

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 2001 through 2013, 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 of 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 (1/1/2014 to 12/1/2016).

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-25th and the average of the incurred and paid-to-25th methods.

As an illustration, the incurred loss development approach generated an indemnity severity ratio of 0.3933 for policy year 2008 (page 6.1). Fitting the severity ratios for policy years 2002 to 2005 using a straight line and projecting that to 2008 yielded a severity ratio of 0.4038 (page 6.2) which overstates our current estimate for 2008 by 0.0105 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-25)
	2001	0.3555	0.3497	0.3612
	2002	0.3530	0.3451	0.3609
	2003	0.3819	0.3783	0.3856
	2004	0.3624	0.3506	0.3743
	2005	0.3920	0.3835	0.4005
	2006	0.4059	0.3992	0.4126
	2007	0.4178	0.4122	0.4237
	2008	0.4094	0.3933	0.4258
	2009	0.4660	0.4654	0.4667
	2010	0.4594	0.4392	0.4797
	2011	0.5060	0.4661	0.5459
	2012	0.5606	0.5441	0.5769
	2013	0.6562	0.5898	0.7224

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-25)
2001-2004 (4)	2007	0.3855	0.3721	0.3993
2002-2005 (4)	2008	0.4162	0.4038	0.4287
2003-2006 (4)	2009	0.4313	0.4209	0.4415
2004-2007 (4)	2010	0.4756	0.4766	0.4749
2005-2008 (4)	2011	0.4351	0.4161	0.4548
2006-2009 (4)	2012	0.5021	0.4984	0.5062
2007-2010 (4)	2013	0.5198	0.4964	0.5430
2001-2005 (5)	2008	0.4102	0.3980	0.4225
2002-2006 (5)	2009	0.4370	0.4280	0.4459
2003-2007 (5)	2010	0.4497	0.4430	0.4566
2004-2008 (5)	2011	0.4574	0.4448	0.4705
2005-2009 (5)	2012	0.4940	0.4897	0.4987
2006-2010 (5)	2013	0.5093	0.4885	0.5303
2001-2006 (6)	2009	0.4300	0.4204	0.4398
2002-2007 (6)	2010	0.4524	0.4459	0.4591
2003-2008 (6)	2011	0.4448	0.4295	0.4605
2004-2009 (6)	2012	0.5004	0.4976	0.5035
2005-2010 (6)	2013	0.5051	0.4875	0.5229
2001-2007 (7)	2010	0.4461	0.4386	0.4539
2002-2008 (7)	2011	0.4499	0.4362	0.4639
2003-2009 (7)	2012	0.4848	0.4779	0.4919
2004-2010 (7)	2013	0.5110	0.4970	0.5251
2001-2008 (8)	2011	0.4469	0.4335	0.4607
2002-2009 (8)	2012	0.4843	0.4774	0.4915
2003-2010 (8)	2013	0.4989	0.4834	0.5146
2001-2009 (9)	2012	0.4785	0.4708	0.4866
2002-2010 (9)	2013	0.4984	0.4840	0.5130
2001-2010 (10)	2013	0.4932	0.4791	0.5077

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

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-25)
2001-2004 (4)	2007	0.0323	0.0401	0.0244
2002-2005 (4)	2008	-0.0068	-0.0105	-0.0029
2003-2006 (4)	2009	0.0347	0.0445	0.0252
2004-2007 (4)	2010	-0.0162	-0.0374	0.0048
2005-2008 (4)	2011	0.0709	0.0500	0.0911
2006-2009 (4)	2012	0.0585	0.0457	0.0707
2007-2010 (4)	2013	0.1364	0.0934	0.1794
2001-2005 (5)	2008	-0.0008	-0.0047	0.0033
2002-2006 (5)	2009	0.0290	0.0374	0.0208
2003-2007 (5)	2010	0.0098	-0.0038	0.0231
2004-2008 (5)	2011	0.0486	0.0213	0.0754
2005-2009 (5)	2012	0.0666	0.0544	0.0782
2006-2010 (5)	2013	0.1469	0.1013	0.1921
2001-2006 (6)	2009	0.0360	0.0450	0.0269
2002-2007 (6)	2010	0.0070	-0.0067	0.0206
2003-2008 (6)	2011	0.0612	0.0366	0.0854
2004-2009 (6)	2012	0.0602	0.0465	0.0734
2005-2010 (6)	2013	0.1511	0.1023	0.1995
2001-2007 (7)	2010	0.0133	0.0006	0.0258
2002-2008 (7)	2011	0.0561	0.0299	0.0820
2003-2009 (7)	2012	0.0758	0.0662	0.0850
2004-2010 (7)	2013	0.1453	0.0928	0.1973
2001-2008 (8)	2011	0.0591	0.0326	0.0852
2002-2009 (8)	2012	0.0763	0.0667	0.0854
2003-2010 (8)	2013	0.1573	0.1064	0.2078
2001-2009 (9)	2012	0.0821	0.0733	0.0903
2002-2010 (9)	2013	0.1578	0.1058	0.2094
2001-2010 (10)	2013	0.1630	0.1107	0.2147

