

DELAWARE COMPENSATION RATING BUREAU, INC.

Retrospective Test of Trend Projections for Severity Ratios – Unlimited Losses

Attached is a retrospective test of the predictive accuracy of various trend procedures using severity ratios, i.e., ultimate loss ratios adjusted by dividing out the frequency component. The analysis is limited to Policy Years 2002 through 2014, the years for which frequency data is available.

Results for both indemnity and medical are shown using both linear and exponential fits. All possible combinations from four to ten data points, which permitted a test of the projected loss ratio three years hence, were used. Our current review trends 2.9167 years beyond the midpoint of the latest available completed policy year (1/1/2015 to 12/1/2017).

Current estimates of policy year ultimate loss ratios are compared with predicted values based on trending through earlier years. The results are available for each of three loss development approaches: incurred, paid-to-26th and the average of the incurred and paid-to-26th methods.

As an illustration, the incurred loss development approach generated an indemnity severity ratio of 0.4706 for policy year 2009 (page 6.1). Fitting the severity ratios for policy years 2003 to 2006 using a straight line and projecting that to 2009 yielded a severity ratio of 0.4298 (page 6.2) which understates our current estimate for 2009 by 0.0408 points (page 6.3).

**Indemnity
Actual Ultimate Severity Ratios**

INDEMNITY	Policy Year	Ultimate Severity Ratio (Avg Pd & Inc)	Ultimate Severity Ratio (Incur)	Ultimate Severity Ratio (Pd-26)
	2002	0.3979	0.3896	0.4062
	2003	0.3885	0.3822	0.3948
	2004	0.3849	0.3739	0.3957
	2005	0.4017	0.3902	0.4133
	2006	0.4181	0.4074	0.4289
	2007	0.4281	0.4239	0.4324
	2008	0.4304	0.4132	0.4477
	2009	0.4734	0.4706	0.4761
	2010	0.4620	0.4365	0.4874
	2011	0.4940	0.4519	0.5361
	2012	0.5318	0.4997	0.5638
	2013	0.6068	0.5579	0.6558
	2014	0.6516	0.5906	0.7128

Trend # Years = 3

**Indemnity
Linear Fit
Trended Loss Ratios**

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-26)
2002-2005 (4)	2008	0.3968	0.3811	0.4125
2003-2006 (4)	2009	0.4458	0.4298	0.4621
2004-2007 (4)	2010	0.4739	0.4741	0.4741
2005-2008 (4)	2011	0.4628	0.4472	0.4786
2006-2009 (4)	2012	0.5132	0.5093	0.5169
2007-2010 (4)	2013	0.5136	0.4789	0.5479
2008-2011 (4)	2014	0.5457	0.4800	0.6113
2002-2006 (5)	2009	0.4250	0.4105	0.4397
2003-2007 (5)	2010	0.4605	0.4540	0.4672
2004-2008 (5)	2011	0.4713	0.4579	0.4852
2005-2009 (5)	2012	0.5082	0.5044	0.5119
2006-2010 (5)	2013	0.5090	0.4828	0.5349
2007-2011 (5)	2014	0.5393	0.4789	0.5995
2002-2007 (6)	2010	0.4435	0.4359	0.4513
2003-2008 (6)	2011	0.4645	0.4491	0.4801
2004-2009 (6)	2012	0.5074	0.5026	0.5123
2005-2010 (6)	2013	0.5094	0.4881	0.5305
2006-2011 (6)	2014	0.5334	0.4838	0.5827
2002-2008 (7)	2011	0.4521	0.4374	0.4669
2003-2009 (7)	2012	0.4976	0.4897	0.5056
2004-2010 (7)	2013	0.5113	0.4925	0.5301
2005-2011 (7)	2014	0.5318	0.4898	0.5737
2002-2009 (8)	2012	0.4838	0.4752	0.4924
2003-2010 (8)	2013	0.5049	0.4857	0.5241
2004-2011 (8)	2014	0.5320	0.4950	0.5691
2002-2010 (9)	2013	0.4939	0.4757	0.5121
2003-2011 (9)	2014	0.5256	0.4905	0.5607
2002-2011 (10)	2014	0.5151	0.4826	0.5476

