

PENNSYLVANIA COMPENSATION RATING BUREAU

Retrospective Test of Trend Projections for Severity Ratios

Attached is a retrospective test of the predictive accuracy of various trend procedures. Please note that instead of using ultimate loss ratios, as in Exhibit 11a, Exhibit 11b uses ultimate severity ratios, i.e., ultimate loss ratios adjusted by dividing out the frequency component. Please note that our analysis is limited to Policy Years 2002 through 2013, the years shown on Exhibit 6, page 6.

Results for both indemnity and medical are shown using both linear and exponential fits. All possible combinations from 4 to 10 data points, which permitted a test of the projected severity ratio three years hence, were used. Our current review trends Policy Year 2013 3.25 years, Policy Year 2012 4.25 years, and Policy Year 2011 5.25 years. An average of those three values is then calculated.

Current estimates of policy year ultimate severity ratios are compared with predicted values based on trending through earlier years. The results are shown for three loss development approaches: incurred, paid to twenty-seventh and the average of the incurred and paid to twenty-seventh methods.

As an illustration, the incurred loss development approach generates an indemnity severity ratio of 0.8108 for Policy Year 2008. Fitting the loss ratios for Policy Years 2002 to 2005 using a straight line and projecting that to 2008 yields a severity ratio of 0.7733, which understates our current estimate for 2008 by 0.0375.

**Indemnity
Actual Ultimate Severity Ratios
Including Average of Paid and Incurred**

INDEMNITY	Policy Year	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-27)
	2002	0.6882	0.6765	0.6999
	2003	0.7022	0.6907	0.7139
	2004	0.7368	0.7278	0.7459
	2005	0.7326	0.7163	0.7489
	2006	0.7452	0.7301	0.7605
	2007	0.8016	0.7807	0.8224
	2008	0.8410	0.8108	0.8713
	2009	0.8283	0.7938	0.8626
	2010	0.8294	0.7964	0.8623
	2011	0.8463	0.8027	0.8898
	2012	0.8585	0.8028	0.9141
	2013	0.9028	0.8406	0.9651

Trend # Years = 3

**Indemnity
Linear Fit
Trended Severity Ratios**

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-27)
02-05 (4)	2008	0.7905	0.7733	0.8077
03-06 (4)	2009	0.7854	0.7642	0.8066
04-07 (4)	2010	0.8472	0.8164	0.8779
05-08 (4)	2011	0.9518	0.9098	0.9939
06-09 (4)	2012	0.9339	0.8784	0.9890
07-10 (4)	2013	0.8569	0.8090	0.9046
02-06 (5)	2009	0.7932	0.7747	0.8119
03-07 (5)	2010	0.8473	0.8203	0.8741
04-08 (5)	2011	0.9101	0.8683	0.9520
05-09 (5)	2012	0.9333	0.8842	0.9822
06-10 (5)	2013	0.9067	0.8552	0.9577
02-07 (6)	2010	0.8431	0.8190	0.8673
03-08 (6)	2011	0.9015	0.8642	0.9387
04-09 (6)	2012	0.9128	0.8643	0.9611
05-10 (6)	2013	0.9178	0.8690	0.9663
02-08 (7)	2011	0.8923	0.8587	0.9259
03-09 (7)	2012	0.9102	0.8657	0.9544
04-10 (7)	2013	0.9089	0.8597	0.9579
02-09 (8)	2012	0.9051	0.8642	0.9459
03-10 (8)	2013	0.9110	0.8645	0.9572
02-10 (9)	2013	0.9096	0.8659	0.9532

Indemnity
Linear Fit
Differences: (Actual - Trended)

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-27)
02-05 (4)	2008	0.0505	0.0376	0.0636
03-06 (4)	2009	0.0429	0.0296	0.0560
04-07 (4)	2010	-0.0178	-0.0199	-0.0156
05-08 (4)	2011	-0.1055	-0.1071	-0.1041
06-09 (4)	2012	-0.0754	-0.0756	-0.0749
07-10 (4)	2013	0.0459	0.0316	0.0605
02-06 (5)	2009	0.0351	0.0191	0.0507
03-07 (5)	2010	-0.0179	-0.0239	-0.0118
04-08 (5)	2011	-0.0638	-0.0656	-0.0621
05-09 (5)	2012	-0.0748	-0.0814	-0.0681
06-10 (5)	2013	-0.0038	-0.0146	0.0074
02-07 (6)	2010	-0.0137	-0.0226	-0.0050
03-08 (6)	2011	-0.0552	-0.0615	-0.0489
04-09 (6)	2012	-0.0543	-0.0615	-0.0470
05-10 (6)	2013	-0.0150	-0.0284	-0.0012
02-08 (7)	2011	-0.0460	-0.0560	-0.0361
03-09 (7)	2012	-0.0517	-0.0629	-0.0403
04-10 (7)	2013	-0.0061	-0.0191	0.0072
02-09 (8)	2012	-0.0466	-0.0614	-0.0318
03-10 (8)	2013	-0.0082	-0.0239	0.0079
02-10 (9)	2013	-0.0068	-0.0253	0.0119