**Indemnity  
Exponential Fit  
Trended Loss Ratios**

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-25)
2001-2004 (4)	2007	0.3860	0.3720	0.4004
2002-2005 (4)	2008	0.4185	0.4056	0.4316
2003-2006 (4)	2009	0.4333	0.4226	0.4439
2004-2007 (4)	2010	0.4849	0.4886	0.4821
2005-2008 (4)	2011	0.4363	0.4166	0.4568
2006-2009 (4)	2012	0.5064	0.5018	0.5110
2007-2010 (4)	2013	0.5271	0.5014	0.5524
2001-2005 (5)	2008	0.4119	0.3991	0.4248
2002-2006 (5)	2009	0.4410	0.4318	0.4501
2003-2007 (5)	2010	0.4533	0.4467	0.4602
2004-2008 (5)	2011	0.4630	0.4503	0.4761
2005-2009 (5)	2012	0.4984	0.4936	0.5035
2006-2010 (5)	2013	0.5151	0.4922	0.5380
2001-2006 (6)	2009	0.4332	0.4231	0.4434
2002-2007 (6)	2010	0.4577	0.4514	0.4644
2003-2008 (6)	2011	0.4479	0.4319	0.4644
2004-2009 (6)	2012	0.5094	0.5073	0.5118
2005-2010 (6)	2013	0.5112	0.4921	0.5303
2001-2007 (7)	2010	0.4507	0.4429	0.4587
2002-2008 (7)	2011	0.4547	0.4404	0.4694
2003-2009 (7)	2012	0.4904	0.4829	0.4980
2004-2010 (7)	2013	0.5212	0.5066	0.5357
2001-2008 (8)	2011	0.4515	0.4373	0.4660
2002-2009 (8)	2012	0.4915	0.4841	0.4991
2003-2010 (8)	2013	0.5063	0.4896	0.5230
2001-2009 (9)	2012	0.4852	0.4767	0.4938
2002-2010 (9)	2013	0.5073	0.4919	0.5227
2001-2010 (10)	2013	0.5017	0.4864	0.5171

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

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-25)
2001-2004 (4)	2007	0.0318	0.0402	0.0233
2002-2005 (4)	2008	-0.0091	-0.0123	-0.0058
2003-2006 (4)	2009	0.0327	0.0428	0.0228
2004-2007 (4)	2010	-0.0255	-0.0494	-0.0024
2005-2008 (4)	2011	0.0697	0.0495	0.0891
2006-2009 (4)	2012	0.0542	0.0423	0.0659
2007-2010 (4)	2013	0.1291	0.0884	0.1700
2001-2005 (5)	2008	-0.0025	-0.0058	0.0010
2002-2006 (5)	2009	0.0250	0.0336	0.0166
2003-2007 (5)	2010	0.0061	-0.0075	0.0195
2004-2008 (5)	2011	0.0430	0.0158	0.0698
2005-2009 (5)	2012	0.0622	0.0505	0.0734
2006-2010 (5)	2013	0.1411	0.0976	0.1844
2001-2006 (6)	2009	0.0328	0.0423	0.0233
2002-2007 (6)	2010	0.0017	-0.0122	0.0153
2003-2008 (6)	2011	0.0581	0.0342	0.0815
2004-2009 (6)	2012	0.0512	0.0368	0.0651
2005-2010 (6)	2013	0.1450	0.0977	0.1921
2001-2007 (7)	2010	0.0087	-0.0037	0.0210
2002-2008 (7)	2011	0.0513	0.0257	0.0765
2003-2009 (7)	2012	0.0702	0.0612	0.0789
2004-2010 (7)	2013	0.1350	0.0832	0.1867
2001-2008 (8)	2011	0.0545	0.0288	0.0799
2002-2009 (8)	2012	0.0691	0.0600	0.0778
2003-2010 (8)	2013	0.1499	0.1002	0.1994
2001-2009 (9)	2012	0.0754	0.0674	0.0831
2002-2010 (9)	2013	0.1489	0.0979	0.1997
2001-2010 (10)	2013	0.1545	0.1034	0.2053

