Workers Compensation - How Long is the Tail?

- **Estimating Unpaid Tail Losses With Incomplete Information**

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Estimating Unpaid Tail Losses With Incomplete Information

- Individual Claim Review
- Case Reserve Development Method
- Backward Recursive Development Method (Marker and Mohl)
- Incremental Paid Loss Method

Individual Claim Review

- Requires a relatively small number of open claims.
- Individual case reserving.
- Model the impact of mortality, medical inflation, reinsurance, etc.

Case Reserve Development Method

- A factor is calculated that, when applied to case reserves, will yield an estimate of total outstanding loss.
- The case reserve development factor is calculated using previously selected cumulative paid development factors and incurred development factors.

Case Reserve Development Method (cont.)

$$\text{Case Reserve Development Factor (CRDF)} = \frac{1 - \frac{1}{\text{Paid ATU}}}{\frac{1}{\text{Incd ATU}} - \frac{1}{\text{Paid ATU}}}$$

$$= \frac{1 - \%\ \text{Paid To Date}}{\%\ \text{Incd to Date} - \%\ \text{Paid to Date}}$$

Where ATU = "Age to Ultimate" and

Case Reserves x CRDF = Estimated Total Outstanding Losses

Case Reserve Development Method (cont.)

(1)	(2)	(3)	(4)	(5) $\frac{1.0 - (3)}{(4) - (3)}$	(6) (2) × (5)
Accident Year	Case Outstanding Losses as of 12/31/08	Cumulative Percentage of Loss Paid	Cumulative Percentage of Loss Incurred	Case Reserve Development Factor	Estimated Total Outstanding Losses as of 12/31/08
1969	65,961	98.0%	99.5%	1.340	88,388
1970	331,149	97.7%	99.5%	1.283	424,864
1971	427,108	97.5%	99.5%	1.243	530,895
1972	943,918	97.1%	99.4%	1.282	1,210,103
1973	1,046,371	96.7%	99.3%	1.291	1,350,865
1974	1,806,053	96.3%	99.1%	1.299	2,346,062
1975	1,905,294	95.9%	99.0%	1.316	2,507,367
1976	2,087,916	95.5%	98.9%	1.321	2,758,137
1977	2,305,345	95.1%	98.8%	1.326	3,056,888
1978	2,460,633	94.7%	98.7%	1.322	3,252,957
1979	2,565,012	94.2%	98.6%	1.318	3,380,686
Total	15,944,759				20,907,212

