CAS/CARe Seminar
Boston - Monday, June 4, 2012

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Analytics

INT-1: Intermediate/Advanced
Exposure and Experience Rating – Next Steps

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Agenda

- **Case Study Review**
  - What's Your Final Answer? - Trick Question *{pgs. 4-8}*
- **Benchmarking**
  - Pigeonholing What Actuaries Do *{9-11}*
  - Actuarial Utopia – Benchmark Assessment Matrix *{12-15}*
- **Taking Further Steps**
  - Excess Trends – Empirical Hypothesis Testing *{16-21}*
  - Excess LDFs – Benchmark Comparison *{22}*
  - Rate Changes – Premium Stratification / New-Renewal *{23-24}*
  - Experience vs. Exposure Hybrid Roll-ups *{25-28}*
  - Emergence Testing (to IT4) *{29-37}*
- **Appendix: Underwriting Cycle**
  - Emergence Lag *{38-40}*
  - Actuarial Overconfidence *{41-42}*
  - Actuarial Prankster – The Movie *{43-49}*

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Case Study - What's your final answer?

- **Experience** for the layer 100x100 is **half** of the **exposure**
- Exposure = 3.92% (1.57 mm)
- Experience = 1.85% (0.74 mm)

- Trick Question…
  - More investigation needed

Source: CARe IT 1 – June 2011 – Mike Angelina

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Case Study - Exposure Pricing

	Layer		Exposure Method			
			Indicated Exposure Burn (%)	Indicated Ultimate Loss (USD)	Benchmark Excess Claim Counts	Benchmark Severity
125,000	xs	75,000	6.59%	2,636,000	23.47	112,292
100,000	**xs**	**100,000**	**3.92%**	1,568,000	**20.26**	77,406
350,000	xs	150,000	3.19%	1,276,000	**5.61**	227,500
300,000	xs	200,000	2.00%	800,000	**4.10**	195,000

- Don't just look at layer you are pricing (100 xs 100k)
- Look at layers below and above as well
- Look at Exposure burns and claim counts
- To estimate counts, can use trick of pricing $1 xs of retention, and assuming average severity of $1 to back into frequencies

Source: CARe IT 1 – June 2011 – John Buchanan / Mike Angelina

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Case Study - Experience Pricing

	Layer		Experience - Traditional Burning Cost Method			
			Indicated Experience Burn (%)	Indicated Ultimate Loss (USD)	Indicated Excess Claim Counts	Implied Indicated Severity
125,000	xs	75,000	2.86%	1,144,422	10.19	112,292
100,000	**xs**	**100,000**	**1.85%**	741,067	**9.57**	77,406
350,000	xs	150,000	2.75%	1,101,180	**6.18**	178,281
300,000	xs	200,000	1.92%	768,718	**5.56**	138,284

- Ditto for Experience Pricing
- Use same layers for easier comparison

Source: CARe IT 1 – June 2011 – John Buchanan / Mike Angelina

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Exposure and Experience Comparison
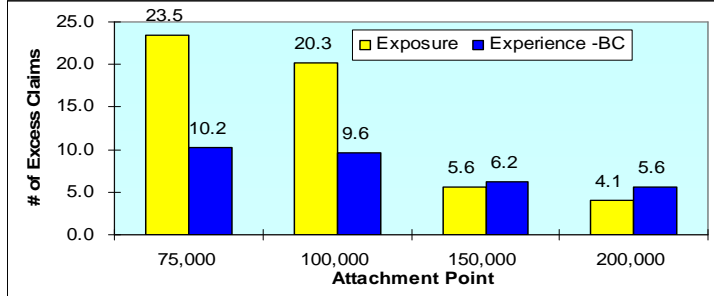
- **In this case study, there is an inconsistent relationship as move up the attachment points**
- **While the low layer Experience is about half of Exposure, the upper layers are about equal to Exposure**
- **Need more investigation to reconcile and help solve the puzzle**
- **Look for internal submission inconsistencies (oftentimes profile issues), as well as outside help through benchmarking for credibility**

Source: CARe IT 1 – June 2011 – John Buchanan / Mike Angelina

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Hybrid Method: Bringing it All Together

A. Experience Method - Traditional Burning Cost (USD)   **Step 1**
Subject Premium: 111,000,000

1	2		3	5	6	7	8
				Experience Method - TBC			
	Layer (Limit xs Retention)			Indicated Experience Burn (%)	Ultimate Loss (USD)	Excess Claim Counts	Implied Severity
					[5xSPI]		[6/7]
1	50,000	xs	200,000	1.19%	1,322,008	27.05	48,874
2	100,000	xs	250,000	1.52%	1,691,358	24.54	68,919
3	150,000	xs	350,000	0.89%	984,586	12.05	81,695
4	500,000	xs	500,000	0.41%	456,121	2.69	169,751
5	250,000	xs	750,000	0.09%	95,024	0.54	176,822
6	1,000,000	xs	1,000,000	0.03%	30,874	0.36	86,177
	Total			0.44%	486,996	2.69	181,241

C. Experience / Exposure Indicated and Selected Ratios   **Step 3**   **Step 5**

10	11	12	13	14	15
Indicated Exper/Expos Freq Ratio	Selected Exper/Expos Freq Ratio	Base Layer Weights	Devt/Trended # of Claims	Actual # of Claims	Weight to Experience Severity
[A7/B7]		[f/ 13]			
71.1%	80.0%	39.9%	189.4	178	100.0%
82.3%	80.0%	36.5%	173.4	129	100.0%
78.6%	80.0%	18.1%	85.8	54	85.0%
44.8%	80.0%	4.5%	21.3	11	22.5%
28.3%	80.0%	0.6%	3.1	2	5.0%
46.8%	80.0%	0.4%	2.1	0	2.5%
75.1%	80.0%	100.0%	475.0	374	
	80.0%				

Step 4

B. Exposure Method (USD)   **Step 2**

1	2		3	5	6	7	8
				Exposure Method			
	Layer (Limit xs Retention)			Indicated Exposure Burn (%)	Indicated Ultimate Loss (USD)	Benchmark Excess Claim Counts	Benchmark Severity
					[5xSPI]		[6/7]
1	50,000	xs	200,000	1.51%	1,671,633	38.05	43,937
2	100,000	xs	250,000	1.92%	2,134,498	29.80	71,616
3	150,000	xs	350,000	1.33%	1,481,529	15.34	96,588
4	500,000	xs	500,000	1.54%	1,709,680	6.00	285,088
5	250,000	xs	750,000	0.27%	296,553	1.90	156,416
6	1,000,000	xs	1,000,000	0.27%	304,773	0.77	398,338
	Total			1.81%	2,014,454	6.00	335,909

