



AMERICAN ACADEMY *of* ACTUARIES

***A Risk-Based Capital Trend Test For P/C Insurers:
Addendum to the August 2004 Study***

**Report to the National Association of Insurance
Commissioners Capital Adequacy Task Force**

June 7, 2005

**American Academy of Actuaries
P/C Risk Based Capital Committee**

The American Academy of Actuaries is the public policy organization for actuaries practicing in all specialties within the United States. A major purpose of the Academy is to act as the public information organization for the profession. The Academy is non-partisan and assists the public policy process through the presentation of clear and objective actuarial analysis. The Academy regularly prepares testimony for Congress, provides information to federal elected officials, comments on proposed federal regulations, and works closely with state officials on issues related to insurance. The Academy also develops and upholds actuarial standards of conduct, qualification and practice, and the Code of Professional Conduct for all actuaries practicing in the United States.

Summary

In August of 2004 the American Academy of Actuaries Committee on P/C Risk Based Capital (“the Academy committee”) issued a report to the National Association of Insurance Commissioners (NAIC) regarding possible approaches to a trend test that could be considered for incorporation in some way into the Property & Casualty Risk-Based Capital (RBC) regulatory framework. While this Academy Committee report found that no company characteristic is 100% accurate in predicting which companies will encounter adverse outcomes in the RBC formula in the future, it did find one approach was significantly better than others tested. This was the “two tiered Combined Ratio test” described in the Academy Committee report.

The NAIC proposed adopting a similar test, and released formulas for an “informational trend test” for comment in December 2004. The formulas released by the NAIC varied slightly from those originally tested in two ways: (1) the Combined Ratio definition, and (2) the tier of companies subject to the test. This update provides information on additional tests performed at the request of the NAIC, in consideration of these two differences. As this addendum updates the original August 2004 study, we refer the reader to that report for a complete description of the data and methods used.

The differences do not significantly affect the effectiveness of the trend test - the trend test exposed by the NAIC is effective as is that in the Academy report. However, there is some loss in tested effectiveness that may be due to the change in formula. It may also be due to the expanded scope of the analysis presented below. The expanded analysis scope is in response to industry comments and feedback resulting from the trend test the NAIC exposed.

Trend Test Formulas

The following table presents the trend test exposed by the NAIC, showing the relative likelihood that companies with the specified RBC Ratio and Current Year Combined Ratio ranges will fall to a Company Action Level (CAL).

RBC P/C Trend Test Exposed by the NAIC

RBC Ratio	Current Year Combined Ratio	Company Status
200%-300%	Greater than 120%	More Likely to Decline to CAL
200%-300%	Less than 120%	Less Likely to Decline to CAL
Above 300%	All	Less Likely to Decline to CAL

Definitions of Combined Ratio

In the original Academy Committee report, the definition of the Combined Ratio was consistent with that displayed in the five-year history exhibit of the statutory blank, 1-u.

1-*u* equals losses plus loss expenses plus underwriting expenses all divided by earned premium.

The NAIC exposed formula used a definition consistent with the NAIC Insurance Regulatory Information System (IRIS) combined ratio. This is the loss plus loss expense plus dividends divided by earned premium plus the underwriting expenses plus write-in for underwriting deductions divided by the written premium. We did not include Other Income, but instead matched the definition exactly as exposed by the NAIC. We refer to this as the “IRIS definition” of Combined Ratio.

We also introduce a definition of “Operating Ratio” with this addendum that uses the IRIS definition of Combined Ratio and subtracts from it the ratio of investment income earned divided by earned premium. Note this calculation excludes all realized and unrealized capital gains.

Company Tiers

The original Academy Committee report tested companies with RBCs in two ranges: 200% - 300% and 300% - 350%. The test exposed by the NAIC and all subsequent testing has focused only on those companies with RBC between 200% and 300%. Companies with RBC ratios between 200% and 300% are referred to in the exhibits as “weak” companies.