**Indemnity
Exponential Fit
Trended Loss Ratios**

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Incur)	Severity Ratio (Incur)	Severity Ratio (Pd-27)
02-05 (4)	2008	0.7946	0.7770	0.8122
03-06 (4)	2009	0.7879	0.7662	0.8097
04-07 (4)	2010	0.8509	0.8187	0.8832
05-08 (4)	2011	0.9697	0.9241	1.0156
06-09 (4)	2012	0.9466	0.8863	1.0074
07-10 (4)	2013	0.8579	0.8093	0.9068
02-06 (5)	2009	0.7971	0.7781	0.8163
03-07 (5)	2010	0.8530	0.8248	0.8811
04-08 (5)	2011	0.9197	0.8749	0.9650
05-09 (5)	2012	0.9471	0.8939	1.0005
06-10 (5)	2013	0.9145	0.8600	0.9694
02-07 (6)	2010	0.8497	0.8246	0.8748
03-08 (6)	2011	0.9118	0.8721	0.9518
04-09 (6)	2012	0.9227	0.8706	0.9753
05-10 (6)	2013	0.9284	0.8763	0.9807
02-08 (7)	2011	0.9028	0.8672	0.9385
03-09 (7)	2012	0.9216	0.8737	0.9696
04-10 (7)	2013	0.9181	0.8655	0.9712
02-09 (8)	2012	0.9171	0.8733	0.9611
03-10 (8)	2013	0.9221	0.8721	0.9723
02-10 (9)	2013	0.9220	0.8750	0.9691

**Indemnity
Exponential Fit
Differences: (Actual - Trended)**

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-27)
02-05 (4)	2008	0.0464	0.0338	0.0591
03-06 (4)	2009	0.0404	0.0276	0.0529
04-07 (4)	2010	-0.0215	-0.0223	-0.0209
05-08 (4)	2011	-0.1234	-0.1214	-0.1258
06-09 (4)	2012	-0.0881	-0.0835	-0.0933
07-10 (4)	2013	0.0449	0.0313	0.0583
02-06 (5)	2009	0.0312	0.0157	0.0463
03-07 (5)	2010	-0.0236	-0.0284	-0.0188
04-08 (5)	2011	-0.0734	-0.0722	-0.0752
05-09 (5)	2012	-0.0886	-0.0911	-0.0864
06-10 (5)	2013	-0.0117	-0.0194	-0.0043
02-07 (6)	2010	-0.0203	-0.0282	-0.0125
03-08 (6)	2011	-0.0655	-0.0694	-0.0620
04-09 (6)	2012	-0.0642	-0.0678	-0.0612
05-10 (6)	2013	-0.0256	-0.0357	-0.0156
02-08 (7)	2011	-0.0565	-0.0645	-0.0487
03-09 (7)	2012	-0.0631	-0.0709	-0.0555
04-10 (7)	2013	-0.0153	-0.0249	-0.0061
02-09 (8)	2012	-0.0586	-0.0705	-0.0470
03-10 (8)	2013	-0.0193	-0.0315	-0.0072
02-10 (9)	2013	-0.0192	-0.0344	-0.0040

Medical
Actual Ultimate Severity Ratios
Including Average of Paid and Incurred

MEDICAL	Policy Year	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-27)
	2002	0.6323	0.6184	0.6462
	2003	0.6827	0.6627	0.7026
	2004	0.7472	0.7286	0.7660
	2005	0.7530	0.7341	0.7720
	2006	0.7607	0.7418	0.7796
	2007	0.8442	0.8216	0.8667
	2008	0.8655	0.8344	0.8966
	2009	0.8793	0.8474	0.9112
	2010	0.9280	0.9043	0.9515
	2011	0.9891	0.9531	1.0250
	2012	0.9977	0.9538	1.0414
	2013	1.0543	1.0177	1.0908

Trend # Years = 3

**Medical
Linear Fit
Trended Severity Ratios**

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-27)
02-05 (4)	2008	0.8958	0.8718	0.9201
03-06 (4)	2009	0.8438	0.8261	0.8617
04-07 (4)	2010	0.9107	0.8855	0.9354
05-08 (4)	2011	0.9953	0.9543	1.0361
06-09 (4)	2012	1.0071	0.9596	1.0546
07-10 (4)	2013	0.9986	0.9694	1.0276
02-06 (5)	2009	0.8787	0.8562	0.9014
03-07 (5)	2010	0.9258	0.9033	0.9483
04-08 (5)	2011	0.9580	0.9217	0.9941
05-09 (5)	2012	0.9992	0.9555	1.0429
06-10 (5)	2013	1.0404	1.0053	1.0753
02-07 (6)	2010	0.9409	0.9157	0.9660
03-08 (6)	2011	0.9661	0.9338	0.9983
04-09 (6)	2012	0.9783	0.9378	1.0185
05-10 (6)	2013	1.0352	0.9995	1.0707
02-08 (7)	2011	0.9771	0.9443	1.0099
03-09 (7)	2012	0.9870	0.9501	1.0239
04-10 (7)	2013	1.0182	0.9831	1.0531
02-09 (8)	2012	0.9982	0.9613	1.0352
03-10 (8)	2013	1.0241	0.9907	1.0574
02-10 (9)	2013	1.0331	0.9989	1.0673