D. Hybrid Method (USD)   **Step 6**

10	11	12	13
Hybrid Method			
Selected Excess Claim Counts	Selected Severity (Wtd)	Selected Hybrid Burn (%)	Selected Ultimate Loss
[B7xC11]	[f/ A8,B8,C15]	[13/SPI]	[10x11]
30.44	48,874	1.34%	1,487,569
23.84	68,919	1.48%	1,643,296
12.27	84,218	0.93%	1,033,439
4.80	259,137	1.12%	1,243,242
1.52	157,436	0.22%	238,790
0.61	390,534	0.22%	239,042
		1.34%	1,482,284

Step 7

The Hybrid Reinsurance Pricing Method: A Practitioners Guide: By J. Buchanan and M. Angelina – Accepted in Variance

Source: CARe IT 2 – June 2011 – John Buchanan

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What Next?
Further Steps - Need for Benchmarking

- Obtain relevant internal and external information to establish companywide benchmarks
- Information can be used not only for individual account puzzle solving, but also as proxy for entry into new lines of business or territories
- Actuary, underwriter and management vetting of information annually or as needed – helps establish consistency across units
- After the inevitable loss or series of losses, easier with a benchmarking framework to "fix" the issue that has arisen
- Helps identify areas of potential "**Overconfidence**"
  - The impact due to lack of credibility combined with Information lag is significant – e.g. RAA Loss Development Study started in the 1960s
  - Byproduct of underestimating the impact is innocent capacity by inexperienced reinsurers
- Added company management, regulatory, and Solvency II pressure to establish benchmarking framework

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Benchmark Assessment Matrix
A Suggested Framework

- All information received can be slotted ("pigeonholed") for further analysis
- Set up an initial matrix of lines of business and types of analyses of interest to a primary company or reinsurer
  - US some 30 LOBs and 20 types of analyses
  - Trends, LDFs, ILFs, …, cycle analysis
  - Similar for Global
- Visual framework to systematically:
  - Survey and slot internal and external info into each cell
  - Assess confidence of each item in each cell
  - Establish priorities for pricing projects – direct and proxy
- Ultimately chief actuaries and upper management use all information to assess market cycles for each LOB
- Framework for slotting actuarial presentations, including today's

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Pigeonholing:
Putting What Actuaries Do in a Box

Perspectives From America: By John Buchanan – May 2012

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Benchmark Assessment Matrix
Estimating Confidences - Illustrative

	1	2	3	4	5	6	7
	Trends						
	Ground Up			Excess		Loss Dev't Factors	
	Severity	Freq	Exposure	Severity	Freq	Ground Up	Excess
Property	●	◐	●	◐	⊙	●	●
Casualty	●	◐	○	◐	⊙	●	●
Specialty	●	◐	○	◐	⊙	◐	◐

	8	9	10	11	12	13	14	15
	Rate Changes		Ground-Up Loss Costs	Excess Loss Factors	ALAE	State/ Hazard/ Subline	Layer Experience/ Exposure	Emergence Testing
	Primary	Reinsurance						
Property	●	●	●	●	●	●	●	●
Casualty	●	●	●	●	●	●	●	◐
Specialty	◐	◐	●	◐	●	◐	⊙	◐

	16	17	18	19	20	21	22	23
	External Forces	Loss Ratios			Aggregate Distribution	Industry Macro Application	LOB Redund/Def/ Correlations	Where in the Cycle?
		Primary	Reinsurers	Volatility				
Property	●	●	⊙	◐	◐	●	◐	●
Casualty	●	●	⊙	◐	⊙	◐	◐	◐
Specialty	●	●	⊙	◐	⊙	⊙	◐	⊙

Confidence | Good ● | Medium ◐ | Some ⊙ | Minimal ○

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Today's Presentations
Intermediate Track 1 (US)

	1	2	3	4	5	6	7
	Trends						
	Ground Up			Excess		Loss Dev't Factors	
	Severity	Freq	Exposure	Severity	Freq	Ground Up	Excess
Property							
Casualty				IT1-JB/DC			IT1-JB
Specialty							

	8	9	10	11	12	13	14	15
				Excess		Region/	Layer	
	Rate Changes		Ground-Up	Loss		Hazard/	Experience/	Emergence
	Primary	Reinsurance	Loss Costs	Factors	ALAE	Subline	Exposure	Testing
Property								
Casualty	IT1-JB			IT1-DC			IT1-JB	IT1-JB
Specialty								

	16	17	18	19	20	21	22	23
						Industry	LOB	Where
	External	Loss Ratios			Aggregate	Macro	Redund/Def/	in the
	Forces	Primary	Reinsurers	Volatility	Distribution	Application	Correlations	Cycle?
Property								
Casualty								
Specialty		IT1-JB					IT1-JB	IT1-JB

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Today's Other Track Presentations
Intermediate Track 2, 3, 4 (Int'l Casualty and Property, Link to Reserving)

	1	2	3	4	5	6	7
	Trends						
	Ground Up			Excess		Loss Dev't Factors	
	Severity	Freq	Exposure	Severity	Freq	Ground Up	Excess
Property							
Casualty	IT2-AM						IT4-CP, SK
Specialty	IT2-AM						

	8	9	10	11	12	13	14	15
				Excess		Region/	Layer	
	Rate Changes		Ground-Up	Loss		Hazard/	Experience/	Emergence
	Primary	Reinsurance	Loss Costs	Factors	ALAE	Subline	Exposure	Testing
Property			IT3-JB	IT3-JB/MC-AP		IT3-JB	IT3-MC-AP	
Casualty	IT2-AM	IT2-AM		IT2-JB/AM/RB	IT2-AM		IT2-AM	IT4-CP, SK
Specialty				IT2-AM/RB				

	16	17	18	19	20	21	22	23
						Industry	LOB	Where
	External	Loss Ratios			Aggregate	Macro	Redund/Def/	in the
	Forces	Primary	Reinsurers	Volatility	Distribution	Application	Correlations	Cycle?
Property		IT3-MC-AP				IT3-JB		
Casualty	IT2-AM/RB				IT2-AM			IT4-SK
Specialty								

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Tuesday Presentation (BAM Illustration)
CS3 – Medical Professional Liability

	1	2	3	4	5	6	7
	Trends						
	Ground Up			**Excess**		**Loss Dev't Factors**	
	Severity	**Freq**	**Exposure**	**Severity**	**Freq**	**Ground Up**	**Excess**
Property							
Casualty							
Specialty	CS3-KL	CS3-KB, KL				CS3-KB, KL	

	8	9	10	11	12	13	14	15
	Rate Changes		**Ground-Up Loss Costs**	**Excess Loss Factors**	**ALAE**	**Region/ Hazard/ Subline**	**Layer Experience/ Exposure**	**Emergence Testing**
	Primary	**Reinsurance**						
Property								
Casualty								
Specialty	CS3-KB					CS3-EK		