Tests Conducted by the Academy Committee

We tested the effectiveness of this ratio in a manner similar to the original Academy Committee report. We expanded the number of test years, testing reported results in each year 1998-2002, compared to just 2001 and 2002 combined in the original report. We expanded the tracking of subsequent activity to all available subsequent years, while the original Academy Committee report tracked just one subsequent year. We performed the test for all companies as in the original report, and then only for companies considered lead companies in their group (including companies with no other affiliated companies), and then only for companies with premium greater than \$1 million. We also tested the effectiveness of an operating ratio test, changing the threshold from a Combined Ratio of 120% to an Operating Ratio of 109%, chosen because it is comparable, and causes a similar number of flagged companies as the 120% combined ratio.

When comparing the same test years between the report and this addendum, there may be some change due to data revision. When the original Academy Committee report was created, an early version of the NAIC database for 2003 was used. Many companies have either been added, or revised the entries in the database since then, and this study used the more current version.

Using these thresholds, we reproduced the table from the summary section of the original report using the same test years:

**One Tiered Combined Ratio Test Using a Band of Companies with RBC
between 200% and 300% and Combined Ratio Threshold of 120%**

	Flagged	Not Flagged	Total
Below 200% Next Year	20	18	38
Above 200% Next Year	106	201	307
Total	126	219	345
Ratio of Companies Falling to <200% to Total	15.9%	8.2%	11.0%
Statistical Significance		>96.0%	

Note: Using Test Years 2001 and 2002 only to compare to the original report

Using all available test years:

**One Tiered Combined Ratio Test Using a Band of Companies with RBC
between 200% and 300% and Combined Ratio Threshold of 120%**

	Flagged	Not Flagged	Total
Below 200% Next Year	39	37	76
Above 200% Next Year	212	402	614
Total	251	439	690
Ratio of Companies Falling to <200% to Total	15.5%	8.4%	11.0%
Statistical Significance		99.0%	

Note: Using Test Years 1998-2002

For comparison, we compared the Operating Ratio test using all test years:

**One Tiered Operating Ratio Test Using a Band of Companies with RBC
between 200% and 300% and Operating Ratio Threshold of 109%**

	Flagged	Not Flagged	Total
Below 200% Next Year	42	34	76
Above 200% Next Year	214	400	614
Total	256	434	690
Ratio of Companies Falling to <200% to Total	16.4%	7.8%	11.0%
Statistical Significance		>99.5%	

Note: Using Test Years 1998-2002

We include as exhibits the outcome for all test years and evaluation periods. This creates a “triangle” format of the test performance over various outlook periods. The statistical significance was calculated using a normal approximation to the binomial distribution.

Observations:

While the metrics show the revised test is not quite as effective as that in the original Academy Committee report, it is still a highly significant differentiator in a statistical sense between those companies that later fail, and those that do not. The statistical significant level of the revised test is 96% compared to 99.5% for the original test. To

the extent the test outcome changed, it is due to changes in the NAIC data, changes in the Combined Ratio definition, and changes in the companies subject to the test from the original study.

The “triangle” exhibits show this test to be effective in predicting a period of 24 months, but not for longer periods.

If “false alarms” are viewed as problematic, the threshold Combined Ratio can be raised without any loss of effectiveness. In fact, we ran several scenarios that show increased effectiveness at a higher threshold, and these are included in the exhibits. For example, a combined ratio test of 135% flags only 146 companies for all test years (compare to 251 using 120%) and 17.1% of those subsequently fall below CAL (compare to 15.5%).

The effectiveness of the test is not significantly different if only lead companies are considered or only larger companies are considered, and is in fact, slightly enhanced.

The Operating Ratio test is slightly more effective than the Combined Ratio test at comparable thresholds.

The test seems most effective in years in which the industry is in the greatest financial stress; in this case, test years 2000-2001 are more effective than 1998-1999 and 2002. Test years 2000 and 2001 had the highest Combined Ratio of the five years tested.

We examined whether the test may be biased against carriers with long tail business, such as companies writing mainly medical malpractice, workers compensation etc. or biased based on the size of the companies. The number of medical malpractice companies testing as false positive was proportional to their position in the total population. Similar results were noted based on size of companies.