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

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-26)
2002-2005 (4)	2008	0.0336	0.0322	0.0352
2003-2006 (4)	2009	0.0276	0.0408	0.0140
2004-2007 (4)	2010	-0.0119	-0.0376	0.0133
2005-2008 (4)	2011	0.0312	0.0047	0.0575
2006-2009 (4)	2012	0.0186	-0.0096	0.0469
2007-2010 (4)	2013	0.0932	0.0790	0.1079
2008-2011 (4)	2014	0.1059	0.1107	0.1016
2002-2006 (5)	2009	0.0484	0.0601	0.0364
2003-2007 (5)	2010	0.0015	-0.0175	0.0202
2004-2008 (5)	2011	0.0227	-0.0060	0.0509
2005-2009 (5)	2012	0.0236	-0.0047	0.0519
2006-2010 (5)	2013	0.0979	0.0751	0.1210
2007-2011 (5)	2014	0.1123	0.1117	0.1133
2002-2007 (6)	2010	0.0185	0.0006	0.0361
2003-2008 (6)	2011	0.0295	0.0028	0.0560
2004-2009 (6)	2012	0.0244	-0.0029	0.0515
2005-2010 (6)	2013	0.0974	0.0698	0.1253
2006-2011 (6)	2014	0.1182	0.1068	0.1301
2002-2008 (7)	2011	0.0419	0.0145	0.0692
2003-2009 (7)	2012	0.0342	0.0100	0.0582
2004-2010 (7)	2013	0.0955	0.0654	0.1257
2005-2011 (7)	2014	0.1198	0.1008	0.1392
2002-2009 (8)	2012	0.0480	0.0245	0.0714
2003-2010 (8)	2013	0.1019	0.0722	0.1317
2004-2011 (8)	2014	0.1196	0.0956	0.1437
2002-2010 (9)	2013	0.1129	0.0822	0.1437
2003-2011 (9)	2014	0.1260	0.1001	0.1521
2002-2011 (10)	2014	0.1365	0.1080	0.1652

**Indemnity
Exponential Fit
Trended Loss Ratios**

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-26)
2002-2005 (4)	2008	0.3966	0.3809	0.4124
2003-2006 (4)	2009	0.4481	0.4314	0.4652
2004-2007 (4)	2010	0.4794	0.4812	0.4783
2005-2008 (4)	2011	0.4653	0.4493	0.4812
2006-2009 (4)	2012	0.5180	0.5141	0.5215
2007-2010 (4)	2013	0.5183	0.4804	0.5563
2008-2011 (4)	2014	0.5532	0.4828	0.6262
2002-2006 (5)	2009	0.4253	0.4105	0.4403
2003-2007 (5)	2010	0.4639	0.4574	0.4706
2004-2008 (5)	2011	0.4759	0.4623	0.4898
2005-2009 (5)	2012	0.5138	0.5104	0.5169
2006-2010 (5)	2013	0.5135	0.4851	0.5413
2007-2011 (5)	2014	0.5462	0.4807	0.6140
2002-2007 (6)	2010	0.4448	0.4370	0.4526
2003-2008 (6)	2011	0.4681	0.4521	0.4843
2004-2009 (6)	2012	0.5147	0.5104	0.5190
2005-2010 (6)	2013	0.5152	0.4923	0.5373
2006-2011 (6)	2014	0.5400	0.4865	0.5941
2002-2008 (7)	2011	0.4539	0.4388	0.4691
2003-2009 (7)	2012	0.5035	0.4952	0.5117
2004-2010 (7)	2013	0.5189	0.4989	0.5385
2005-2011 (7)	2014	0.5395	0.4942	0.5846
2002-2009 (8)	2012	0.4872	0.4781	0.4962
2003-2010 (8)	2013	0.5116	0.4910	0.5319
2004-2011 (8)	2014	0.5415	0.5015	0.5812
2002-2010 (9)	2013	0.4985	0.4791	0.5175
2003-2011 (9)	2014	0.5343	0.4964	0.5719
2002-2011 (10)	2014	0.5215	0.4869	0.5557

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

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-26)
2002-2005 (4)	2008	0.0338	0.0323	0.0353
2003-2006 (4)	2009	0.0253	0.0392	0.0109
2004-2007 (4)	2010	-0.0174	-0.0447	0.0091
2005-2008 (4)	2011	0.0287	0.0026	0.0549
2006-2009 (4)	2012	0.0138	-0.0144	0.0423
2007-2010 (4)	2013	0.0885	0.0775	0.0995
2008-2011 (4)	2014	0.0984	0.1078	0.0866
2002-2006 (5)	2009	0.0481	0.0601	0.0358
2003-2007 (5)	2010	-0.0019	-0.0209	0.0168
2004-2008 (5)	2011	0.0181	-0.0104	0.0463
2005-2009 (5)	2012	0.0180	-0.0107	0.0469
2006-2010 (5)	2013	0.0933	0.0728	0.1145
2007-2011 (5)	2014	0.1054	0.1099	0.0988
2002-2007 (6)	2010	0.0172	-0.0005	0.0348
2003-2008 (6)	2011	0.0259	-0.0002	0.0518
2004-2009 (6)	2012	0.0171	-0.0107	0.0448
2005-2010 (6)	2013	0.0916	0.0656	0.1185
2006-2011 (6)	2014	0.1116	0.1041	0.1187
2002-2008 (7)	2011	0.0401	0.0131	0.0670
2003-2009 (7)	2012	0.0283	0.0045	0.0521
2004-2010 (7)	2013	0.0879	0.0590	0.1173
2005-2011 (7)	2014	0.1121	0.0964	0.1282
2002-2009 (8)	2012	0.0446	0.0216	0.0676
2003-2010 (8)	2013	0.0952	0.0669	0.1239
2004-2011 (8)	2014	0.1101	0.0891	0.1316
2002-2010 (9)	2013	0.1083	0.0788	0.1383
2003-2011 (9)	2014	0.1173	0.0942	0.1409
2002-2011 (10)	2014	0.1301	0.1037	0.1571

