

DELAWARE COMPENSATION RATING BUREAU, INC.

Retrospective Test of Trend Projections for Severity Ratios – Limited 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 0.4482 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 0.4085 (page 6.2) which understates our current estimate for 2009 by 0.0397 points (page 6.3).

**Indemnity
Actual Ultimate Limited Severity Ratios**

INDEMNITY	Policy Year	Ult Limited Severity Ratio (Avg Pd & Inc)	Ult Limited Severity Ratio (Incur)	Ult Limited Severity Ratio (Pd-26)
	2002	0.3392	0.3313	0.3472
	2003	0.3691	0.3672	0.3711
	2004	0.3494	0.3407	0.3579
	2005	0.3751	0.3692	0.3810
	2006	0.3949	0.3888	0.4008
	2007	0.4037	0.4034	0.4039
	2008	0.4031	0.3915	0.4147
	2009	0.4472	0.4482	0.4462
	2010	0.4337	0.4103	0.4572
	2011	0.4710	0.4362	0.5060
	2012	0.5105	0.4910	0.5301
	2013	0.5784	0.5397	0.6170
	2014	0.6148	0.5588	0.6707

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	0.3978	0.3913	0.4040
2003-2006 (4)	2009	0.4185	0.4085	0.4282
2004-2007 (4)	2010	0.4630	0.4690	0.4569
2005-2008 (4)	2011	0.4360	0.4249	0.4470
2006-2009 (4)	2012	0.4826	0.4828	0.4826
2007-2010 (4)	2013	0.4823	0.4482	0.5166
2008-2011 (4)	2014	0.5243	0.4648	0.5842
2002-2006 (5)	2009	0.4242	0.4179	0.4302
2003-2007 (5)	2010	0.4358	0.4341	0.4372
2004-2008 (5)	2011	0.4532	0.4466	0.4599
2005-2009 (5)	2012	0.4810	0.4806	0.4815
2006-2010 (5)	2013	0.4771	0.4523	0.5021
2007-2011 (5)	2014	0.5143	0.4601	0.5690
2002-2007 (6)	2010	0.4388	0.4381	0.4392
2003-2008 (6)	2011	0.4380	0.4285	0.4473
2004-2009 (6)	2012	0.4870	0.4876	0.4865
2005-2010 (6)	2013	0.4802	0.4603	0.5003
2006-2011 (6)	2014	0.5065	0.4625	0.5509
2002-2008 (7)	2011	0.4420	0.4348	0.4490
2003-2009 (7)	2012	0.4711	0.4682	0.4740
2004-2010 (7)	2013	0.4879	0.4723	0.5036
2005-2011 (7)	2014	0.5060	0.4687	0.5436
2002-2009 (8)	2012	0.4710	0.4688	0.4731
2003-2010 (8)	2013	0.4770	0.4612	0.4930
2004-2011 (8)	2014	0.5104	0.4790	0.5420
2002-2010 (9)	2013	0.4779	0.4645	0.4913
2003-2011 (9)	2014	0.5001	0.4704	0.5300
2002-2011 (10)	2014	0.4996	0.4734	0.5258

**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	0.0053	0.0002	0.0107
2003-2006 (4)	2009	0.0287	0.0397	0.0180
2004-2007 (4)	2010	-0.0293	-0.0587	0.0003
2005-2008 (4)	2011	0.0350	0.0113	0.0590
2006-2009 (4)	2012	0.0279	0.0082	0.0476
2007-2010 (4)	2013	0.0961	0.0915	0.1004
2008-2011 (4)	2014	0.0905	0.0940	0.0865
2002-2006 (5)	2009	0.0230	0.0303	0.0161
2003-2007 (5)	2010	-0.0021	-0.0238	0.0200
2004-2008 (5)	2011	0.0178	-0.0104	0.0461
2005-2009 (5)	2012	0.0295	0.0104	0.0486
2006-2010 (5)	2013	0.1013	0.0874	0.1149
2007-2011 (5)	2014	0.1005	0.0987	0.1018
2002-2007 (6)	2010	-0.0051	-0.0278	0.0180
2003-2008 (6)	2011	0.0330	0.0077	0.0587
2004-2009 (6)	2012	0.0235	0.0034	0.0436
2005-2010 (6)	2013	0.0982	0.0794	0.1167
2006-2011 (6)	2014	0.1083	0.0963	0.1198
2002-2008 (7)	2011	0.0290	0.0014	0.0570
2003-2009 (7)	2012	0.0394	0.0228	0.0561
2004-2010 (7)	2013	0.0905	0.0674	0.1134
2005-2011 (7)	2014	0.1088	0.0901	0.1271
2002-2009 (8)	2012	0.0395	0.0222	0.0570
2003-2010 (8)	2013	0.1014	0.0785	0.1240
2004-2011 (8)	2014	0.1044	0.0798	0.1287
2002-2010 (9)	2013	0.1005	0.0752	0.1257
2003-2011 (9)	2014	0.1147	0.0884	0.1407
2002-2011 (10)	2014	0.1152	0.0854	0.1449