**Medical
Linear Fit
Differences: (Actual - Trended)**

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-27)
02-05 (4)	2008	-0.0303	-0.0374	-0.0235
03-06 (4)	2009	0.0355	0.0213	0.0495
04-07 (4)	2010	0.0173	0.0188	0.0161
05-08 (4)	2011	-0.0062	-0.0012	-0.0111
06-09 (4)	2012	-0.0094	-0.0058	-0.0132
07-10 (4)	2013	0.0557	0.0483	0.0633
02-06 (5)	2009	0.0006	-0.0088	0.0098
03-07 (5)	2010	0.0022	0.0010	0.0032
04-08 (5)	2011	0.0311	0.0314	0.0309
05-09 (5)	2012	-0.0015	-0.0017	-0.0015
06-10 (5)	2013	0.0139	0.0124	0.0155
02-07 (6)	2010	-0.0129	-0.0114	-0.0145
03-08 (6)	2011	0.0230	0.0193	0.0267
04-09 (6)	2012	0.0194	0.0160	0.0229
05-10 (6)	2013	0.0191	0.0182	0.0201
02-08 (7)	2011	0.0120	0.0088	0.0151
03-09 (7)	2012	0.0107	0.0037	0.0175
04-10 (7)	2013	0.0361	0.0346	0.0377
02-09 (8)	2012	-0.0005	-0.0075	0.0062
03-10 (8)	2013	0.0302	0.0270	0.0334
02-10 (9)	2013	0.0212	0.0188	0.0235

**Medical
Exponential Fit
Trended Loss Ratios**

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-27)
02-05 (4)	2008	0.9256	0.9001	0.9515
03-06 (4)	2009	0.8538	0.8366	0.8712
04-07 (4)	2010	0.9184	0.8928	0.9435
05-08 (4)	2011	1.0172	0.9729	1.0615
06-09 (4)	2012	1.0282	0.9765	1.0804
07-10 (4)	2013	1.0056	0.9758	1.0352
02-06 (5)	2009	0.9013	0.8779	0.9249
03-07 (5)	2010	0.9430	0.9208	0.9653
04-08 (5)	2011	0.9720	0.9338	1.0100
05-09 (5)	2012	1.0199	0.9725	1.0673
06-10 (5)	2013	1.0629	1.0254	1.1002
02-07 (6)	2010	0.9701	0.9437	0.9964
03-08 (6)	2011	0.9883	0.9548	1.0217
04-09 (6)	2012	0.9948	0.9517	1.0377
05-10 (6)	2013	1.0590	1.0206	1.0971
02-08 (7)	2011	1.0106	0.9754	1.0458
03-09 (7)	2012	1.0113	0.9723	1.0503
04-10 (7)	2013	1.0390	1.0016	1.0761
02-09 (8)	2012	1.0337	0.9936	1.0739
03-10 (8)	2013	1.0525	1.0171	1.0877
02-10 (9)	2013	1.0727	1.0354	1.1098

Medical
Exponential Fit
Differences: (Actual - Trended)

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-27)
02-05 (4)	2008	-0.0601	-0.0657	-0.0549
03-06 (4)	2009	0.0255	0.0108	0.0400
04-07 (4)	2010	0.0096	0.0115	0.0080
05-08 (4)	2011	-0.0281	-0.0198	-0.0365
06-09 (4)	2012	-0.0305	-0.0227	-0.0390
07-10 (4)	2013	0.0487	0.0419	0.0556
02-06 (5)	2009	-0.0220	-0.0305	-0.0137
03-07 (5)	2010	-0.0150	-0.0165	-0.0138
04-08 (5)	2011	0.0171	0.0193	0.0150
05-09 (5)	2012	-0.0222	-0.0187	-0.0259
06-10 (5)	2013	-0.0086	-0.0077	-0.0094
02-07 (6)	2010	-0.0421	-0.0394	-0.0449
03-08 (6)	2011	0.0008	-0.0017	0.0033
04-09 (6)	2012	0.0029	0.0021	0.0037
05-10 (6)	2013	-0.0047	-0.0029	-0.0063
02-08 (7)	2011	-0.0215	-0.0223	-0.0208
03-09 (7)	2012	-0.0136	-0.0185	-0.0089
04-10 (7)	2013	0.0153	0.0161	0.0147
02-09 (8)	2012	-0.0360	-0.0398	-0.0325
03-10 (8)	2013	0.0018	0.0006	0.0031
02-10 (9)	2013	-0.0184	-0.0177	-0.0190