The Impact of the Market Cycle on Reinsurance Reserving

Casualty Loss Reserve Seminar

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Overview

- Historical perspective and background

- Potential causes for differences in reserve estimates

- Research performed to test differences

- Which methods provide better estimates

- How do development patterns differ

# Historical perspective and background

Historical perspective

- Insurance industry has historically been very cyclical

- 1997-2001 and 1981-1985 were most recent soft markets

- Each soft market has been followed by a significant hard market
  - Companies exit the reinsurance business
  - Significant reserve strengthening occurs
  - New companies enter the business with no "legacy liabilities"
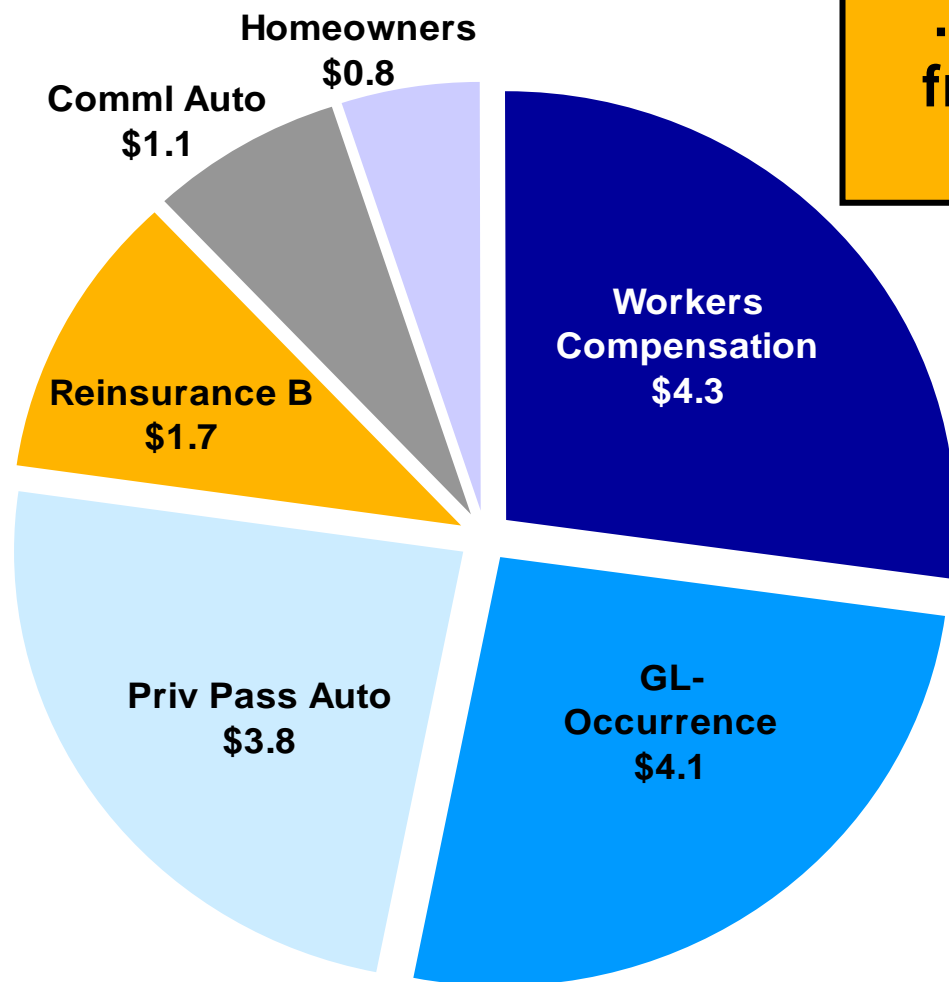
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U.S. industry calendar year combined ratios