**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	0.4000	0.3936	0.4060
2003-2006 (4)	2009	0.4205	0.4100	0.4307
2004-2007 (4)	2010	0.4729	0.4819	0.4643
2005-2008 (4)	2011	0.4386	0.4270	0.4499
2006-2009 (4)	2012	0.4867	0.4869	0.4866
2007-2010 (4)	2013	0.4865	0.4489	0.5253
2008-2011 (4)	2014	0.5331	0.4681	0.6016
2002-2006 (5)	2009	0.4284	0.4223	0.4341
2003-2007 (5)	2010	0.4395	0.4380	0.4406
2004-2008 (5)	2011	0.4604	0.4541	0.4666
2005-2009 (5)	2012	0.4868	0.4865	0.4870
2006-2010 (5)	2013	0.4809	0.4537	0.5083
2007-2011 (5)	2014	0.5215	0.4620	0.5843
2002-2007 (6)	2010	0.4443	0.4444	0.4439
2003-2008 (6)	2011	0.4418	0.4320	0.4515
2004-2009 (6)	2012	0.4971	0.4989	0.4954
2005-2010 (6)	2013	0.4859	0.4639	0.5077
2006-2011 (6)	2014	0.5129	0.4649	0.5624
2002-2008 (7)	2011	0.4477	0.4405	0.4545
2003-2009 (7)	2012	0.4774	0.4743	0.4803
2004-2010 (7)	2013	0.4976	0.4807	0.5142
2005-2011 (7)	2014	0.5140	0.4731	0.5555
2002-2009 (8)	2012	0.4790	0.4772	0.4805
2003-2010 (8)	2013	0.4841	0.4667	0.5012
2004-2011 (8)	2014	0.5223	0.4878	0.5568
2002-2010 (9)	2013	0.4867	0.4722	0.5007
2003-2011 (9)	2014	0.5094	0.4768	0.5419
2002-2011 (10)	2014	0.5106	0.4822	0.5386

**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	0.0031	-0.0021	0.0087
2003-2006 (4)	2009	0.0267	0.0382	0.0155
2004-2007 (4)	2010	-0.0392	-0.0716	-0.0071
2005-2008 (4)	2011	0.0324	0.0092	0.0561
2006-2009 (4)	2012	0.0238	0.0041	0.0435
2007-2010 (4)	2013	0.0919	0.0908	0.0917
2008-2011 (4)	2014	0.0817	0.0907	0.0691
2002-2006 (5)	2009	0.0188	0.0259	0.0121
2003-2007 (5)	2010	-0.0058	-0.0277	0.0166
2004-2008 (5)	2011	0.0106	-0.0179	0.0394
2005-2009 (5)	2012	0.0237	0.0045	0.0431
2006-2010 (5)	2013	0.0975	0.0860	0.1087
2007-2011 (5)	2014	0.0933	0.0968	0.0864
2002-2007 (6)	2010	-0.0106	-0.0341	0.0133
2003-2008 (6)	2011	0.0292	0.0042	0.0545
2004-2009 (6)	2012	0.0134	-0.0079	0.0347
2005-2010 (6)	2013	0.0925	0.0758	0.1093
2006-2011 (6)	2014	0.1019	0.0939	0.1083
2002-2008 (7)	2011	0.0233	-0.0043	0.0515
2003-2009 (7)	2012	0.0331	0.0167	0.0498
2004-2010 (7)	2013	0.0808	0.0590	0.1028
2005-2011 (7)	2014	0.1008	0.0857	0.1152
2002-2009 (8)	2012	0.0315	0.0138	0.0496
2003-2010 (8)	2013	0.0943	0.0730	0.1158
2004-2011 (8)	2014	0.0925	0.0710	0.1139
2002-2010 (9)	2013	0.0917	0.0675	0.1163
2003-2011 (9)	2014	0.1054	0.0820	0.1288
2002-2011 (10)	2014	0.1042	0.0766	0.1321