	16	17	18	19	20	21	22	23
	External Forces	**Loss Ratios**			**Aggregate Distribution**	**Industry Macro Application**	**LOB Redund/Def/ Correlations**	**Where in the Cycle?**
		Primary	**Reinsurers**	**Volatility**				
Property								
Casualty								
Specialty	CS3-KB, KL, EK	CS3-KL					CS3-KB	CS3-KB, KL

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Size of Loss Trend
Empirical Approach - Unadjusted

Trend Test - Base Case (no exposure growth or freq trend)

Tot	426	460	497	546	601	
#	35	35	35	35	35	
Avg	12.2	13.1	14.2	15.6	17.2	
check sev chg		1.080	1.080	1.100	1.100	1.090
"feeder" trend sel	1.000	1.000	1.000	1.000	1.000	1.000
Threshold	25.0	25.0	25.0	25.0	25.0	
Tot xs	290	313	338	398	438	
#	6	6	6	7	7	
Avg	48.3	52.2	56.3	56.9	62.6	
indic sev chg		1.080	1.080	1.010	1.100	1.067
On-level SP	1000	1000	1000	1000	1000	
GU Freq	0.0350	0.0350	0.0350	0.0350	0.0350	
XS Freq	0.0060	0.0060	0.0060	0.0070	0.0070	
indic freq chg		1.000	1.000	1.167	1.000	1.039
GU Burn	0.4258	0.4598	0.4966	0.5463	0.6009	
XS Burn	0.2897	0.3129	0.3379	0.3982	0.4380	
indic pure prem chg		1.080	1.080	1.178	1.100	1.109

	"true" trend->	1.080	1.080	1.100	1.100
Clm #	Y1	Y2	Y3	Y4	Y5
35	80.45	86.89	93.84	103.22	113.55
34	63.02	68.07	73.51	80.86	88.95
33	49.72	53.69	57.99	63.79	70.17
32	39.49	42.65	46.07	50.67	55.74
31	31.59	34.12	36.85	40.53	44.59
30	25.45	27.49	29.68	32.65	35.92
29	20.64	22.30	24.08	26.49	29.14
28	16.86	18.21	19.67	21.64	23.80
27	13.87	14.98	16.18	17.80	19.58
26	11.49	12.41	13.40	14.74	16.22
25	9.58	10.35	11.18	12.30	13.53
24	8.05	8.69	9.39	10.33	11.36
23	6.81	7.35	7.94	8.74	9.61
22	5.80	6.26	6.77	7.44	8.19
21	4.97	5.37	5.80	6.38	7.02
20	4.30	4.64	5.01	5.51	6.06
19	3.74	4.04	4.36	4.80	5.27
18	3.27	3.54	3.82	4.20	4.62
17	2.89	3.12	3.37	3.70	4.07
16	2.56	2.77	2.99	3.29	3.62
15	2.29	2.48	2.68	2.94	3.24
14	2.07	2.23	2.41	2.65	2.92
13	1.87	2.02	2.19	2.40	2.64
12	1.71	1.85	2.00	2.20	2.41
11	1.57	1.70	1.84	2.02	2.22
10	1.46	1.57	1.70	1.87	2.06
9	1.36	1.47	1.59	1.74	1.92
8	1.28	1.38	1.49	1.64	1.80
7	1.21	1.30	1.41	1.55	1.70
6	1.15	1.24	1.34	1.48	1.62
5	1.10	1.19	1.29	1.41	1.56
4	1.06	1.15	1.24	1.37	1.50
3	1.04	1.12	1.21	1.33	1.46
2	1.01	1.10	1.18	1.30	1.43
1	1.00	1.08	1.17	1.28	1.41

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Size of Loss Trend
Hypothesis Testing – Assuming 6%

Trend Test - Base Case (no exposure growth or freq trend)

							"true" trend->	1.080	1.080	1.100	1.100
						Clm #	Y1	Y2	Y3	Y4	Y5
Tot	426	460	497	546	601						
#	35	35	35	35	35						
Avg	12.2	13.1	14.2	15.6	17.2		35	80.45	86.89	93.84	103.22	113.55
check sev chg		1.080	1.080	1.100	1.100	1.090	34	63.02	68.07	73.51	80.86	88.95
							33	49.72	53.69	57.99	63.79	70.17
"feeder" trend sel		1.060	1.060	1.060	1.060	1.060	32	39.49	42.65	46.07	50.67	55.74
Threshold	25.0	26.5	28.1	29.8	31.6		31	31.59	34.12	36.85	40.53	44.59
Tot xs	290	313	338	372	409		30	25.45	27.49	29.68	32.65	35.92
#	6	6	6	6	6		29	20.64	22.30	24.08	26.49	29.14
Avg	48.3	52.2	56.3	62.0	68.2		28	16.86	18.21	19.67	21.64	23.80
indic sev chg		1.080	1.080	1.100	1.100	1.090	27	13.87	14.98	16.18	17.80	19.58
							26	11.49	12.41	13.40	14.74	16.22
On-level SP	1000	1000	1000	1000	1000		25	9.58	10.35	11.18	12.30	13.53
GU Freq	0.0350	0.0350	0.0350	0.0350	0.0350		24	8.05	8.69	9.39	10.33	11.36
XS Freq	0.0060	0.0060	0.0060	0.0060	0.0060		23	6.81	7.35	7.94	8.74	9.61
indic freq chg		1.000	1.000	1.000	1.000	1.000						
GU Burn	0.4258	0.4598	0.4966	0.5463	0.6009							
XS Burn	0.2897	0.3129	0.3379	0.3717	0.4089							
indic pure prem chg		1.080	1.080	1.100	1.100	1.090						

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Size of Loss Trend
Hypothesis Testing – Assuming 12%

Trend Test - Base Case (no exposure growth or freq trend)

							"true" trend->	1.080	1.080	1.100	1.100
						Clm #	Y1	Y2	Y3	Y4	Y5
Tot	426	460	497	546	601						
#	35	35	35	35	35						
Avg	12.2	13.1	14.2	15.6	17.2		35	80.45	86.89	93.84	103.22	113.55
check sev chg		1.080	1.080	1.100	1.100	1.090	34	63.02	68.07	73.51	80.86	88.95
							33	49.72	53.69	57.99	63.79	70.17
"feeder" trend sel		1.120	1.120	1.120	1.120	1.120	32	39.49	42.65	46.07	50.67	55.74
Threshold	25.0	28.0	31.4	35.1	39.3		31	31.59	34.12	36.85	40.53	44.59
Tot xs	290	285	308	339	373		30	25.45	27.49	29.68	32.65	35.92
#	6	5	5	5	5		29	20.64	22.30	24.08	26.49	29.14
Avg	48.3	57.1	61.7	67.8	74.6		28	16.86	18.21	19.67	21.64	23.80
indic sev chg		1.182	1.080	1.100	1.100	1.115	27	13.87	14.98	16.18	17.80	19.58
							26	11.49	12.41	13.40	14.74	16.22
On-level SP	1000	1000	1000	1000	1000		25	9.58	10.35	11.18	12.30	13.53
GU Freq	0.0350	0.0350	0.0350	0.0350	0.0350		24	8.05	8.69	9.39	10.33	11.36
XS Freq	0.0060	0.0050	0.0050	0.0050	0.0050		23	6.81	7.35	7.94	8.74	9.61
indic freq chg		0.833	1.000	1.000	1.000	0.955						
GU Burn	0.4258	0.4598	0.4966	0.5463	0.6009							
XS Burn	0.2897	0.2854	0.3083	0.3391	0.3730							
indic pure prem chg		0.985	1.080	1.100	1.100	1.065						