Further Information

The Academy Committee appreciates the opportunity to provide additional analysis, and we are available to answer any additional questions users of this addendum may have. We would also be happy to expand this research if NAIC wishes to view the testing of other Combined Ratio or Operating Ratio thresholds, or different bands of companies subject to the test.

Summary of Testing Retrospective Results of Proposed Combined Ratio Trend Test Using All Companies

Test Year	Years Elapsed Since Test Year									
	1		2		3		4		5	
	#	%	#	%	#	%	#	%	#	%
1998 Weak Companies	99	xxx	99	xxx	99	xxx	99	xxx	99	xxx
Weak Companies Later Failing	5	5.1%	8	8.1%	18	18.2%	21	21.2%	29	29.3%
Flagged Companies	26	xxx	26	xxx	26	xxx	26	xxx	26	xxx
Flagged Companies Later Failing	2	7.7%	2	7.7%	4	15.4%	6	23.1%	6	23.1%
1999 Weak Companies	107	xxx	107	xxx	107	xxx	107	xxx		
Weak Companies Later Failing	12	11.2%	24	22.4%	30	28.0%	35	32.7%		
Flagged Companies	40	xxx	40	xxx	40	xxx	40	xxx		
Flagged Companies Later Failing	5	12.5%	8	20.0%	10	25.0%	10	25.0%		
2000 Weak Companies	139	xxx	139	xxx	139	xxx				
Weak Companies Later Failing	21	15.1%	32	23.0%	40	28.8%				
Flagged Companies	59	xxx	59	xxx	59	xxx				
Flagged Companies Later Failing	12	20.3%	16	27.1%	18	30.5%				
2001 Weak Companies	164	xxx	164	xxx						
Weak Companies Later Failing	28	17.1%	36	22.0%						
Flagged Companies	74	xxx	74	xxx						
Flagged Companies Later Failing	19	25.7%	21	28.4%						
2002 Weak Companies	181	xxx								
Weak Companies Later Failing	10	5.5%								
Flagged Companies	52	xxx								
Flagged Companies Later Failing	1	1.9%								
All Test Years	690	xxx	509	xxx	345	xxx	206	xxx	99	xxx
Weak Companies Later Failing	76	11.0%	100	19.6%	88	25.5%	56	27.2%	29	29.3%
Flagged Companies	251	xxx	199	xxx	125	xxx	66	xxx	26	xxx
Flagged Companies Later Failing	39	15.5%	47	23.6%	32	25.6%	16	24.2%	6	23.1%

Summary of Tested Companies (Each Test Year)

Total Companies	2,408
Lead Companies	1,098
Companies not Considered Small	1,735

RBC Ratios for "Weak" Companies

Lower Band	200%
Upper Band	300%

Combined/Operating Threshold to "Flag"

Combined Ratio over	120%
Operating Ratio over	109%

Summary of Testing Retrospective Results of Proposed Combined Ratio Trend Test Using Lead Companies Only

Test Year	Years Elapsed Since Test Year									
	1		2		3		4		5	
	#	%	#	%	#	%	#	%	#	%
1998 Weak Companies	53	xxx	53	xxx	53	xxx	53	xxx	53	xxx
Weak Companies Later Failing	4	7.5%	7	13.2%	15	28.3%	15	28.3%	21	39.6%
Flagged Companies	10	xxx	10	xxx	10	xxx	10	xxx	10	xxx
Flagged Companies Later Failing	1	10.0%	1	10.0%	2	20.0%	2	20.0%	2	20.0%
1999 Weak Companies	61	xxx	61	xxx	61	xxx	61	xxx		
Weak Companies Later Failing	8	13.1%	16	26.2%	18	29.5%	22	36.1%		
Flagged Companies	16	xxx	16	xxx	16	xxx	16	xxx		
Flagged Companies Later Failing	2	12.5%	4	25.0%	4	25.0%	4	25.0%		
2000 Weak Companies	85	xxx	85	xxx	85	xxx				
Weak Companies Later Failing	15	17.6%	22	25.9%	28	32.9%				
Flagged Companies	31	xxx	31	xxx	31	xxx				
Flagged Companies Later Failing	8	25.8%	10	32.3%	11	35.5%				
2001 Weak Companies	98	xxx	98	xxx						
Weak Companies Later Failing	18	18.4%	24	24.5%						
Flagged Companies	39	xxx	39	xxx						
Flagged Companies Later Failing	11	28.2%	13	33.3%						
2002 Weak Companies	107	xxx								
Weak Companies Later Failing	8	7.5%								
Flagged Companies	23	xxx								
Flagged Companies Later Failing	0	0.0%								
All Test Years	404	xxx	297	xxx	199	xxx	114	xxx	53	xxx
Weak Companies Later Failing	53	13.1%	69	23.2%	61	30.7%	37	32.5%	21	39.6%
Flagged Companies	119	xxx	96	xxx	57	xxx	26	xxx	10	xxx
Flagged Companies Later Failing	22	18.5%	28	29.2%	17	29.8%	6	23.1%	2	20.0%