Medical
Actual Ultimate Limited Severity Ratios

MEDICAL	Policy Year	Ult Limited Severity Ratio (Avg Pd & Inc)	Ult Limited Severity Ratio (Incur)	Ult Limited Severity Ratio (Pd-26)
	2002	0.4407	0.4260	0.4554
	2003	0.4804	0.4829	0.4780
	2004	0.5015	0.4907	0.5122
	2005	0.5501	0.5557	0.5446
	2006	0.5714	0.5696	0.5731
	2007	0.6585	0.6483	0.6688
	2008	0.7297	0.7161	0.7436
	2009	0.8415	0.8271	0.8557
	2010	1.0130	0.9757	1.0503
	2011	1.0463	1.0020	1.0904
	2012	1.1350	1.0958	1.1741
	2013	1.2334	1.1745	1.2924
	2014	1.4421	1.3929	1.4914

**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	0.6504	0.6674	0.6334
2003-2006 (4)	2009	0.6706	0.6710	0.6699
2004-2007 (4)	2010	0.7919	0.7851	0.7989
2005-2008 (4)	2011	0.9091	0.8744	0.9442
2006-2009 (4)	2012	1.0970	1.0684	1.1255
2007-2010 (4)	2013	1.3396	1.2837	1.3951
2008-2011 (4)	2014	1.4122	1.3331	1.4908
2002-2006 (5)	2009	0.6744	0.6850	0.6637
2003-2007 (5)	2010	0.7654	0.7543	0.7766
2004-2008 (5)	2011	0.8846	0.8678	0.9020
2005-2009 (5)	2012	1.0408	1.0080	1.0735
2006-2010 (5)	2013	1.2959	1.2429	1.3490
2007-2011 (5)	2014	1.3873	1.3173	1.4567
2002-2007 (6)	2010	0.7554	0.7546	0.7563
2003-2008 (6)	2011	0.8552	0.8369	0.8737
2004-2009 (6)	2012	1.0076	0.9869	1.0284
2005-2010 (6)	2013	1.2296	1.1775	1.2817
2006-2011 (6)	2014	1.3679	1.3013	1.4342
2002-2008 (7)	2011	0.8389	0.8299	0.8481
2003-2009 (7)	2012	0.9722	0.9506	0.9937
2004-2010 (7)	2013	1.1827	1.1428	1.2227
2005-2011 (7)	2014	1.3204	1.2556	1.3849
2002-2009 (8)	2012	0.9484	0.9347	0.9621
2003-2010 (8)	2013	1.1367	1.0987	1.1748
2004-2011 (8)	2014	1.2814	1.2276	1.3351
2002-2010 (9)	2013	1.1023	1.0728	1.1318
2003-2011 (9)	2014	1.2398	1.1889	1.2907
2002-2011 (10)	2014	1.2062	1.1638	1.2486

**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	0.0793	0.0487	0.1102
2003-2006 (4)	2009	0.1709	0.1561	0.1858
2004-2007 (4)	2010	0.2211	0.1906	0.2514
2005-2008 (4)	2011	0.1372	0.1276	0.1462
2006-2009 (4)	2012	0.0380	0.0274	0.0486
2007-2010 (4)	2013	-0.1062	-0.1092	-0.1027
2008-2011 (4)	2014	0.0299	0.0598	0.0006
2002-2006 (5)	2009	0.1671	0.1421	0.1920
2003-2007 (5)	2010	0.2476	0.2214	0.2737
2004-2008 (5)	2011	0.1617	0.1342	0.1884
2005-2009 (5)	2012	0.0942	0.0878	0.1006
2006-2010 (5)	2013	-0.0625	-0.0684	-0.0565
2007-2011 (5)	2014	0.0549	0.0756	0.0347
2002-2007 (6)	2010	0.2576	0.2211	0.2940
2003-2008 (6)	2011	0.1911	0.1651	0.2167
2004-2009 (6)	2012	0.1274	0.1089	0.1457
2005-2010 (6)	2013	0.0038	-0.0030	0.0107
2006-2011 (6)	2014	0.0742	0.0916	0.0572
2002-2008 (7)	2011	0.2075	0.1721	0.2424
2003-2009 (7)	2012	0.1628	0.1452	0.1804
2004-2010 (7)	2013	0.0507	0.0317	0.0697
2005-2011 (7)	2014	0.1217	0.1373	0.1065
2002-2009 (8)	2012	0.1866	0.1611	0.2120
2003-2010 (8)	2013	0.0967	0.0758	0.1176
2004-2011 (8)	2014	0.1607	0.1653	0.1563
2002-2010 (9)	2013	0.1311	0.1017	0.1606
2003-2011 (9)	2014	0.2023	0.2040	0.2007
2002-2011 (10)	2014	0.2359	0.2291	0.2428