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Size of Loss Trend – Ground Up Benchmarking - Using Sample Data

State X - Subset of GL Claims
Ground-Up Severity Trend Indication - Loss+ALAE

$y = 6433.1e^{0.1153x}$
$R^2 = 0.7166$
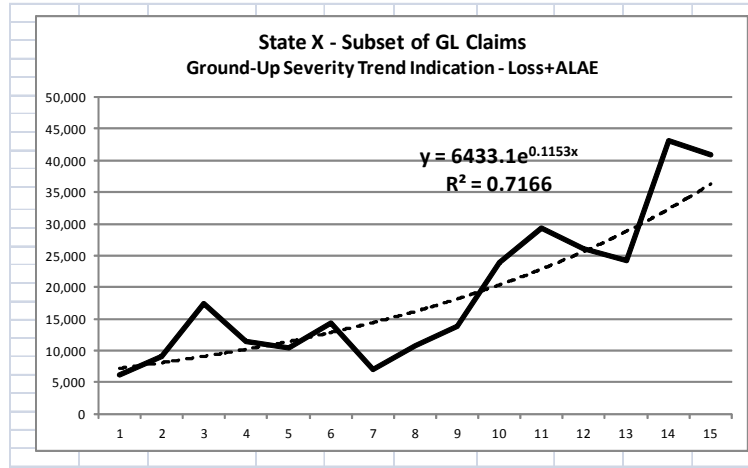
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Size of Loss Trend – Empirical Approach Benchmarking - Using Sample Data

State X - Subset of GL Claims
Severity Trend Indication - Loss+ALAE (25k, 50k, and 100k Threshold
(Trended using Hypothesis Testing of Severity Trend of 6%)
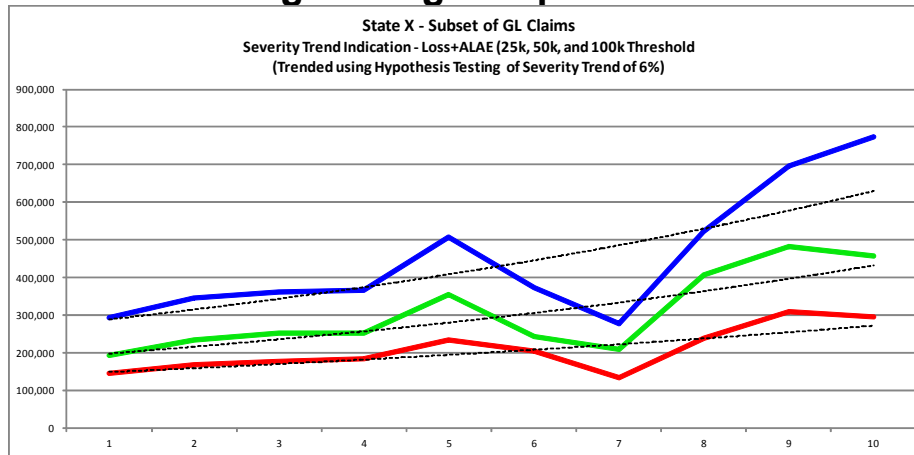
Range of Indicated excess trends depending upon data threshold, years selected, and capping amounts: 3.2% to 9.6%

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Yr 1-9 - Ltd to 2mm

Threshold	Indic Trend	R^2	#Raw
Ground-Up	11.5%	0.72	14,245
25,000	6.2%	0.39	652
35,000	7.2%	0.46	538
50,000	8.6%	0.51	417
75,000	7.5%	0.40	314
100,000	7.2%	0.41	254

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Size of Loss Trend
Percentile Graphing - Illustration

State X - Report Year - 36 month evaluation
75, 90, 95th percentile
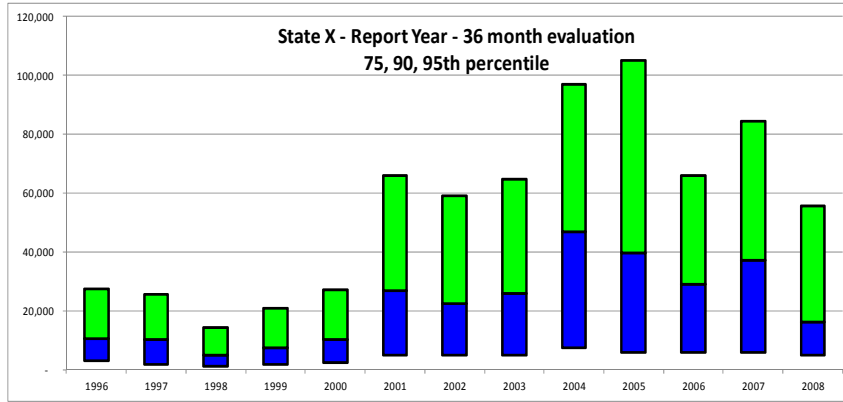
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Excess Loss Development Factors
Scaling Industry Benchmarks

■ Actual 100x100k   ■ Industry (Unscaled)   ■ Industry (Scaled)
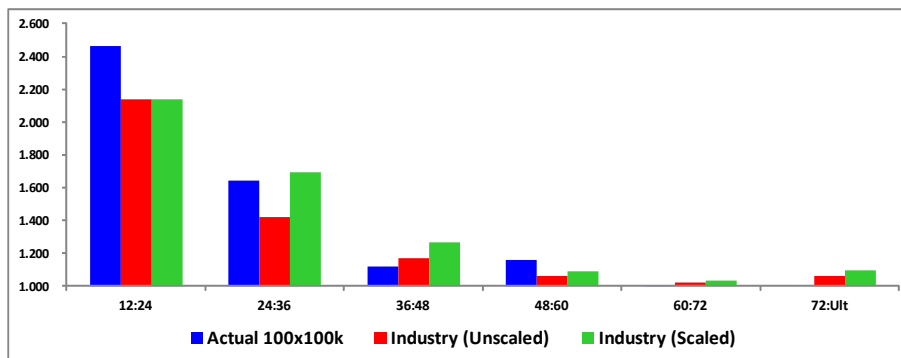
Actual Increase (All numerators/denominators)	13,619,089
Expected Increase using unscaled Industry Factors	8,332,308
indicated Scale	1.634
Selected Scale	1.500

Judgmentally selected after assessing confidence in industry factors,
variation in actual LDFs, number of claims underlying actual and cred formula.

