

# 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
- Backward Recursive Development Method (Marker and Mohl)
- Case Reserve Development Method
- Incremental Paid Loss Method

## Individual Claim Review

- When there are a relatively small number of open claims, a review by an experienced claim professional can be very valuable.
- Review of claim files and interview of key personnel to evaluate claim handling (e.g., experience, workload, intake, investigation, reserving, mitigation, negotiation, resolution).
- Can directly model the impact of medical inflation, reinsurance, etc.

## Backward-Recursive Development Method

- This method is discussed in a 1980 paper by Marker and Mohl titled “Rating Claims-Made Insurance Policies”.
  - Also discussed in Chapter 5 of the Foundations of Casualty Actuarial Science.
- 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.)

- The idea is to 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.
  - $P_x = [\text{Paid}_x - \text{Paid}_{x-1}] \div \text{OS}_{x-1}$

## Backward Recursive Development Method (cont.)

Accident Year	Paid on Prior Case Reserves (P <sub>x</sub> )										
	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.)

- The idea is to 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.
  - $P_x = [\text{Paid}_x - \text{Paid}_{x-1}] \div \text{OS}_{x-1}$
- Calculate ratios ( $R_x$ ) of case reserves at the end of the period to case reserves at the end of the prior period.
  - $R_x = \text{OS}_x \div \text{OS}_{x-1}$

## Backward Recursive Development Method (cont.)

Accident Year	Case Reserve Development ( $R_x$ )										
	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.)

- The idea is to 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.
  - $P_x = [\text{Paid}_x - \text{Paid}_{x-1}] \div \text{OS}_{x-1}$
- Calculate ratios ( $R_x$ ) of case reserves at the end of the period to case reserves at the end of the prior period.
  - $R_x = \text{OS}_x \div \text{OS}_{x-1}$
- **$P_x + R_x$  gives a history of the amount developed on reserves in the prior period.**

## 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 <sub>x</sub> )	Selected Remaining in Reserve Ratio (R <sub>x</sub> )	Cumulative Reserve Development Factor	Estimated Total Outstanding Losses as of 12/31/08
Prior				1.068 <sup>1</sup>	
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

<sup>1</sup> Assumes that the pattern continues for an additional 10 years, with any remaining reserves converted to payments in year 11.

## 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.)

$$\begin{aligned} \text{Case Reserve Development Factor (CRDF)} &= \frac{1 - \frac{1}{\text{Paid ATU}}}{\frac{1}{\text{Incd ATU}} - \frac{1}{\text{Paid ATU}}} \\ &= \frac{1 - \% \text{ Paid To Date}}{\% \text{ Incd to Date} - \% \text{ Paid to Date}} \end{aligned}$$

Where ATU = "Age to Ultimate" and

$$\text{Case Reserves} \times \text{CRDF} = \text{Estimated Total Outstanding Losses}$$

## Case Reserve Development Method (cont.)

(1)	(2)	(3)	(4)	(5)	(6)
				$\frac{1.0 - (3)}{(4) - (3)}$	$(2) \times (5)$
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

## Incremental Paid Loss Method

- This method uses a pre-selected incremental loss payment pattern and several years of incremental paid losses to generate multiple indications of the total outstanding losses at a particular point in time.
- 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.)

### Sample Calculation for Incremental Paid Loss Method (All Amounts are Hypothetical)

(1)	Cumulative % Paid to Date at 120 Months	60.0%
(2)	Cumulative % Paid to Date at 180 Months	75.0%
(3) = (2) - (1)	% of Ultimate Loss Paid Between 120 and 180 Months	15.0%
(4) = 100% - (1)	% Unpaid at 120 Months	40.0%
(5) = (3) ÷ (4)	% of Unpaid at 120 Months that is expected to be Paid Between 120 and 180 Months	37.5%
(6)	Actual Loss Paid Between 120 and 180 Months	\$100,000
(7) = (6) ÷ (5)	Expected Unpaid Loss at 120 Months	\$266,667
<b>(8) = (7) - (6)</b>	<b>Expected Unpaid Loss at 180 Months</b>	<b>\$166,667</b>

# 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	01/01/03-12/31/08
<b>Incremental Paid Losses</b>									
1977	--	220,437	213,433	209,950	147,947	145,795	132,479	--	1,070,041
1978	--	302,479	276,574	257,987	210,433	214,357	224,378	--	1,486,208
1979	--	242,375	195,333	154,326	143,762	154,378	148,975	--	1,039,149
1980	--	267,575	258,223	250,280	187,530	193,245	178,435	--	1,335,288
<b>Estimated Percentage of Ultimate Loss Unpaid at End of Period</b>									
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%	--	--
<b>Estimated Total Outstanding Loss as of 12/31/02</b>									
1977	--	3,802,538	3,681,719	3,621,637	2,552,086	2,514,964	3,047,017	3,203,327	3,210,123
1978	--	5,520,242	5,047,475	4,708,263	3,840,402	3,912,015	4,094,898	4,520,549	4,520,549
1979	--	3,191,271	3,857,827	3,047,939	2,839,300	3,048,966	2,942,256	3,154,593	3,157,414
1980	--	5,552,181	3,572,085	5,193,310	3,891,247	4,009,834	3,702,526	4,320,197	4,262,650
$= 258,223 \div [(7.9\% - 7.3\%) \div 8.3\%]$ $1,335,288 \div [(8.3\% - 5.7\%) \div 8.3\%] =$									
<b>Estimated Total Outstanding Loss as of 12/31/08</b>									
1977	--	2,732,497	2,611,678	2,551,596	1,482,045	1,444,923	1,976,976	2,133,286	2,140,082
1978	--	4,034,034	3,561,267	3,222,055	2,354,194	2,425,807	2,608,690	3,034,341	3,034,341
1979	--	2,152,122	2,818,678	2,008,790	1,800,151	2,009,817	1,903,107	2,115,444	2,118,265
1980	--	4,216,893	2,236,797	3,858,022	2,555,959	2,674,546	2,367,238	2,984,909	2,927,362
$= 3,572,085 - 1,335,288$									



Questions?