**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	0.6761	0.7018	0.6519
2003-2006 (4)	2009	0.6912	0.6917	0.6905
2004-2007 (4)	2010	0.8340	0.8296	0.8388
2005-2008 (4)	2011	0.9731	0.9242	1.0245
2006-2009 (4)	2012	1.2245	1.1833	1.2663
2007-2010 (4)	2013	1.5257	1.4496	1.6019
2008-2011 (4)	2014	1.5882	1.4789	1.6987
2002-2006 (5)	2009	0.7029	0.7204	0.6862
2003-2007 (5)	2010	0.8032	0.7901	0.8165
2004-2008 (5)	2011	0.9502	0.9316	0.9696
2005-2009 (5)	2012	1.1443	1.0949	1.1952
2006-2010 (5)	2013	1.4989	1.4206	1.5787
2007-2011 (5)	2014	1.5803	1.4831	1.6782
2002-2007 (6)	2010	0.7990	0.8035	0.7948
2003-2008 (6)	2011	0.9144	0.8915	0.9380
2004-2009 (6)	2012	1.1089	1.0835	1.1347
2005-2010 (6)	2013	1.4003	1.3210	1.4820
2006-2011 (6)	2014	1.5940	1.4949	1.6950
2002-2008 (7)	2011	0.9020	0.8963	0.9082
2003-2009 (7)	2012	1.0636	1.0348	1.0928
2004-2010 (7)	2013	1.3433	1.2905	1.3968
2005-2011 (7)	2014	1.5294	1.4298	1.6318
2002-2009 (8)	2012	1.0409	1.0287	1.0533
2003-2010 (8)	2013	1.2799	1.2280	1.3326
2004-2011 (8)	2014	1.4852	1.4099	1.5615
2002-2010 (9)	2013	1.2413	1.2087	1.2740
2003-2011 (9)	2014	1.4278	1.3553	1.5014
2002-2011 (10)	2014	1.3895	1.3371	1.4421

**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	0.0536	0.0143	0.0917
2003-2006 (4)	2009	0.1503	0.1354	0.1652
2004-2007 (4)	2010	0.1790	0.1461	0.2115
2005-2008 (4)	2011	0.0732	0.0778	0.0659
2006-2009 (4)	2012	-0.0895	-0.0875	-0.0922
2007-2010 (4)	2013	-0.2923	-0.2751	-0.3095
2008-2011 (4)	2014	-0.1461	-0.0860	-0.2073
2002-2006 (5)	2009	0.1386	0.1067	0.1695
2003-2007 (5)	2010	0.2098	0.1856	0.2338
2004-2008 (5)	2011	0.0961	0.0704	0.1208
2005-2009 (5)	2012	-0.0093	0.0009	-0.0211
2006-2010 (5)	2013	-0.2655	-0.2461	-0.2863
2007-2011 (5)	2014	-0.1382	-0.0902	-0.1868
2002-2007 (6)	2010	0.2140	0.1722	0.2555
2003-2008 (6)	2011	0.1319	0.1105	0.1524
2004-2009 (6)	2012	0.0261	0.0123	0.0394
2005-2010 (6)	2013	-0.1669	-0.1465	-0.1896
2006-2011 (6)	2014	-0.1519	-0.1020	-0.2036
2002-2008 (7)	2011	0.1443	0.1057	0.1822
2003-2009 (7)	2012	0.0714	0.0610	0.0813
2004-2010 (7)	2013	-0.1099	-0.1160	-0.1044
2005-2011 (7)	2014	-0.0873	-0.0369	-0.1404
2002-2009 (8)	2012	0.0941	0.0671	0.1208
2003-2010 (8)	2013	-0.0465	-0.0535	-0.0402
2004-2011 (8)	2014	-0.0431	-0.0170	-0.0701
2002-2010 (9)	2013	-0.0079	-0.0342	0.0184
2003-2011 (9)	2014	0.0143	0.0376	-0.0100
2002-2011 (10)	2014	0.0526	0.0558	0.0493