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Rate Changes - Primary
Check for Appropriateness of On-level Factors

MarketWatch Unleashed - Commercial Lines - 2002Q2
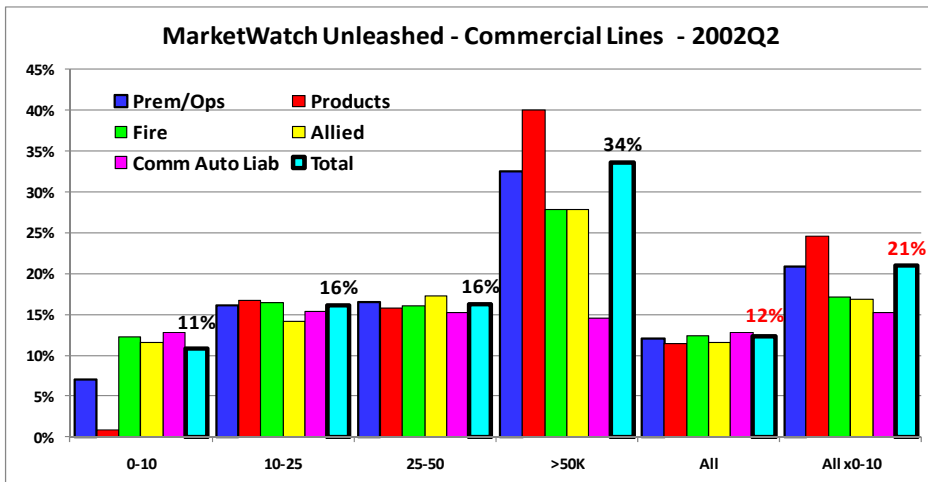
Assessing New vs. Renewal Business
Conversion to Index – Impact of Cycle?

Loss Ratio Difference between New and Renewal Business by Premium Size
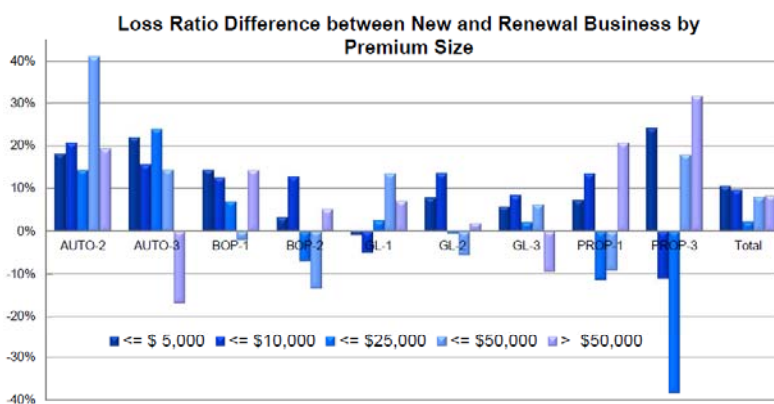
Source: CAS RPM Seminar – March 2012: PMGMT-4

Roll-up Results across Accounts

Test of Default Parameters

- Aggregate across "similar" accounts to evaluate pressure on industry defaults
  - May want to re-rate accounts using e.g. default rate changes, ILFs, premium allocations, LDFs, trends, etc.
- Each individual observation represents a cedant/attachment point exper/expos ratio
- Review dispersion of results and overall trend
  - E.g. if weighted and/or fitted exper/expos ratios are well below 100% (or e.g. 90% if give some underwriter credit) then perhaps default L/Rs overall are too high (or conversely LDFs or trends too light)
  - If trend is up when going from e.g. 100k to 10mm att pt, then perhaps expos curve is predicting well at lower points but is underestimating upper points

Source: CARe IT 2 – June 2011 – John Buchanan   25

Roll-up Results across Accounts

Test of Default Parameters *(cont.)*

- Before making overall judgments, must consider
  - UW contract selectivity (contracts seen vs. written),
  - Sample size (# of cedants/years),
  - Impact "as-if" data (either current or historical)
  - Survivor bias
  - Systematic bias in models
  - "Lucky"

Source: CARe IT 2 – June 2011 – John Buchanan

Hybrid roll-ups: Test of Default Factors
Example 1

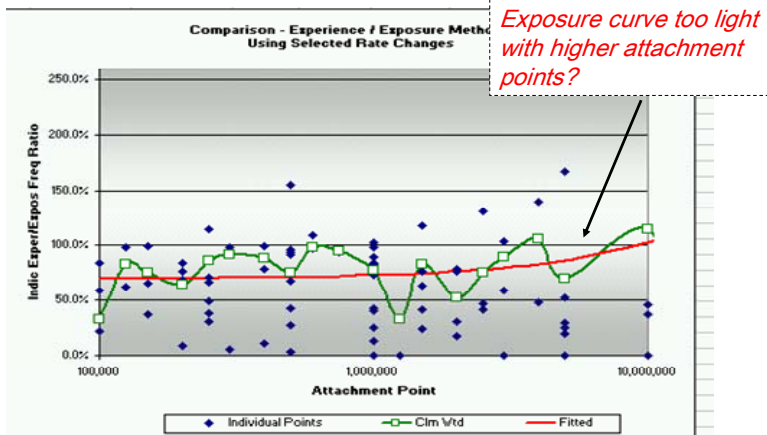*Well below 100%, pressure to reduce expos params or increase exper params…but credible??*

Average Exper/Expos Freq Ratio	
Arithmetic Avg=	65.1%
Sumproduct(clms)	72.5%

Dispersion Statistics		
Total # > 90%=	7	25.9%
Total 0> # <90%=	20	74.1%
Total # > 0%=	27	100.0%
Total # = 0	3	
Total # =	30	
U/W Selectivity =	90.0%	

Source: CARe IT 2 – June 2011 – John Buchanan

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Test of Default Rating Factors – Example 2

Exposure curve too light with higher attachment points?