Medical
Actual Ultimate Severity Ratios

MEDICAL	Policy Year	Ultimate Severity Ratio (Avg Pd & Inc)	Ultimate Severity Ratio (Incur)	Ultimate Severity Ratio (Pd-26)
	2002	0.6531	0.6209	0.6854
	2003	0.5920	0.5672	0.6168
	2004	0.6396	0.5980	0.6812
	2005	0.6838	0.6523	0.7154
	2006	0.6934	0.6527	0.7340
	2007	0.8086	0.7575	0.8597
	2008	0.8964	0.8243	0.9684
	2009	1.0209	0.9459	1.0959
	2010	1.2833	1.1764	1.3900
	2011	1.2697	1.1390	1.4005
	2012	1.3609	1.2162	1.5058
	2013	1.4929	1.3221	1.6640
	2014	1.8553	1.7889	1.9218

**Medical
Linear Fit
Trended Loss Ratios**

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-26)
2002-2005 (4)	2008	0.7050	0.6659	0.7442
2003-2006 (4)	2009	0.8090	0.7574	0.8605
2004-2007 (4)	2010	0.9388	0.8806	0.9969
2005-2008 (4)	2011	1.1094	1.0011	1.2175
2006-2009 (4)	2012	1.3365	1.2210	1.4520
2007-2010 (4)	2013	1.6992	1.5463	1.8518
2008-2011 (4)	2014	1.7396	1.5500	1.9294
2002-2006 (5)	2009	0.7386	0.6926	0.7845
2003-2007 (5)	2010	0.9270	0.8632	0.9907
2004-2008 (5)	2011	1.0636	0.9759	1.1511
2005-2009 (5)	2012	1.2592	1.1459	1.3724
2006-2010 (5)	2013	1.6366	1.4893	1.7837
2007-2011 (5)	2014	1.7103	1.5262	1.8945
2002-2007 (6)	2010	0.8553	0.7976	0.9130
2003-2008 (6)	2011	1.0393	0.9526	1.1259
2004-2009 (6)	2012	1.2084	1.1094	1.3073
2005-2010 (6)	2013	1.5370	1.3954	1.6783
2006-2011 (6)	2014	1.6915	1.5146	1.8685
2002-2008 (7)	2011	0.9703	0.8916	1.0489
2003-2009 (7)	2012	1.1746	1.0770	1.2722
2004-2010 (7)	2013	1.4626	1.3354	1.5896
2005-2011 (7)	2014	1.6258	1.4560	1.7956
2002-2009 (8)	2012	1.1054	1.0149	1.1959
2003-2010 (8)	2013	1.4075	1.2844	1.5304
2004-2011 (8)	2014	1.5680	1.4123	1.7237
2002-2010 (9)	2013	1.3266	1.2119	1.4411
2003-2011 (9)	2014	1.5203	1.3704	1.6701
2002-2011 (10)	2014	1.4472	1.3065	1.5878

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

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-26)
2002-2005 (4)	2008	0.1914	0.1585	0.2242
2003-2006 (4)	2009	0.2119	0.1885	0.2354
2004-2007 (4)	2010	0.3445	0.2958	0.3931
2005-2008 (4)	2011	0.1603	0.1379	0.1830
2006-2009 (4)	2012	0.0244	-0.0048	0.0538
2007-2010 (4)	2013	-0.2063	-0.2242	-0.1878
2008-2011 (4)	2014	0.1157	0.2389	-0.0076
2002-2006 (5)	2009	0.2823	0.2533	0.3114
2003-2007 (5)	2010	0.3563	0.3132	0.3993
2004-2008 (5)	2011	0.2061	0.1631	0.2494
2005-2009 (5)	2012	0.1017	0.0703	0.1334
2006-2010 (5)	2013	-0.1437	-0.1672	-0.1197
2007-2011 (5)	2014	0.1450	0.2627	0.0273
2002-2007 (6)	2010	0.4280	0.3788	0.4770
2003-2008 (6)	2011	0.2304	0.1864	0.2746
2004-2009 (6)	2012	0.1525	0.1068	0.1985
2005-2010 (6)	2013	-0.0441	-0.0733	-0.0143
2006-2011 (6)	2014	0.1638	0.2743	0.0533
2002-2008 (7)	2011	0.2994	0.2474	0.3516
2003-2009 (7)	2012	0.1863	0.1392	0.2336
2004-2010 (7)	2013	0.0303	-0.0133	0.0744
2005-2011 (7)	2014	0.2295	0.3329	0.1262
2002-2009 (8)	2012	0.2555	0.2013	0.3099
2003-2010 (8)	2013	0.0854	0.0377	0.1336
2004-2011 (8)	2014	0.2873	0.3766	0.1981
2002-2010 (9)	2013	0.1663	0.1102	0.2229
2003-2011 (9)	2014	0.3350	0.4185	0.2517
2002-2011 (10)	2014	0.4081	0.4824	0.3340

