear Models"

Bailey & Simon, "Two Studies in Automobile Insurance Ratemaking"

Berquist & Sherman, "Loss Reserve Adequacy Testing: A Comprehensive, Systematic Approach"

Feldblum & Brosius, "Minimum Bias Procedure: A Practitoner's Guide"

Mildenhall, "A Systematic Relationship Between Minimum Bias and Generalized Linear Models"

Peck, "Discussion of A Simulation Test of Prediction Errors of Loss Reserve Estimation Techniques"

Taylor & McGuire, "Loss Reserving with GLMS: A Case Study"

These are all available via the CAS website.