Source: 16 contracts; approx 1800 claims, above median att pt of 250k
To investigate:
ILF curves, L/R's, LDF's, trends, rate changes, "as if's", U/W selectivity, sample size, "lucky"

Source: CARe IT 2 – June 2011 – John Buchanan

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Reinsurance Emergence Testing
Examples – Excess MPL and Primary Casualty

	1	2	3	4	5	6	7
				Trends			
		Ground Up			Excess		Loss Dev't Factors	
	Severity	Freq	Exposure	Severity	Freq	Ground Up	Excess
Property							
Casualty	Used in ET					Used in ET	
Specialty				Used in ET			Used in ET

	8	9	10	11	12	13	14	15
				Excess		Region/	Layer	
		Rate Changes		Ground-Up	Loss		Hazard/	Experience/	Emergence
	Primary	Reinsurance	Loss Costs	Factors	ALAE	Subline	Exposure	Testing
Property								
Casualty	Used in ET							IT1-JB
Specialty	Used in ET							IT1-JB

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Reinsurance Emergence Testing

- **Start with individual claims and their histories**
- Create ground-up and excess layer LDFs and compare to benchmarks for credibility
  - Create both $ and # claim count triangles
  - Loss year and calculated report year
- Excess trends by threshold - severity and frequency
- Vary thresholds (detrended)
  - e.g. Ground-up, $10,000, $25,000, $50,000, $100,000
- Compare to benchmark severity and frequency trends
- Include exposure base to project future quarterly losses, including rate change estimates
- Estimate expected losses by layer and compare to actual – aggregate across accounts
  - Roll-up quarterly testing by year and inspect to see if hot (or cold) patterns arise for early warning signals

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Reinsurance Emergence Index
Sample Individual Claim data and histories

AY	Claim #	State	Subline	Policy Limit	12/31/03	12/31/04	12/31/05	12/31/06	12/31/07	12/31/08	12/31/09	12/31/10
2003 ABC0001	1	CRR	1,000,000	0	0	0	43,176	17,073	17,102	17,102	17,102
2003 ABC0002	2	CRR	1,000,000	0	0	0	0	147,910	147,910	147,910	147,910
2006 ABC0003	1	CRR	1,000,000	0	0	0	0	6,443	8,297	15,450	15,450
2003 ABC0004	1	CRR	1,000,000	0	0	13,903	311,435	312,805	312,805	312,805	312,805
2006 ABC0005	1	CRR	1,000,000	0	0	0	0	0	0	0	42,166
2003 ABC0006	1	CRR	1,000,000	0	11,577	5,706	27,664	16,076	360,897	377,355	378,831
2004 ABC0007	1	CRR	1,000,000	0	0	258,453	255,375	251,860	120,971	120,971	120,971
2003 ABC0008	1	CRR	1,000,000	0	0	0	94,355	14,351	14,351	14,351	14,351
2004 ABC0009	1	CRR	1,000,000	0	0	0	2,177	341,994	455,320	468,139	94,391
2006 ABC0010	1	CRR	2,000,000	0	0	0	0	0	1	1	14,551
2006 ABC0011	1	CRR	2,000,000	0	0	0	0	0	16,710	21,381	47,404
2006 ABC0012	1	CRR	2,000,000	0	0	0	0	0	0	0	20,320
2006 ABC0013	1	CRR	2,000,000	0	0	0	0	0	0	15,001	15,610
2006 ABC0014	1	CRR	2,000,000	0	0	0	0	0	23,222	19,229	16,618
2006 ABC0015	1	CRR	2,000,000	0	0	0	0	0	12,158	35,292	16,804
2006 ABC0016	1	CRR	2,000,000	0	0	0	0	0	0	2	10,067
2006 ABC0017	1	CRR	1,000,000	0	0	0	0	0	20,519	39,000	68,426
2003 ABC0018	1	CRR	1,000,000	0	1,081	27,067	29,824	29,824	29,824	29,824	29,824
2003 ABC0019	1	CRR	1,000,000	0	7,616	7,718	16,572	30,216	153,340	153,340	153,340
2006 ABC0020	1	CRR	1,000,000	0	0	0	0	0	11,502	11,502	11,502
2003 ABC0021	1	CRR	1,000,000	0	4,654	15,386	15,386	15,386	15,386	15,386	15,386
2005 ABC0022	1	CRR	1,000,000	0	0	0	15,745	15,745	15,745	15,745	15,745
2003 ABC0023	1	CRR	1,000,000	0	0	2,153	149,677	149,917	149,917	149,917	149,917
2003 ABC0024	1	CRR	1,000,000	0	508	122,889	126,775	681,869	681,868	755,276	735,403
2003 ABC0025	1	CRR	1,000,000	0	78,435	77,177	128,449	388,870	639,199	660,562	660,562

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Information Emergence

To help identify where we are in the underwriting cycle, it is important to perform "emergence testing." That is, the actuary should set up his total loss expectations for any individual contract, and specify how he expects those losses will be reported over each of the subsequent quarters or years. Over time, these expectations should then be compared with what has actually been reported.

For example, the expected losses for a particular contract might be $1 million. Further, it may be expected that these claims will be reported over each of the remaining five years in the following pattern: $100,000, $300,000, $300,000, $200,000, a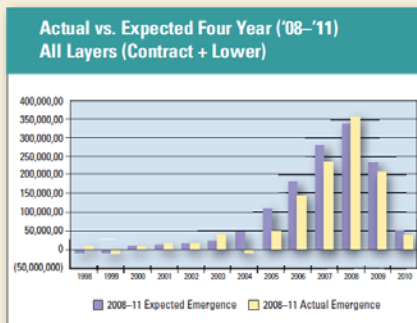nd $100,000. Since any one account will have a significant amount of variation attached to it, it is important to combine the accounts, to try to detect an overall pattern. And, most important, this is valuable for detecting any recent patterns, to see if there are any pressures on the initial assumptions that were made, and to identify any new loss plateaus or spikes.

To review the MPL industry in general, and to help identify any recent changes in loss activity, the figure below is an illustration of the accumulation of emergence from accounts of a reinsurer over the last four years. In keeping with the other figures, this emergence roll-up shows that period 2007 and prior years has behaved favorably in general over the last four years (with the exception of a minor spike in 2003). For 2008 and subsequent years, it is still too early to tell whether they will also yield better results than expected. In fact, at this point, 2008 is showing slightly worse results than what we would have expected.

Analyzing this information emergence provides a critical early warning tool. Appropriate analysis will determine when, and to what extent, insurers or reinsurers have entered into "hot water." And they should adjust how much business they underwrite accordingly.

Actual vs. Expected Four Year ('08–'11)
All Layers (Contract + Lower)

■ 2008–11 Expected Emergence ☐ 2008–11 Actual Emergence

Source: *Physician Insurer*, Fourth Quarter 2011, a publication of the Physician Insurers Association of America; J. Buchanan pg. 33

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Ground-Up Emergence Testing - Illustration
(General Liability - Owners, Landlords, and Tenants)
2007Q4 Reported Losses Projected to 2008Q1

| Accident Year	Reported Losses as of 2007Q4 (1)	Projected Losses as of 2008Q1 (2)	Reported Losses as of 2008Q1 (3)	% Difference = (3 – 2) (3)
2000	609,424,639	610,643,488	612,018,570	0.225%
2001	611,253,046	611,253,046	609,106,228	-0.352%
2002	572,327,255	573,471,910	583,361,236	1.695%
2003	596,941,562	599,926,270	600,328,281	0.067%
2004	600,340,992	608,145,425	608,328,584	0.030%
2005	603,706,418	624,836,143	619,763,753	-0.818%
2006	453,889,256	486,115,393	485,901,765	-0.044%
Total	4,047,883,168	4,114,391,674	4,118,808,417	