Combined Ratio (1991 - 2006)
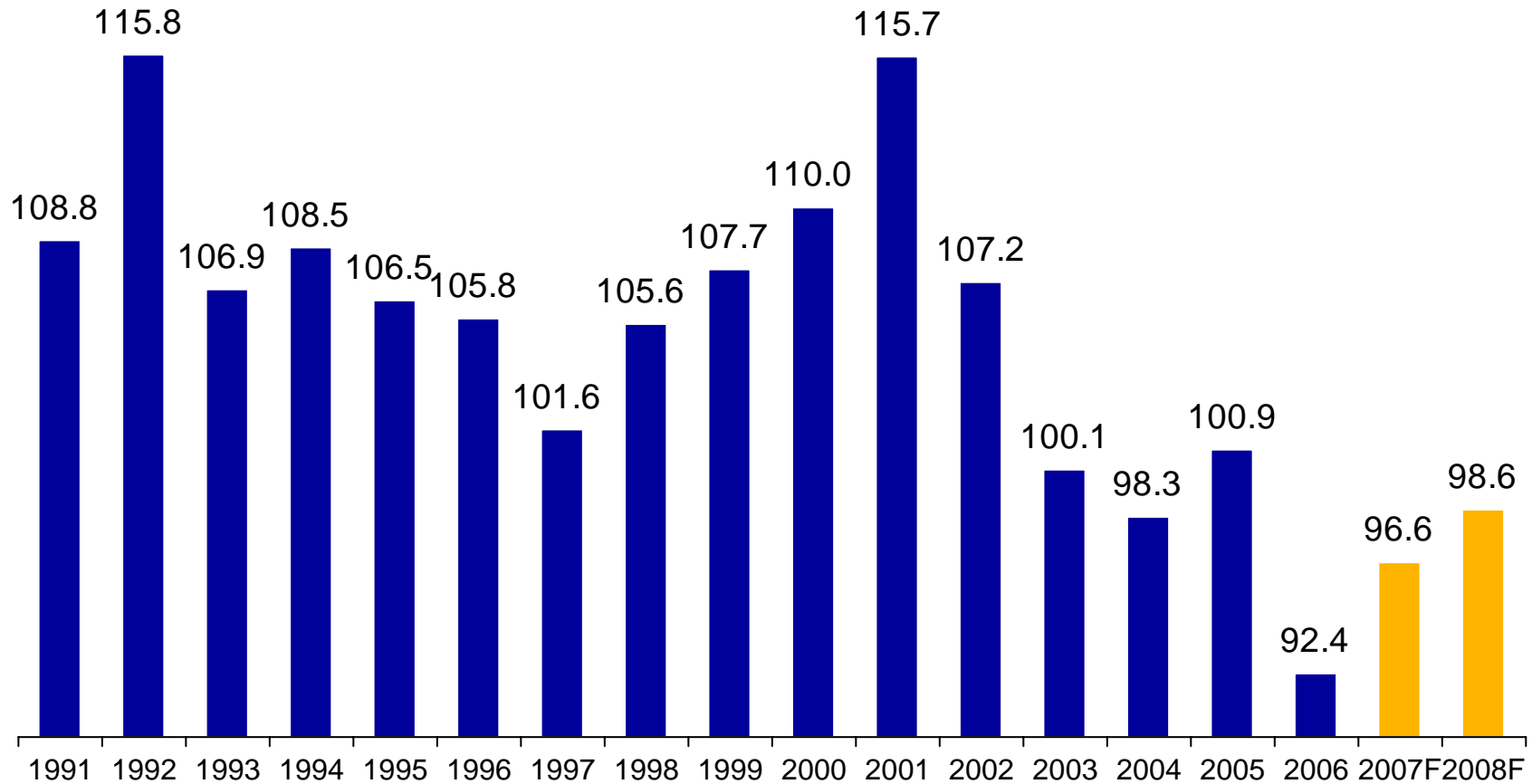
*2007 and 2008 forecasts reflect Insurance Information Institute (iii.org) Early Bird Forecast
Sources: A.M. Best, ISO,Insurance Information Institute.

2003-05 implied reserve redundancies of $15.9 billion

Homeowners $0.8

Comml Auto $1.1

Reinsurance B $1.7

Priv Pass Auto $3.8

Workers Compensation $4.3

GL-Occurrence $4.1

…outweigh deficiencies from 2002 and prior of at least $7.0 billion

However, more significant gross deficiencies are being ceded to off-shore parents (especially in reinsurance)

Reflects over 80% of US insurance market
Source: Tillinghast estimates.

Current marketplace

- Since 2002, the industry has been in a hard market
  - Reserve deficiencies have been recognized
  - Reserve redundancies appear to be building and now outweigh remaining deficiencies from 1997-2001

- Going forward, market appears to be softening again and projections indicate that financial results will worsen over the next several years
  - Prices are dropping
  - More companies are entering new markets
  - Primary companies increasing net retentions for casualty business
  - Reserve redundancies will be recognized

As we enter the next soft market....

What can we learn from past cycles to avoid the mistakes of the past and provide company management with better reserve estimates?