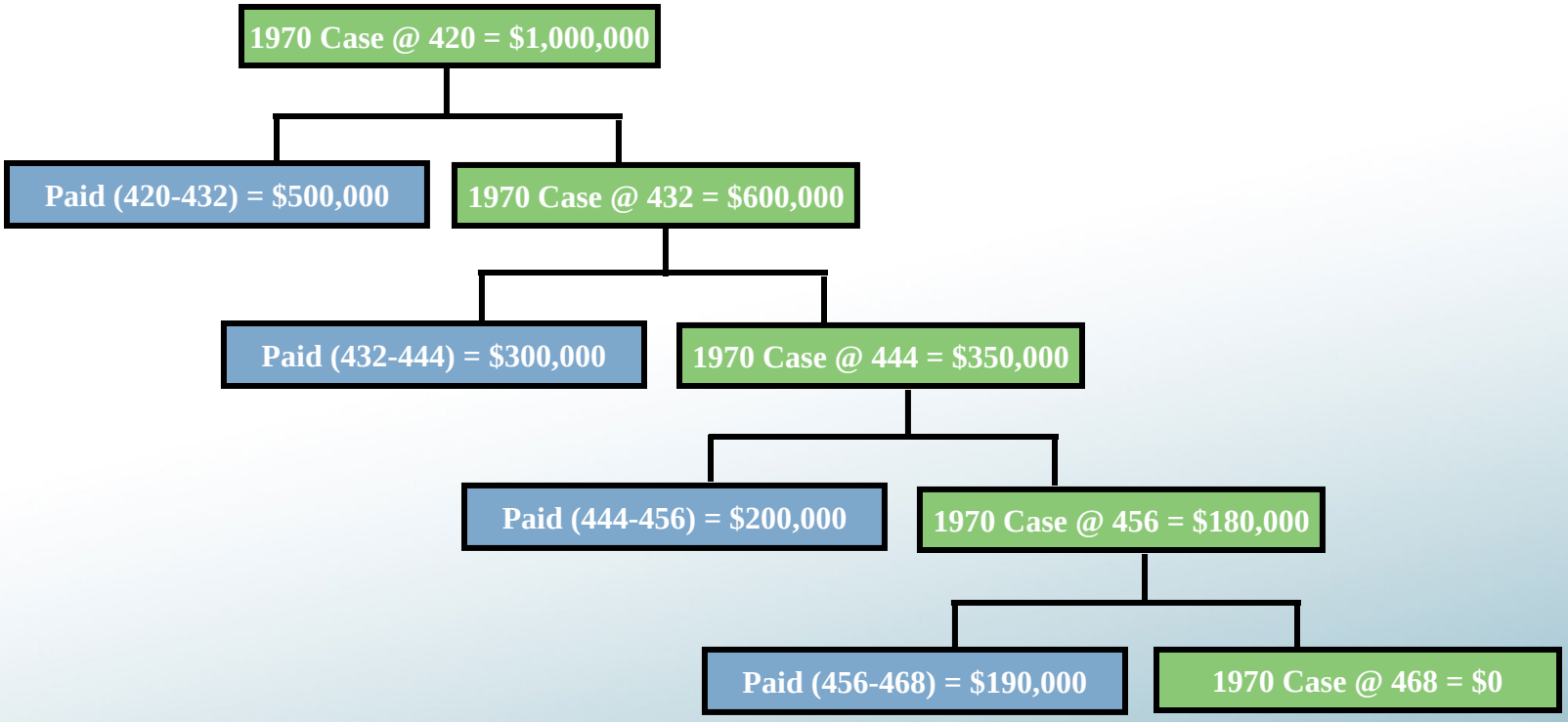
Backward-Recursive Development Method

- This method is discussed in a 1980 paper by Marker and Mohl titled "Rating Claims-Made Insurance Policies".
- Since you are dealing with a fixed number of open claims when estimating WC tail reserves, you can apply reserving techniques that are typically used for claims-made policies.
- Data needed:
  - Triangle of incremental paid losses
  - Triangle of case reserves
- Advantage: Cumulative paid losses are not needed
- Disadvantage: Results are more sensitive to parameter selections

Backward Recursive Development Method (cont.)

- Track the development of a case reserve amount into subsequent paid losses and remaining reserves.

Backward Recursive Development Method (cont.)



Backward Recursive Development Method (cont.)

- Track the development of a case reserve amount into subsequent paid losses and remaining reserves.
- Calculate ratios (P_x) of incremental paid losses to case reserves at the end of the prior period.

$$P_x = [Paid_{x+1} – Paid_x] \div OS_x$$

Backward Recursive Development Method (cont.)

Paid on Prior Case Reserves (P_x)

Accident Year	216-228	228-240	240-252	252-264	264-276	276-288	288-300	300-312	312-324	324-336	336-348
1969											0.086
1970										0.106	0.106
1971									0.112	0.090	0.066
1972								0.094	0.095	0.096	0.101
1973							0.106	0.129	0.105	0.098	0.170
1974						0.080	0.077	0.085	0.081	0.082	0.080
1975					0.079	0.077	0.076	0.082	0.099	0.095	0.100
1976				0.091	0.097	0.095	0.107	0.107	0.103	0.112	0.121
1977			0.094	0.098	0.099	0.113	0.101	0.107	0.107	0.110	0.108
1978		0.111	0.097	0.101	0.099	0.093	0.109	0.104	0.110	0.115	0.112
1979	0.092	0.093	0.096	0.110	0.097	0.117	0.110	0.116	0.114	0.116	0.119
Average	0.092	0.102	0.095	0.100	0.094	0.096	0.098	0.103	0.103	0.102	0.106
5 Year Avg	0.092	0.102	0.095	0.100	0.094	0.099	0.101	0.103	0.107	0.110	0.112
3 Year Avg	0.092	0.102	0.095	0.103	0.098	0.108	0.107	0.109	0.110	0.114	0.113
Avg Excl H/L			0.096	0.100	0.098	0.095	0.100	0.102	0.104	0.103	0.104
Selected	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100

Backward Recursive Development Method (cont.)

- Track the development of a case reserve amount into subsequent paid losses and remaining reserves.
- Calculate ratios (P_x) of incremental paid losses to case reserves at the end of the prior period.

$$P_x = [Paid_{x+1} – Paid_x] \div OS_x$$

- Calculate ratios (R_x) of case reserves at the end of the period to case reserves at the end of the prior period.

$$R_x = OS_{x+1} \div OS_x$$

Backward Recursive Development Method (cont.)

Case Reserve Development (R_x)

Accident Year	216-228	228-240	240-252	252-264	264-276	276-288	288-300	300-312	312-324	324-336	336-348
1969											0.928
1970										0.981	0.901
1971									0.951	0.886	0.856
1972								0.895	0.954	0.942	0.949
1973							0.950	0.917	0.915	0.871	0.768
1974						0.979	0.875	0.898	0.913	0.803	0.760
1975					0.912	0.938	0.919	0.877	0.839	0.901	0.957
1976				0.953	0.943	0.890	0.946	0.929	0.870	0.950	0.918
1977			0.847	0.938	0.886	0.985	0.939	0.916	0.934	0.862	0.963
1978		0.899	0.901	0.943	0.906	0.855	0.945	0.898	0.921	0.912	0.890
1979	0.891	0.949	0.873	0.900	0.873	0.912	0.927	0.963	0.919	0.927	0.964
Average	0.891	0.924	0.874	0.934	0.904	0.927	0.929	0.912	0.913	0.904	0.896
5 Year Avg	0.891	0.924	0.874	0.934	0.904	0.916	0.935	0.917	0.897	0.911	0.938
3 Year Avg	0.891	0.924	0.874	0.927	0.888	0.917	0.937	0.926	0.925	0.901	0.939
Avg Excl H/L			0.873	0.941	0.901	0.930	0.935	0.909	0.917	0.906	0.903
Selected	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910

Backward Recursive Development Method (cont.)