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Emergence Component - Company A
2007Q4 Reported Losses Projected to 2008Q1

Accident Year	Reported Losses as of 2007Q4 (1)	Projected Losses as of 2008Q1 (2)	Reported Losses as of 2008Q1 (3)	% Difference = (3 – 2) (3)
2000	19,317,573	19,259,620	19,361,439	-0.526%
2001	12,188,713	12,127,769	12,112,665	0.125%
2002	10,053,476	9,983,102	9,448,410	5.659%
2003	14,977,080	15,141,828	15,150,756	-0.059%
2004	13,627,123	13,858,784	13,952,278	-0.670%
2005	15,275,255	15,641,861	15,009,203	4.215%
2006	10,055,740	11,161,871	11,474,044	-2.721%

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Ground-Up Emergence Testing - Illustration
Ratio of Actual/Projected Losses by Accident Year
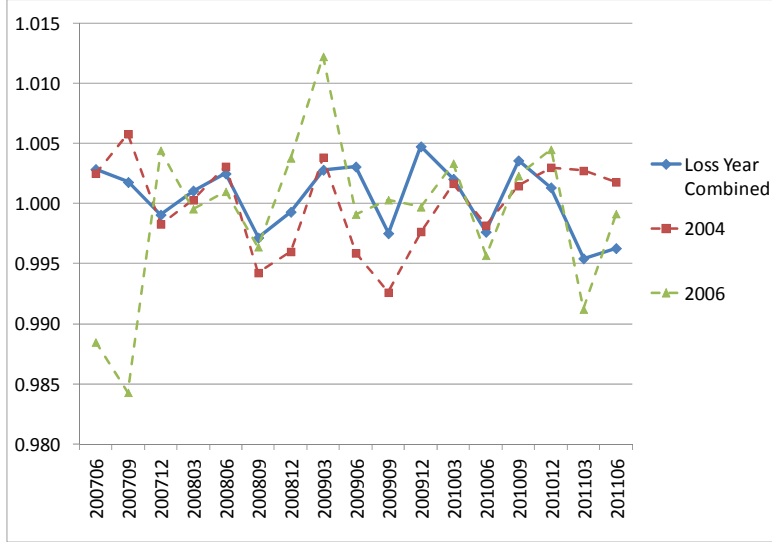
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Case Study – Reconciliation and Final Selection

Reconciliation of Estimates

➢Experience Indications (burning cost)
- Selected — 700 — 1.85%
- Alternate Sel. — 925 — Years Wtd
- ALAE Differences — 103 — 20% vs 8%
- Revised Selection — 1,028 — 2.55 %

➢Experience Indications (Frq/ Sev)
- Selected — 1,040 — 2.6%
- Alter Selection — 1,020 — Yrs Wtd
- ALAE Differences — 119 — 20% vs 7.5%
- Revised Selection — 1,139 — 2.85%

➢Final Selection — 1,100 — 2.75%

Source: CARe IT 2 – June 2011 – Mike Angelina

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Case Study
Emergence Information to Reserving (IT4)

Treaty Year	Adjusted Subject Earned Premium	Subject Reported L&ALAE	Subject Reported Counts	Severity Trend	Frequency Trend	Adjusted Subject Reported L&ALAE	Adjusted Subject Reported Counts	XS LDF	LDF Burn Cost	Cape Cod Burn Cost	Selected Burn Cost	Selected Ultimate Adjusted Subject L&ALAE
2001	26,471,130	0	0	1.657	1.000	51,032	1	1.070	0.21%	0.21%	0.21%	54,605
2002	25,839,654	121,638	1	1.573	1.000	125,048	1	1.082	0.52%	0.51%	0.52%	135,302
2003	23,751,778	962,293	7	1.484	1.000	1,137,320	7	1.101	5.27%	4.96%	5.27%	1,252,189
2004	24,116,512	548,373	3	1.415	1.000	745,593	4	1.129	3.49%	3.35%	3.49%	841,775
2005	27,085,710	101,634	1	1.335	1.000	101,865	2	1.174	0.44%	0.66%	0.44%	119,589
2006	26,124,453	433,472	1	1.268	1.000	433,472	1	1.249	2.07%	2.04%	2.07%	541,406
2007	32,301,844	383,064	3	1.211	1.000	383,064	3	1.396	1.66%	1.72%	1.66%	534,757
2008	37,808,219	295,429	4	1.154	1.000	372,765	5	1.704	1.68%	1.75%	1.68%	635,192
2009	41,489,120	0	0	1.100	1.000	157,264	1	2.506	0.95%	1.45%	1.45%	600,223
2010	40,992,570	103,942	1	1.049	1.000	104,136	1	6.192	1.57%	1.74%	1.74%	712,519
Total	305,980,990	2,949,845	21			3,611,558	26		1.68%	1.77%	1.77%	5,427,557
Prospective 2011	40,000,000										1.85%	741,067

| | | | | | | | | | | Selected | 2.75% | 1,100,000 |

Expected Emergence - Pricing Assumptions

| PremOps-1 100x100	12	24	36	48	60	72	84	96	108	120	120+
Selected ATU	6.192	2.506	1.704	1.396	1.249	1.174	1.129	1.101	1.082	1.070	
Selected Cum'l % Reptd	16.1%	39.9%	58.7%	71.6%	80.1%	85.2%	88.6%	90.8%	92.4%	93.5%	100.0%
Selected Incr % Reptd	16.1%	23.8%	18.8%	12.9%	8.4%	5.1%	3.4%	2.3%	1.6%	1.0%	6.5%
Incremental Reported	177,649	261,298	206,593	142,426	92,739	56,263	37,346	24,778	17,544	11,402	71,963
Cumulative Reported	177,649	438,947	645,540	787,966	880,705	936,968	974,314	999,092	1,016,636	1,028,037	1,100,000

NB: After each contract is written, the expected ultimate losses, along with reporting, payment, premium, and commission patterns reflecting all treaty terms and conditions (e.g. AADs…) should be given to reserving for their initial selections and subsequent testing.   For more robust pricing/reserving links and other management purposes items like capital usage, expected loss and combined ratios, expected investment income, ROEs and other pricing assumptions such as trends, LDFs, rate changes, and ILFs selected should be given as well.