Potential causes of differences in reserve estimates

Characteristics of a soft market

- Slow industry premium growth – Inadequate pricing that does not keep up with increases in economic growth and inflation

- New market entrants – Insurers expanding their product offering to find new sources of growth increase competition for all participants

- Loosening of terms and conditions – Insurers offering broader coverage for little or no additional premium
  - Quantifiable in actuarial pricing – changes in limits, retentions or additional product lines
  - Qualitative items
    — changes in exclusions (primary and reinsurance)
    — More "cedant friendly" language in reinsurance contracts
      – Changes in special acceptances
      – Options for cedants (e.g. commutation options)

Why are these characteristics a reserving problem?

- Inadequate pricing results in less profitable business and must be identified as early as possible

- With insurers expanding their product line, there is often little historical data to rely upon for estimating reserves

- Loosening of terms and conditions changes the underlying exposure of the business and results in more losses than historically experienced

- Long feedback loop for casualty lines, particularly reinsurance casualty means deficiencies may build up for a number of years before issue is recognized

How do you address these issues?

■ Inadequate pricing can be addressed by evaluating changes in pricing and incorporating changes into Initial Expected Loss Ratios (IELRs)

■ Companies that grow in a soft market should be considered to have worse than average experience as they are likely undercutting the competition on price – increasing the IELRs is prudent

■ Companies with little historical experience or limited data will likely under-perform the market – increasing the IELRs is prudent

■ Quantifiable terms and conditions should be addressed through evaluating the actuarial pricing

■ Qualitative items can be evaluated through underwriting files reviews to at least get a sense of the direction of changes and adjustments in the reserve analysis can be made accordingly

Methods commonly used in reinsurance reserving

- Reported loss development

- Paid loss development

- Initial expected loss ratios

- Bornhuetter-Ferguson methods (paid and reported)

- Stanard-Buhlmann/Cape Cod

Are some of these methods better than others?

Hindsight testing of reserve methods

Summary of research

- As part of Tillinghast's internal product development and point-of-view efforts, research was performed to test various actuarial reserving methods, in particular with regard to soft markets

- With the use of back-testing, we attempted to answer the following questions:

  - Which reserving methods more accurately estimated the ultimate liabilities at various evaluations?

  - Were some methods better at early evaluations while others were better at later evaluations?

  - Were some methods better in soft markets versus hard markets?

Summary of research

- Consolidated total of gross Schedule P Reinsurance B (Assumed Liability) data from four reinsurers where complete historical data was available

- Methods tested include:
  - Reported loss development
  - Paid loss development
  - Paid Bornhuetter-Ferguson (IELR = Initial booked for AY)
  - Reported Bornhuetter-Ferguson (IELR = Initial booked for AY)
  - Reported Standard-Buhlmann
  - Paid Standard-Buhlmann

- Compared Results to Current Booked Ultimate Losses as of December 31, 2006

- Performed analyses at year-end 2001 through 2006

Which methods were best overall?

Eval.	Reserving Method (percentage error)					
	Rept. Dev.	Paid Dev.	Rept. BF	Paid BF	Rept. SB	Paid SB
2001	**-28.9%**	-42.1%	-47.9%	-57.3%	-40.3%	-51.6%
2002	**-18.7%**	-48.7%	-39.5%	-56.0%	-30.1%	-52.5%
2003	**1.3%**	-38.0%	-26.7%	-49.3%	-8.7%	-40.0%
2004	17.1%	-21.5%	-13.1%	-40.4%	**9.0%**	-22.7%
2005	*14.2%*	*-16.6%*	***-6.0%***	*-35.0%*	*13.8%*	*-18.6%*
2006	*6.8%*	*-28.3%*	***-1.5%***	*-29.6%*	*13.7%*	*-14.4%*

Which methods were best overall?

Eval.	Reserving Method (rankings)					
	Rept. Dev.	Paid Dev.	Rept. BF	Paid BF	Rept. SB	Paid SB
2001	1	3	4	6	2	5
2002	1	4	3	6	2	5
2003	1	4	3	6	2	5
2004	3	4	2	6	1	5
2005	3	4	1	6	2	5
2006	2	5	1	6	3	4

Which methods were best by evaluation age?