**Medical
Exponential Fit
Trended Loss Ratios**

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-26)
2002-2005 (4)	2008	0.7064	0.6664	0.7465
2003-2006 (4)	2009	0.8304	0.7748	0.8861
2004-2007 (4)	2010	0.9718	0.9121	1.0314
2005-2008 (4)	2011	1.1825	1.0531	1.3140
2006-2009 (4)	2012	1.4945	1.3507	1.6396
2007-2010 (4)	2013	1.9526	1.7597	2.1462
2008-2011 (4)	2014	1.9598	1.7257	2.1956
2002-2006 (5)	2009	0.7432	0.6959	0.7905
2003-2007 (5)	2010	0.9668	0.8963	1.0376
2004-2008 (5)	2011	1.1257	1.0283	1.2231
2005-2009 (5)	2012	1.3767	1.2365	1.5187
2006-2010 (5)	2013	1.9128	1.7194	2.1077
2007-2011 (5)	2014	1.9504	1.7142	2.1893
2002-2007 (6)	2010	0.8695	0.8088	0.9303
2003-2008 (6)	2011	1.1039	1.0043	1.2041
2004-2009 (6)	2012	1.3101	1.1951	1.4255
2005-2010 (6)	2013	1.7510	1.5660	1.9383
2006-2011 (6)	2014	1.9811	1.7446	2.2206
2002-2008 (7)	2011	1.0023	0.9168	1.0881
2003-2009 (7)	2012	1.2745	1.1580	1.3919
2004-2010 (7)	2013	1.6431	1.4871	1.7999
2005-2011 (7)	2014	1.8809	1.6537	2.1118
2002-2009 (8)	2012	1.1647	1.0622	1.2677
2003-2010 (8)	2013	1.5740	1.4205	1.7287
2004-2011 (8)	2014	1.7986	1.5993	1.9996
2002-2010 (9)	2013	1.4338	1.2984	1.5701
2003-2011 (9)	2014	1.7389	1.5451	1.9349
2002-2011 (10)	2014	1.6043	1.4314	1.7788

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

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-26)
2002-2005 (4)	2008	0.1900	0.1579	0.2219
2003-2006 (4)	2009	0.1905	0.1711	0.2098
2004-2007 (4)	2010	0.3115	0.2643	0.3586
2005-2008 (4)	2011	0.0872	0.0859	0.0865
2006-2009 (4)	2012	-0.1336	-0.1345	-0.1338
2007-2010 (4)	2013	-0.4597	-0.4376	-0.4822
2008-2011 (4)	2014	-0.1045	0.0632	-0.2738
2002-2006 (5)	2009	0.2777	0.2500	0.3054
2003-2007 (5)	2010	0.3165	0.2801	0.3524
2004-2008 (5)	2011	0.1440	0.1107	0.1774
2005-2009 (5)	2012	-0.0158	-0.0203	-0.0129
2006-2010 (5)	2013	-0.4199	-0.3973	-0.4437
2007-2011 (5)	2014	-0.0951	0.0747	-0.2675
2002-2007 (6)	2010	0.4138	0.3676	0.4597
2003-2008 (6)	2011	0.1658	0.1347	0.1964
2004-2009 (6)	2012	0.0508	0.0211	0.0803
2005-2010 (6)	2013	-0.2581	-0.2439	-0.2743
2006-2011 (6)	2014	-0.1258	0.0443	-0.2988
2002-2008 (7)	2011	0.2674	0.2222	0.3124
2003-2009 (7)	2012	0.0864	0.0582	0.1139
2004-2010 (7)	2013	-0.1502	-0.1650	-0.1359
2005-2011 (7)	2014	-0.0256	0.1352	-0.1900
2002-2009 (8)	2012	0.1962	0.1540	0.2381
2003-2010 (8)	2013	-0.0811	-0.0984	-0.0647
2004-2011 (8)	2014	0.0567	0.1896	-0.0778
2002-2010 (9)	2013	0.0591	0.0237	0.0939
2003-2011 (9)	2014	0.1164	0.2438	-0.0131
2002-2011 (10)	2014	0.2510	0.3575	0.1430