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Combined Ratio over	120%
Operating Ratio over	109%

Summary of Testing Retrospective Results of Proposed Combined Ratio Trend Test Excluding Small Companies

Test Year	Years Elapsed Since Test Year									
	1		2		3		4		5	
	#	%	#	%	#	%	#	%	#	%
1998 Weak Companies	89	xxx	89	xxx	89	xxx	89	xxx	89	xxx
Weak Companies Later Failing	4	4.5%	7	7.9%	16	18.0%	19	21.3%	26	29.2%
Flagged Companies	22	xxx	22	xxx	22	xxx	22	xxx	22	xxx
Flagged Companies Later Failing	1	4.5%	1	4.5%	3	13.6%	5	22.7%	5	22.7%
1999 Weak Companies	99	xxx	99	xxx	99	xxx	99	xxx	99	xxx
Weak Companies Later Failing	11	11.1%	23	23.2%	28	28.3%	33	33.3%		
Flagged Companies	36	xxx	36	xxx	36	xxx	36	xxx		
Flagged Companies Later Failing	4	11.1%	7	19.4%	9	25.0%	9	25.0%		
2000 Weak Companies	126	xxx	126	xxx	126	xxx				
Weak Companies Later Failing	21	16.7%	31	24.6%	39	31.0%				
Flagged Companies	55	xxx	55	xxx	55	xxx				
Flagged Companies Later Failing	12	21.8%	15	27.3%	17	30.9%				
2001 Weak Companies	153	xxx	153	xxx						
Weak Companies Later Failing	26	17.0%	34	22.2%						
Flagged Companies	70	xxx	70	xxx						
Flagged Companies Later Failing	18	25.7%	20	28.6%						
2002 Weak Companies	168	xxx								
Weak Companies Later Failing	8	4.8%								
Flagged Companies	51	xxx								
Flagged Companies Later Failing	1	2.0%								
All Test Years	635	xxx	467	xxx	314	xxx	188	xxx	89	xxx
Weak Companies Later Failing	70	11.0%	95	20.3%	83	26.4%	52	27.7%	26	29.2%
Flagged Companies	234	xxx	183	xxx	113	xxx	58	xxx	22	xxx
Flagged Companies Later Failing	36	15.4%	43	23.5%	29	25.7%	14	24.1%	5	22.7%

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Combined/Operating Threshold to "Flag"

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Operating Ratio over	109%

Summary of Testing Retrospective Results of Proposed Operating Ratio Trend Test Using All Companies