Age	Reserving Method (percentage error)					
	Rept. Dev.	Paid Dev.	Rept. BF	Paid BF	Rept. SB	Paid SB
12	**-11.8%**	-33.9%	-27.9%	-30.3%	-13.0%	-27.9%
24	**-28.0%**	-49.7%	-40.0%	-46.6%	-28.3%	-41.2%
36	**-22.6%**	-46.6%	-41.5%	-54.2%	-30.5%	-47.5%
48	**-20.6%**	-44.8%	-41.5%	-59.9%	-30.2%	-52.0%
60	**-12.8%**	-44.1%	-35.9%	-64.0%	-22.6%	-52.5%

Which methods were best by evaluation age?

	Reserving Method (Number of times it was best by year)					
Age	Rept. Dev.	Paid Dev.	Rept. BF	Paid BF	Rept. SB	Paid SB
12	1*	0	0	3	3*	0
24	2	0	0	3	1	0
36	4	0	0	1	1	0
48	3	0	0	0	2	1
60	4	0	1	0	1	0

*For the 12 month evaluation, there was a tie for best

Which methods were best for soft market years

Age from End	Reserving Method (percentage error)					
	Rept. Dev.	Paid Dev.	Rept. BF	Paid BF	Rept. SB	Paid SB
0	**-28.9%**	-42.1%	-47.9%	-57.3%	-40.3%	-51.6%
1	**-18.2%**	-49.1%	-41.8%	-61.0%	-31.7%	-53.6%
2	**-5.7%**	-43.8%	-33.7%	-62.3%	-18.3%	-50.0%
3	**5.1%**	-40.2%	-24.3%	-63.2%	**-5.1%**	-45.9%
4	6.7%	-37.9%	-18.0%	-64.1%	**2.4%**	-40.3%
5	11.2%	-27.6%	-10.6%	-61.7%	**10.0%**	-27.5%
Avg.	**-9.0%**	-41.7%	-33.1%	-61.2%	-19.0%	-47.1%

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Which methods were best for hard market years

Age from Begin	Reserving Method (percentage error)					
	Rept. Dev.	Paid Dev.	Rept. BF	Paid BF	Rept. SB	Paid SB
0	**-21.4%**	-46.6%	-27.2%	-29.2%	**-21.4%**	-46.6%
1	20.1%	-22.9%	**-8.0%**	-14.5%	16.8%	-13.4%
2	38.2%	11.5%	6.7%	**-0.1%**	34.2%	18.4%
3	23.3%	9.7%	8.7%	**0.6%**	27.8%	8.0%
4	2.9%	-28.8%	6.5%	**-1.7%**	17.0%	-3.0%
Avg.	15.9%	-11.5%	**1.3%**	-5.6%	19.5%	-1.7%

Conclusions of Hindsight Testing

- ■ All methods seem to contain a significant amount of error

- ■ Reported Loss Development method appears to be superior even at early evaluations when it is commonly disregarded
  - ■ However, volatility of this method at early evaluations, particularly for individual companies, needs to be considered

- ■ Stanard-Buhlmann method tends to provide superior estimates to Bornhuetter-Ferguson method

- ■ Bornhuetter-Ferguson method's accuracy could be improved with more accurate IELR assumptions
  - ■ Tests performed here used "booked" loss ratios at year end

Conclusions indicate that loss development patterns are extremely important to the accuracy of the estimate

Impact of cycles on loss development patterns

Summary of Research

- Research was performed to evaluate the differences in loss development factors between soft and hard markets

- Using judgment and statistical hypothesis testing, we attempted to determine whether reported and paid losses develop differently depending upon the stage of the insurance cycle

- If different patterns are present, what would be the reasons for these differences?

- Reinsurance Association of America (RAA) loss triangle data:

    — Workers Compensation

    — General Liability

    — Automobile Liability

Summary of Research

- Observed age-to-age loss development factors (LDFs) for individual years and groups of soft versus hard market years

- Compare LDFs to all year average using four tests to determine significance
  - T-test with unequal variance
  - T-test with equal variance
  - Z-test with unequal variance
  - Z-test with equal variance