Appendix: Underwriting Cycle

- Hard market vs. Soft market
- Calendar year vs. accident year – **information / emergence lag**
  - Accident year – posted vs. "true" after adjusting for reserves
- Loss ratios, combined ratios, operating ratios
- Forensic analysis of cycle
  - Numerator impacts (loss trends, new plateaus, shock losses)
  - Denominator impacts (rate changes, terms and conditions)
- Relative magnitude of components
  - Losses
  - Rates
  - Reserve adequacy (no impact if able to review "true" AY results)
  - Which is larger impact, losses or rates? Perhaps vary by line
- Hypothesis
  - Soft market bias towards Experience model results
  - Could be implicit by underwriters or management override

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Analyzing the Market Cycle
Numerators and Denominators

Figure 4 Historical Look at MPL Industry Underwriting Performance–Accident Year
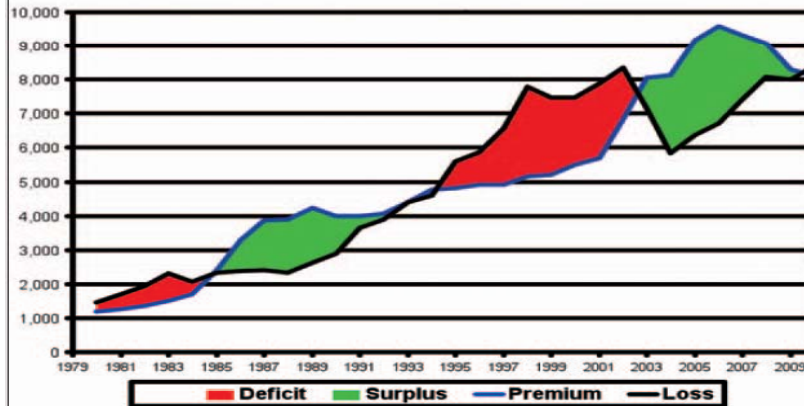
Source: MPL Sch P @ 12/31/2010 by Rich Lino - Oliver Wyman
AY reported results including IBNR reported as of December 31, 2010 (or 9 years after AY, if earlier)
AY estimates reflect investment yield of 0.5% above 5-year US Treasury Rate
Actual posted results through 12/31/2010

Source: *Physician Insurer*, Fourth Quarter 2011, a publication of the Physician Insurers Association of America; J. Buchanan pg. 33

Emergence Lag – Impact of Wrong Signals

Figure 1 Underwriting Cycle – Accident Year (AY) vs. Calendar Year (CY)

Apparent vs. Actual Market Signals – Operating Results

Sch P Year	CY	AY @2010	CY vs. AY Difference	"Breakeven"	"Apparent" Market	"Actual" Market
1980	100%	121%	21.7%	95.0%	Transitional	Soft
1981	101%	134%	33.0%	95.0%	Transitional	Soft
1982	110%	142%	32.8%	95.0%	Transitional	Soft
1983	109%	153%	44.6%	95.0%	Transitional	Soft
1984	118%	121%	2.3%	95.0%	Soft	Soft
1985	130%	96%	-33.5%	95.0%	Soft	Transitional
1986	109%	72%	-36.4%	95.0%	Transitional	Hard
1987	92%	62%	-29.8%	95.0%	Transitional	Hard
1988	84%	60%	-24.1%	95.0%	Transitional	Hard
1989	61%	62%	0.9%	95.0%	Hard	Hard
1990	69%	73%	4.2%	95.0%	Hard	Hard
1991	67%	91%	24.6%	95.0%	Hard	Transitional
1992	76%	95%	19.1%	95.0%	Hard	Transitional
1993	65%	100%	34.6%	95.0%	Hard	Transitional
1994	69%	96%	27.2%	95.0%	Hard	Transitional
1995	71%	117%	46.0%	95.0%	Hard	Soft
1996	76%	119%	43.0%	95.0%	Hard	Soft
1997	78%	134%	56.0%	95.0%	Hard	Soft
1998	88%	151%	63.7%	95.0%	Transitional	Soft
1999	106%	143%	37.4%	95.0%	Transitional	Soft
2000	106%	136%	29.7%	95.0%	Transitional	Soft
2001	136%	138%	2.8%	95.0%	Soft	Soft
2002	130%	122%	-7.4%	95.0%	Soft	Soft
2003	122%	89%	-33.0%	95.0%	Soft	Transitional
2004	96%	72%	-24.0%	95.0%	Transitional	Hard
2005	87%	70%	-17.4%	95.0%	Transitional	Hard
2006	72%	70%	-2.4%	95.0%	Hard	Hard
2007	68%	79%	11.8%	95.0%	Hard	Hard
2008	70%	89%	19.0%	95.0%	Hard	Transitional
2009	72%	96%	24.8%	95.0%	Hard	Transitional
2010	64%	104%	39.9%	95.0%	Hard	Transitional
2011					?	?

Red Years = CY indications -> write MORE business, while actual results much WORSE (average=41% worse)
Blue Years = CY indications -> write LESS business, while actual results much BETTER (average = 29% better)
Green Years = Actual Results TBD after Information Emerges

Actuarial Overconfidence

Figure 3 Information Gap—Calendar Year (CY) vs. Accident Year (AY)

# Years	Actual - AY			
Apparent - CY	**Hard**	**Transitional**	**Soft**	**Total**
Hard	4	7	3	14
Transitional	5	0	7	12
Soft	0	2	3	5
Total	9	9	13	31

Avg. LR Gap	Actual - AY			
Apparent - CY	**Hard**	**Transitional**	**Soft**	**Total**
Hard	3.6%	27.0%	48.4%	24.9%
Transitional	-26.4%	0.0%	37.5%	10.9%
Soft	0.0%	-33.2%	-0.8%	-13.8%
Total	-13.0%	13.6%	31.2%	

Source: *Physician Insurer*, Fourth Quarter 2011, a publication of the Physician Insurers Association of America; J. Buchanan pg. 33

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Diagnostics for Changes in Case Reserve Adequacy
Industry Net Medical Malpractice Only – Heat Map
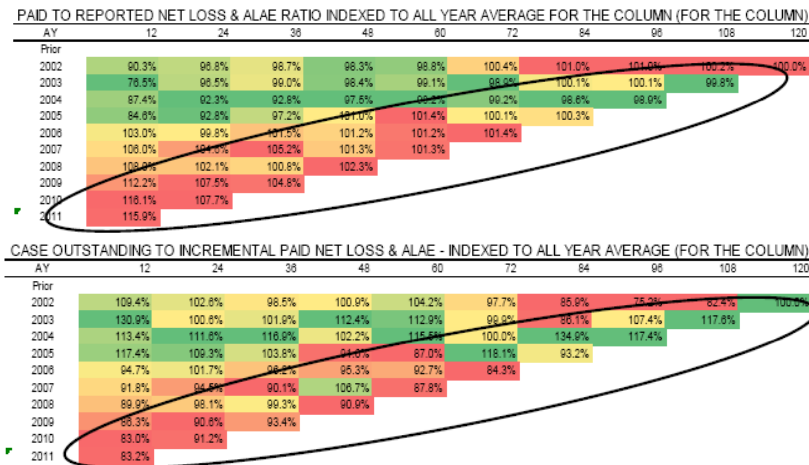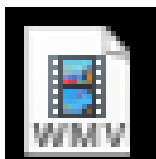

Source: Rich Lino – Oliver Wyman – May 2012

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