Test Year	Years Elapsed Since Test Year									
	1		2		3		4		5	
	#	%	#	%	#	%	#	%	#	%
1998 Weak Companies	99	xxx	99	xxx	99	xxx	99	xxx	99	xxx
Weak Companies Later Failing	5	5.1%	8	8.1%	18	18.2%	21	21.2%	29	29.3%
Flagged Companies	25	xxx	25	xxx	25	xxx	25	xxx	25	xxx
Flagged Companies Later Failing	1	4.0%	2	8.0%	4	16.0%	4	16.0%	5	20.0%
1999 Weak Companies	107	xxx	107	xxx	107	xxx	107	xxx		
Weak Companies Later Failing	12	11.2%	24	22.4%	30	28.0%	35	32.7%		
Flagged Companies	44	xxx	44	xxx	44	xxx	44	xxx		
Flagged Companies Later Failing	6	13.6%	9	20.5%	11	25.0%	12	27.3%		
2000 Weak Companies	139	xxx	139	xxx	139	xxx				
Weak Companies Later Failing	21	15.1%	32	23.0%	40	28.8%				
Flagged Companies	58	xxx	58	xxx	58	xxx				
Flagged Companies Later Failing	14	24.1%	17	29.3%	19	32.8%				
2001 Weak Companies	164	xxx	164	xxx						
Weak Companies Later Failing	28	17.1%	36	22.0%						
Flagged Companies	73	xxx	73	xxx						
Flagged Companies Later Failing	18	24.7%	20	27.4%						
2002 Weak Companies	181	xxx								
Weak Companies Later Failing	10	5.5%								
Flagged Companies	56	xxx								
Flagged Companies Later Failing	3	5.4%								
All Test Years	690	xxx	509	xxx	345	xxx	206	xxx	99	xxx
Weak Companies Later Failing	76	11.0%	100	19.6%	88	25.5%	56	27.2%	29	29.3%
Flagged Companies	256	xxx	200	xxx	127	xxx	69	xxx	25	xxx
Flagged Companies Later Failing	42	16.4%	48	24.0%	34	26.8%	16	23.2%	5	20.0%

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Summary of Testing Retrospective Results of Proposed Operating Ratio Trend Test Using Lead Companies Only

Test Year	Years Elapsed Since Test Year									
	1		2		3		4		5	
	#	%	#	%	#	%	#	%	#	%
1998 Weak Companies	53	xxx	53	xxx	53	xxx	53	xxx	53	xxx
Weak Companies Later Failing	4	7.5%	7	13.2%	15	28.3%	15	28.3%	21	39.6%
Flagged Companies	9	xxx	9	xxx	9	xxx	9	xxx	9	xxx
Flagged Companies Later Failing	0	0.0%	1	11.1%	2	22.2%	2	22.2%	3	33.3%
1999 Weak Companies	61	xxx	61	xxx	61	xxx	61	xxx		
Weak Companies Later Failing	8	13.1%	16	26.2%	18	29.5%	22	36.1%		
Flagged Companies	19	xxx	19	xxx	19	xxx	19	xxx		
Flagged Companies Later Failing	3	15.8%	6	31.6%	7	36.8%	8	42.1%		
2000 Weak Companies	85	xxx	85	xxx	85	xxx				
Weak Companies Later Failing	15	17.6%	22	25.9%	28	32.9%				
Flagged Companies	30	xxx	30	xxx	30	xxx				
Flagged Companies Later Failing	10	33.3%	12	40.0%	13	43.3%				
2001 Weak Companies	98	xxx	98	xxx						
Weak Companies Later Failing	18	18.4%	24	24.5%						
Flagged Companies	38	xxx	38	xxx						
Flagged Companies Later Failing	11	28.9%	13	34.2%						
2002 Weak Companies	107	xxx								
Weak Companies Later Failing	8	7.5%								
Flagged Companies	31	xxx								
Flagged Companies Later Failing	2	6.5%								
All Test Years	404	xxx	297	xxx	199	xxx	114	xxx	53	xxx
Weak Companies Later Failing	53	13.1%	69	23.2%	61	30.7%	37	32.5%	21	39.6%
Flagged Companies	127	xxx	96	xxx	58	xxx	28	xxx	9	xxx
Flagged Companies Later Failing	26	20.5%	32	33.3%	22	37.9%	10	35.7%	3	33.3%

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Summary of Testing Retrospective Results of Proposed Operating Ratio Trend Test Excluding Small Companies