**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-25)
	2001	0.4006	0.3957	0.4055
	2002	0.4592	0.4478	0.4705
	2003	0.5161	0.5171	0.5150
	2004	0.5244	0.5106	0.5382
	2005	0.5722	0.5666	0.5779
	2006	0.6090	0.6135	0.6044
	2007	0.6848	0.6681	0.7016
	2008	0.7700	0.7576	0.7823
	2009	0.8772	0.8743	0.8799
	2010	1.0317	1.0029	1.0606
	2011	1.1316	1.1166	1.1467
	2012	1.1834	1.1652	1.2015
	2013	1.2324	1.2044	1.2603

**Medical**  
**Linear Fit**  
**Trended Loss Ratios**

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-25)
2001-2004 (4)	2007	0.6678	0.6541	0.6815
2002-2005 (4)	2008	0.6743	0.6680	0.6808
2003-2006 (4)	2009	0.7024	0.7073	0.6974
2004-2007 (4)	2010	0.8307	0.8234	0.8380
2005-2008 (4)	2011	0.9601	0.9339	0.9862
2006-2009 (4)	2012	1.1357	1.1207	1.1503
2007-2010 (4)	2013	1.3575	1.3302	1.3847
2001-2005 (5)	2008	0.6987	0.6899	0.7077
2002-2006 (5)	2009	0.7140	0.7216	0.7066
2003-2007 (5)	2010	0.7923	0.7776	0.8071
2004-2008 (5)	2011	0.9340	0.9210	0.9468
2005-2009 (5)	2012	1.0881	1.0758	1.1002
2006-2010 (5)	2013	1.3134	1.2758	1.3511
2001-2006 (6)	2009	0.7319	0.7347	0.7291
2002-2007 (6)	2010	0.7895	0.7813	0.7979
2003-2008 (6)	2011	0.8936	0.8762	0.9111
2004-2009 (6)	2012	1.0553	1.0495	1.0608
2005-2010 (6)	2013	1.2583	1.2270	1.2896
2001-2007 (7)	2010	0.7970	0.7881	0.8059
2002-2008 (7)	2011	0.8810	0.8690	0.8932
2003-2009 (7)	2012	1.0121	1.0012	1.0227
2004-2010 (7)	2013	1.2155	1.1926	1.2384
2001-2008 (8)	2011	0.8797	0.8676	0.8918
2002-2009 (8)	2012	0.9913	0.9837	0.9989
2003-2010 (8)	2013	1.1657	1.1413	1.1902
2001-2009 (9)	2012	0.9819	0.9736	0.9901
2002-2010 (9)	2013	1.1356	1.1156	1.1556
2001-2010 (10)	2013	1.1169	1.0978	1.1361



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

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-25)
2001-2004 (4)	2007	0.0170	0.0140	0.0201
2002-2005 (4)	2008	0.0957	0.0896	0.1015
2003-2006 (4)	2009	0.1749	0.1670	0.1825
2004-2007 (4)	2010	0.2010	0.1795	0.2226
2005-2008 (4)	2011	0.1715	0.1827	0.1605
2006-2009 (4)	2012	0.0477	0.0445	0.0512
2007-2010 (4)	2013	-0.1251	-0.1258	-0.1244
2001-2005 (5)	2008	0.0713	0.0677	0.0746
2002-2006 (5)	2009	0.1632	0.1527	0.1734
2003-2007 (5)	2010	0.2394	0.2253	0.2535
2004-2008 (5)	2011	0.1976	0.1956	0.1999
2005-2009 (5)	2012	0.0953	0.0894	0.1013
2006-2010 (5)	2013	-0.0810	-0.0714	-0.0908
2001-2006 (6)	2009	0.1453	0.1396	0.1508
2002-2007 (6)	2010	0.2422	0.2216	0.2627
2003-2008 (6)	2011	0.2380	0.2404	0.2356
2004-2009 (6)	2012	0.1281	0.1157	0.1407
2005-2010 (6)	2013	-0.0259	-0.0226	-0.0293
2001-2007 (7)	2010	0.2347	0.2148	0.2547
2002-2008 (7)	2011	0.2506	0.2476	0.2535
2003-2009 (7)	2012	0.1714	0.1640	0.1788
2004-2010 (7)	2013	0.0169	0.0118	0.0219
2001-2008 (8)	2011	0.2519	0.2490	0.2549
2002-2009 (8)	2012	0.1921	0.1815	0.2026
2003-2010 (8)	2013	0.0667	0.0631	0.0701
2001-2009 (9)	2012	0.2015	0.1916	0.2114
2002-2010 (9)	2013	0.0968	0.0888	0.1047
2001-2010 (10)	2013	0.1155	0.1066	0.1242