General Liability – reported age-to-age factors

Acc Yr	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10
1987					1.111	1.061	1.005	1.021	1.025
1988				1.227	1.025	1.042	1.050	1.010	0.991
1989			1.289	1.165	1.116	1.016	1.014	1.036	1.002
1990		1.435	1.313	1.129	1.083	1.075	1.033	1.005	1.025
1991	2.461	1.557	1.265	1.139	1.137	1.038	1.008	1.008	0.999
1992	3.044	1.713	1.440	1.164	1.142	1.067	1.028	1.009	1.023
1993	2.943	1.781	1.234	1.234	1.113	1.060	1.042	1.030	1.012
1994	3.527	1.842	1.318	1.146	1.127	1.070	1.052	1.016	0.996
1995	4.360	1.638	1.397	1.233	1.113	1.070	1.031	1.060	1.031
1996	2.921	1.780	1.385	1.247	1.113	1.044	1.039	1.025	1.024
1997	**3.200**	**1.944**	**1.410**	**1.220**	**1.128**	**1.069**	**1.022**	**1.050**	**1.015**
1998	**3.625**	**2.004**	**1.401**	**1.217**	**1.144**	**1.131**	**1.077**	**1.024**	
1999	**4.212**	**1.809**	**1.427**	**1.252**	**1.117**	**1.059**	**1.051**		
2000	**3.284**	**2.200**	**1.426**	**1.287**	**1.153**	**1.090**			
2001	**3.610**	**2.070**	**1.447**	**1.242**	**1.132**				
2002	3.796	1.989	1.410	1.198					
2003	3.818	1.922	1.376						
2004	3.801	2.174							
2005	3.779									

General Liability – reported age-to-age factors

Acc Yr	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10
1982-1986	-	-	-	-	-	1.040	1.037	1.025	1.009
1987-1991	2.461	1.496	1.289	1.165	1.094	1.046	1.022	1.016	1.008
1992-1996	3.359	1.751	1.355	1.205	1.122	1.062	1.039	1.028	1.017
1997-2001	**3.586**	**2.005**	**1.422**	**1.244**	**1.135**	**1.087**	**1.050**	**1.037**	**1.015**
2002-2006	3.799	2.028	1.393	1.198	-	-	-	-	-
All Years	**3.492**	**1.857**	**1.369**	**1.207**	**1.117**	**1.062**	**1.035**	**1.025**	**1.012**

General Liability – reported age-to-age factors

Acc Yr	1-5	5-10	10-15	15-20	20-25	25-30	30-35
1972-1976	-	-	-	-	1.013	1.005	1.029
1977-1981	-	-	-	1.007	1.007	1.039	-
1982-1986	-	-	1.034	1.006	1.038	-	-
1987-1991	5.528	1.199	1.026	1.007	-	-	-
1992-1996	9.600	1.294	1.067	-	-	-	-
1997-2001	**12.724**	**1.363**	**-**	**-**	**-**	**-**	**-**
2002-2006	12.862	-	-	-	-	-	-
All Years	**10.717**	**1.273**	**1.036**	**1.009**	**1.015**	**1.016**	**1.029**

General Liability – hypothesis testing results

Statistical Level of Significance for 1997-2001 for one year LDF									
Test	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10
T-unequal	0.41	**0.96**	**0.99**	**0.99**	**0.95**	0.86	0.61	0.51	0.41
T-equal	0.38	**0.91**	**0.95**	**0.95**	0.86	**0.95**	0.82	0.73	0.38
Z-unequal	0.42	**0.98**	**1.00**	**1.00**	**0.97**	**0.96**	0.73	0.70	0.42
Z-equal	0.38	**0.94**	**0.97**	**0.97**	**0.89**	**0.97**	0.85	0.75	0.38

Statistical Level of Significance for 1997-2001 for five year LDF				
Period	T-unequal	T-equal	Z-unequal	Z-equal
1-5	**0.98**	**0.92**	**0.99**	**0.95**

Automobile Liability – reported age-to-age factors

Acc Yr	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10
1987					1.009	1.012	1.004	1.008	1.024
1988				1.089	1.053	1.025	1.008	0.997	1.002
1989			1.123	1.063	1.029	1.013	1.007	1.006	1.002
1990		1.263	1.092	1.067	1.038	1.006	1.022	0.991	1.002
1991	2.105	1.269	1.093	1.023	1.039	1.002	1.006	1.002	0.997
1992	1.849	1.259	1.152	1.036	1.023	1.025	1.003	1.002	1.003
1993	2.182	1.283	1.157	1.059	1.043	1.022	1.024	1.006	1.003
1994	2.039	1.286	1.074	1.064	1.059	1.027	1.019	1.000	1.004
1995	2.000	1.250	1.134	1.104	1.058	1.021	1.019	1.014	0.986
1996	2.408	1.275	1.159	1.094	1.043	1.013	1.008	1.016	1.000
1997	2.280	1.317	1.225	1.123	1.062	1.019	1.011	1.001	0.995
1998	2.548	1.466	1.197	1.123	1.035	1.039	1.002	1.003	
1999	2.432	1.413	1.187	1.067	1.040	1.004	1.007		
2000	2.533	1.438	1.188	1.067	1.052	1.021			
2001	2.587	1.403	1.191	1.071	1.047				
2002	2.580	1.501	1.142	1.075					
2003	2.332	1.322	1.201						
2004	2.210	1.393							
2005	2.107								