Test Year	Years Elapsed Since Test Year									
	1		2		3		4		5	
	#	%	#	%	#	%	#	%	#	%
1998 Weak Companies	89	xxx	89	xxx	89	xxx	89	xxx	89	xxx
Weak Companies Later Failing	4	4.5%	7	7.9%	16	18.0%	19	21.3%	26	29.2%
Flagged Companies	22	xxx	22	xxx	22	xxx	22	xxx	22	xxx
Flagged Companies Later Failing	1	4.5%	2	9.1%	4	18.2%	4	18.2%	5	22.7%
1999 Weak Companies	99	xxx	99	xxx	99	xxx	99	xxx		
Weak Companies Later Failing	11	11.1%	23	23.2%	28	28.3%	33	33.3%		
Flagged Companies	40	xxx	40	xxx	40	xxx	40	xxx		
Flagged Companies Later Failing	5	12.5%	8	20.0%	10	25.0%	11	27.5%		
2000 Weak Companies	126	xxx	126	xxx	126	xxx				
Weak Companies Later Failing	21	16.7%	31	24.6%	39	31.0%				
Flagged Companies	54	xxx	54	xxx	54	xxx				
Flagged Companies Later Failing	14	25.9%	16	29.6%	18	33.3%				
2001 Weak Companies	153	xxx	153	xxx						
Weak Companies Later Failing	26	17.0%	34	22.2%						
Flagged Companies	69	xxx	69	xxx						
Flagged Companies Later Failing	17	24.6%	19	27.5%						
2002 Weak Companies	168	xxx								
Weak Companies Later Failing	8	4.8%								
Flagged Companies	55	xxx								
Flagged Companies Later Failing	3	5.5%								
All Test Years	635	xxx	467	xxx	314	xxx	188	xxx	89	xxx
Weak Companies Later Failing	70	11.0%	95	20.3%	83	26.4%	52	27.7%	26	29.2%
Flagged Companies	240	xxx	185	xxx	116	xxx	62	xxx	22	xxx
Flagged Companies Later Failing	40	16.7%	45	24.3%	32	27.6%	15	24.2%	5	22.7%

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Test Year	Years Elapsed Since Test Year									
	1		2		3		4		5	
	#	%	#	%	#	%	#	%	#	%
1998 Weak Companies	99	xxx	99	xxx	99	xxx	99	xxx	99	xxx
Weak Companies Later Failing	5	5.1%	8	8.1%	18	18.2%	21	21.2%	29	29.3%
Flagged Companies	17	xxx	17	xxx	17	xxx	17	xxx	17	xxx
Flagged Companies Later Failing	1	5.9%	1	5.9%	2	11.8%	3	17.6%	3	17.6%
1999 Weak Companies	107	xxx	107	xxx	107	xxx	107	xxx		
Weak Companies Later Failing	12	11.2%	24	22.4%	30	28.0%	35	32.7%		
Flagged Companies	27	xxx	27	xxx	27	xxx	27	xxx		
Flagged Companies Later Failing	4	14.8%	5	18.5%	6	22.2%	6	22.2%		
2000 Weak Companies	139	xxx	139	xxx	139	xxx				
Weak Companies Later Failing	21	15.1%	32	23.0%	40	28.8%				
Flagged Companies	34	xxx	34	xxx	34	xxx				
Flagged Companies Later Failing	8	23.5%	9	26.5%	9	26.5%				
2001 Weak Companies	164	xxx	164	xxx						
Weak Companies Later Failing	28	17.1%	36	22.0%						
Flagged Companies	43	xxx	43	xxx						
Flagged Companies Later Failing	12	27.9%	13	30.2%						
2002 Weak Companies	181	xxx								
Weak Companies Later Failing	10	5.5%								
Flagged Companies	25	xxx								
Flagged Companies Later Failing	0	0.0%								
All Test Years	690	xxx	509	xxx	345	xxx	206	xxx	99	xxx
Weak Companies Later Failing	76	11.0%	100	19.6%	88	25.5%	56	27.2%	29	29.3%
Flagged Companies	146	xxx	121	xxx	78	xxx	44	xxx	17	xxx
Flagged Companies Later Failing	25	17.1%	28	23.1%	17	21.8%	9	20.5%	3	17.6%

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