**Medical**  
**Exponential Fit**  
**Trended Loss Ratios**

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-25)
2001-2004 (4)	2007	0.7161	0.7000	0.7319
2002-2005 (4)	2008	0.7000	0.6950	0.7054
2003-2006 (4)	2009	0.7207	0.7265	0.7149
2004-2007 (4)	2010	0.8770	0.8743	0.8796
2005-2008 (4)	2011	1.0305	0.9962	1.0650
2006-2009 (4)	2012	1.2569	1.2323	1.2817
2007-2010 (4)	2013	1.5326	1.5065	1.5582
2001-2005 (5)	2008	0.7492	0.7398	0.7587
2002-2006 (5)	2009	0.7453	0.7574	0.7336
2003-2007 (5)	2010	0.8267	0.8103	0.8431
2004-2008 (5)	2011	1.0060	0.9950	1.0169
2005-2009 (5)	2012	1.1966	1.1792	1.2134
2006-2010 (5)	2013	1.4975	1.4416	1.5544
2001-2006 (6)	2009	0.7863	0.7922	0.7805
2002-2007 (6)	2010	0.8348	0.8287	0.8409
2003-2008 (6)	2011	0.9510	0.9303	0.9718
2004-2009 (6)	2012	1.1628	1.1606	1.1648
2005-2010 (6)	2013	1.4256	1.3825	1.4688
2001-2007 (7)	2010	0.8646	0.8566	0.8725
2002-2008 (7)	2011	0.9471	0.9361	0.9581
2003-2009 (7)	2012	1.1015	1.0880	1.1148
2004-2010 (7)	2013	1.3770	1.3526	1.4010
2001-2008 (8)	2011	0.9675	0.9554	0.9795
2002-2009 (8)	2012	1.0869	1.0810	1.0928
2003-2010 (8)	2013	1.3029	1.2723	1.3336
2001-2009 (9)	2012	1.0985	1.0908	1.1060
2002-2010 (9)	2013	1.2750	1.2542	1.2958
2001-2010 (10)	2013	1.2760	1.2552	1.2965

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

Years Used (# Yrs)	3 Yr Trend To	Severity Ratio (Avg Pd & Inc)	Severity Ratio (Incur)	Severity Ratio (Pd-25)
2001-2004 (4)	2007	-0.0313	-0.0319	-0.0303
2002-2005 (4)	2008	0.0700	0.0626	0.0769
2003-2006 (4)	2009	0.1565	0.1478	0.1650
2004-2007 (4)	2010	0.1547	0.1286	0.1810
2005-2008 (4)	2011	0.1011	0.1204	0.0817
2006-2009 (4)	2012	-0.0735	-0.0671	-0.0802
2007-2010 (4)	2013	-0.3002	-0.3021	-0.2979
2001-2005 (5)	2008	0.0208	0.0178	0.0236
2002-2006 (5)	2009	0.1319	0.1169	0.1463
2003-2007 (5)	2010	0.2050	0.1926	0.2175
2004-2008 (5)	2011	0.1256	0.1216	0.1298
2005-2009 (5)	2012	-0.0132	-0.0140	-0.0119
2006-2010 (5)	2013	-0.2651	-0.2372	-0.2941
2001-2006 (6)	2009	0.0909	0.0821	0.0994
2002-2007 (6)	2010	0.1969	0.1742	0.2197
2003-2008 (6)	2011	0.1806	0.1863	0.1749
2004-2009 (6)	2012	0.0206	0.0046	0.0367
2005-2010 (6)	2013	-0.1932	-0.1781	-0.2085
2001-2007 (7)	2010	0.1671	0.1463	0.1881
2002-2008 (7)	2011	0.1845	0.1805	0.1886
2003-2009 (7)	2012	0.0819	0.0772	0.0867
2004-2010 (7)	2013	-0.1446	-0.1482	-0.1407
2001-2008 (8)	2011	0.1641	0.1612	0.1672
2002-2009 (8)	2012	0.0965	0.0842	0.1087
2003-2010 (8)	2013	-0.0705	-0.0679	-0.0733
2001-2009 (9)	2012	0.0849	0.0744	0.0955
2002-2010 (9)	2013	-0.0426	-0.0498	-0.0355
2001-2010 (10)	2013	-0.0436	-0.0508	-0.0362