Automobile Liability – reported age-to-age factors

Acc Yr	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10
1982-1986	-	-	-	-	-	1.022	1.011	1.002	1.007
1987-1991	2.105	1.266	1.103	1.061	1.033	1.012	1.009	1.001	1.005
1992-1996	2.095	1.270	1.135	1.071	1.045	1.022	1.014	1.008	0.999
1997-2001	**2.476**	**1.408**	**1.197**	**1.090**	**1.047**	**1.021**	**1.007**	**1.002**	**0.995**
2002-2006	2.307	1.405	1.171	1.075	-	-	-	-	-
All Years	2.279	1.343	1.154	1.075	1.042	1.018	1.011	1.003	1.003

Automobile Liability – reported age-to-age factors

Acc Yr	1-5	5-10	10-15	15-20	20-25	25-30	30-35
1972-1976	-	-	-	-	1.082	1.033	1.062
1977-1981	-	-	-	1.071	1.058	1.093	-
1982-1986	-	-	1.041	0.995	0.987	-	-
1987-1991	3.117	1.062	1.006	1.003	-	-	-
1992-1996	3.238	1.091	1.007	-	-	-	-
1997-2001	**4.549**	**1.074**	**-**	**-**	**-**	**-**	**-**
2002-2006	4.081	-	-	-	-	-	-
All Years	3.797	1.079	1.021	1.039	1.050	1.046	1.062

Automobile Liability – hypothesis testing results

Statistical Level of Significance for 1997-2001 for one year LDF								
Test	**1-2**	**2-3**	**3-4**	**4-5**	**5-6**	**6-7**	**7-8**	**8-9**
T-unequal	**0.99**	**0.98**	**1.00**	0.81	0.74	0.33	0.79	0.43
T-equal	**0.96**	**0.94**	**0.98**	0.84	0.68	0.45	0.69	0.21
Z-unequal	**1.00**	**0.99**	**1.00**	0.86	0.77	0.36	0.85	0.45
Z-equal	**0.98**	**0.96**	**0.99**	0.86	0.70	0.46	0.71	0.21

Statistical Level of Significance for 1997-2001 for five year LDF				
Period	**T-unequal**	**T-equal**	**Z-unequal**	**Z-equal**
1-5	**0.99**	**0.96**	**1.00**	**0.98**

Workers Compensation – reported age-to-age factors

Acc Yr	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10
1987					1.076	1.064	1.113	1.055	*1.973*
1988				1.120	0.993	1.068	1.046	*1.590*	1.017
1989			1.218	1.097	1.044	1.042	*1.678*	0.988	0.998
1990		1.238	1.228	1.065	1.068	*1.635*	0.984	1.000	1.027
1991	1.355	1.113	1.203	1.059	*1.421*	1.008	1.042	1.026	1.017
1992	2.309	1.274	1.124	*1.885*	1.024	1.047	1.018	1.044	1.096
1993	2.676	1.337	*1.769*	1.119	1.121	1.042	1.015	1.117	1.093
1994	2.504	*1.839*	1.102	1.125	1.046	1.099	1.116	1.051	1.044
1995	*3.411*	1.410	1.214	1.109	0.980	1.077	1.139	1.100	1.126
1996	2.156	1.272	1.194	1.074	1.141	1.157	1.123	1.073	1.106
1997	2.364	1.084	1.143	1.184	1.176	1.154	1.123	1.092	1.066
1998	2.148	1.341	1.487	1.237	1.165	1.147	1.104	1.114	
1999	2.235	1.487	1.324	1.210	1.174	1.156	1.080		
2000	2.512	1.394	1.430	1.295	1.152	1.154			
2001	1.945	1.360	1.354	1.223	1.152				
2002	2.568	1.339	1.422	1.197					
2003	1.820	1.201	1.167						
2004	2.296	1.338							
2005	2.351								