(1)	(2)	(3)	(4)	(5) [(4) × prior (5)] + (3)	(6) (2) × (5)
Accident Year	Case Outstanding Losses as of 12/31/08	Selected Paid on Prior Case Reserve Ratio (P_x)	Selected Remaining in Reserve Ratio (R_x)	Cumulative Reserve Development Factor	Estimated Total Outstanding Losses as of 12/31/08
Prior				1.068 [1]	
1969	504,324	0.100	0.910	1.072	538,618
1970	884,475	0.100	0.910	1.076	951,695
1971	1,047,812	0.100	0.910	1.079	1,130,589
1972	1,056,592	0.100	0.910	1.082	1,143,233
1973	1,204,373	0.100	0.910	1.085	1,306,745
1974	2,346,743	0.100	0.910	1.087	2,550,910
1975	2,438,883	0.100	0.910	1.089	2,655,943
1976	2,526,651	0.100	0.910	1.091	2,756,576
1977	2,573,864	0.100	0.910	1.093	2,813,234
1978	2,603,793	0.100	0.910	1.095	2,851,154
1979	3,408,036	0.100	0.910	1.096	3,735,208
Total	20,595,547				22,433,905

[1] Assumes that the pattern continues for an additional 10 years, with any remaining reserves converted to payments in year 11.

Incremental Paid Loss Method

- This method uses a pre-selected loss payment pattern and several years of incremental paid losses to generate multiple indications of the total outstanding losses.
- Advantages:
  - Cumulative paid loss is not an input.
  - Since this method only relies on actual loss payments, changes in case reserve adequacy do not impact the indicated results.
- Disadvantages:
  - Lump sum settlement activity may result in spikes in actual loss payments, which can overestimate outstanding loss.
  - Since this method relies exclusively on paid losses during a relatively short time period (and the associated expected payment pattern), the results are subject to a high degree of volatility.

Incremental Paid Loss Method (cont.)

1. Cumulative Percent Paid

12	24	…	288	300	312	324	336	348	360	372	…
10%	17%	…	60%	64%	68%	71%	73%	75%	77%	79%	…

2. AY 1980 Payments from 288 to 348 = $100,000

3. AY 1980 Estimated Unpaid at 348 Months

$$= \$100{,}000 \times \frac{[1.0 - 75\%]}{[\,75\% - 60\%]}$$

$$= \$166{,}667$$

Incremental Paid Loss Method (cont.)

Accident Year	01/01/02-12/31/02	01/01/03-12/31/03	01/01/04-12/31/04	01/01/05-12/31/05	01/01/06-12/31/06	01/01/07-12/31/07	01/01/08-12/31/08	Average
Incremental Paid Losses								
1977	--	220,437	213,433	209,950	147,947	145,795	132,479	--
1978	--	302,479	276,574	257,987	210,433	214,357	224,378	--
1979	--	242,375	195,333	154,326	143,762	154,378	148,975	--
1980	--	267,575	258,223	250,280	187,530	193,245	178,435	--
Estimated Percentage of Ultimate Loss Unpaid at End of Period								
1977	6.9%	6.5%	6.1%	5.7%	5.3%	4.9%	4.6%	--
1978	7.3%	6.9%	6.5%	6.1%	5.7%	5.3%	4.9%	--
1979	7.9%	7.3%	6.9%	6.5%	6.1%	5.7%	5.3%	--
1980	8.3%	7.9%	7.3%	6.9%	6.5%	6.1%	5.7%	--
Estimated Total Outstanding Loss as of 12/31/08								
1977	--	2,535,026	2,454,480	2,414,425	1,701,391	1,676,643	2,031,345	2,135,551
1978	--	3,705,368	3,388,032	3,160,341	2,577,804	2,625,873	2,748,631	3,034,341
1979	--	2,140,979	2,588,162	2,044,820	1,904,847	2,045,509	1,973,919	2,116,372
1980	--	3,812,944	2,453,119	3,566,490	2,672,303	2,753,741	2,542,699	2,966,882

= 258,223 ÷ [(7.9% - 7.3%) ÷ 5.7%]

= 178,435 ÷ [(6.1% - 5.7%) ÷ 5.7%]

Questions?