Workers Compensation – reported age-to-age factors

Acc Yr	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10
1982-1986	-	-	-	-	-	1.044	1.054	1.041	1.037
1987-1991	1.355	1.175	1.216	1.085	1.121	1.163	1.172	1.132	1.206
1992-1996	2.411	1.323	1.159	1.107	1.063	1.084	1.082	1.077	1.093
1997-2001	**2.241**	**1.333**	**1.348**	**1.230**	**1.164**	**1.152**	**1.102**	**1.103**	**1.066**
2002-2006	2.259	1.293	1.294	1.197	-	-	-	-	-
All Years	2.231	1.299	1.258	1.151	1.094	1.090	1.072	1.056	1.053

1996 calendar year diagonal excluded from all averages

Workers Compensation – reported age-to-age factors

Acc Yr	1-5	5-10	10-15	15-20	20-25	25-30	30-35
1972-1976	-	-	-	-	1.920	1.046	1.131
1977-1981	-	-	-	1.339	1.084	1.114	-
1982-1986	-	-	0.996	1.000	1.051	-	-
1987-1991	2.103	1.18	1.063	1.145	-	-	-
1992-1996	4.093	1.467	1.269	-	-	-	-
1997-2001	**4.952**	**1.738**	**-**	**-**	**-**	**-**	**-**
2002-2006	4.522	-	-	-	-	-	-
All Years	4.198	1.421	1.089	1.132	1.360	1.078	1.131

1996 calendar year diagonal excluded from all averages

Workers Compensation – hypothesis testing results

Statistical Level of Significance for 1997-2001 for one year LDF									
Test	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10
T-unequal	0.07	0.50	**0.92**	**1.00**	**1.00**	**1.00**	**0.91**	**0.96**	-
T-equal	0.06	0.59	**0.93**	**0.99**	**0.98**	**0.98**	0.74	0.89	0.25
Z-unequal	0.07	0.53	**0.97**	**1.00**	**1.00**	**1.00**	**0.94**	**1.00**	0.76
Z-equal	0.06	0.61	**0.96**	**1.00**	**1.00**	**0.99**	0.76	**0.92**	0.25

Statistical Level of Significance for 1997-2001 for five year LDF				
Period	T-unequal	T-equal	Z-unequal	Z-equal
1-5	0.85	0.79	0.89	0.82

1996 calendar year diagonal excluded from all averages

Conclusions of loss development tests

- For GL and AL, 1997-2001 accident years seem to exhibit reported loss development factors that are different from other years at a statistically significant level

- For WC, 1997-2001 accident years exhibit differences at a statistically significant level when 1996 calendar year diagonal is removed

- Other tests performed:
  - 1997-2001 paid loss development
    - GL = differences are statistically significant for 5 year test, not statistically significant for most years in 1 year test
    - AL = differences are statistically significant for 5 year test, not statistically significant for any years in 1 year test (5 year test is skewed by 1-2 increment
    - WC = differences are not statistically significant

Conclusions of loss development tests (continued)

- Other tests performed (continued):
  - 1981-1985 (prior soft market) from 8 to 24 years
    - None of the lines of business showed differences at a statistically significant level
    - Possibly skewed by older population of data
  - Treaty versus Facultative for 1997-2001
    - Similar conclusions for Treaty as Total for GL, AL and WC
    - GL and AL Facultative do not show significant difference

Conclusions of loss development tests (continued)

- Overall, there appears to be some difference in liability loss development patterns in the most recent soft market years

- Prior soft market does not appear to have different loss development patterns

- Anecdotal observation = For GL and AL, accident years 2002-2006 are exhibiting loss development patterns similar to 1997-2001

Possible reasons for differences

- Random noise and false positive indications from hypothesis testing

- More liberal underwriting and terms and conditions leads to different types of claims that take longer to develop

- Changes in limits and retentions
  - Attachment points tend to be lower during soft market, but limits may be higher

- Fundamental shift in liability business resulting in different loss development patterns

- Others?

Closing Remarks

- As we head into a soft market, reserving actuaries must be very aware of the changes to the business that may be affecting their data, methods and conclusions

- Focus on understanding business

- Get a thorough understanding of pricing through price monitoring and pay special attention to "new" business – it is likely someone else's old business

- Don't dismiss loss development estimates just because the factors are "green"

- Try alternative methods such as Stanard-Buhlmann in order to derive additional indications

- Pay attention to changes in the business that could impact the loss development estimates