I-2: Overlooking Tails and Related Impacts

CARe Seminar, June 3-4, 2019
Bermuda

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Including materials from CARe 2018:

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I-2: Overlooking Tails Overview

➢Actuaries are faced with a multitude of decisions when either pricing contracts or establishing reserves. One of the most common decisions to make when confronted with less than fully credible data is establishing what development factors to select, how to weigh them with a library of layered incurred and paid industry benchmarks, and quite importantly trying to assess the length of the "tail".

➢This session will provide updated materials to help solve a "hypothetical real life example" of items typically found in an excess casualty submission, a set of industry benchmarks, and ingenuity to try to derive various pricing, reserving, and aggregate distribution indications. The "real" issue is that the illustrative data is 8x8, while it is expected that the actual development could go to 20+ years. The analysis will be tackled in different ways: one from a classical probability approach using various transforming, scaling, and duration mechanisms. The other approach will be summarized using a Bayesian Loss Development Credibility model to try to build a maximum likelihood estimate that compromises between the actual and benchmark patterns when confronted with wide ranges.

➢This session will also provide an update to research linking loss development factors and profitability, including more recently, impacts of potentially lengthening loss development factors ("longer tails") in various markets, and related impacts on rate changes. Competition hypotheses will be presented and tested for companies that overlook their tails, and the resulting impact on pricing models and profitability levels.
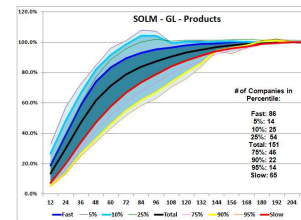

Overlooking Tails
John Buchanan FCAS, ISO
Aleksey Popelyukhin PhD, Swiss Re
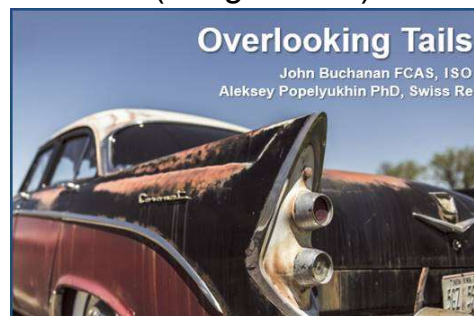
I-2: Overlooking Tails Agenda

- **Overview – John 15 mins**
  - Introducing the hypothetical submission
  - Case study data and benchmarks
 - How are benchmark "Penguins" put together?
- **Illustrative Ultimate Loss and Reserve Estimates – Aleksey 35 mins**
  - Initial investigation of information including assessing the tail
  - Techniques to test and extrapolate beyond the data given
  - Additional considerations
  - Alternate approach *(from CARe 2018-Dave Clark)*
- **Wrap-up and Further Investigation – John 15 mins**
  - How did the presenters do?
  - Additional run-off testing for lengthening tails
  - Further competitive marketplace investigation of profit, LDF speed, and rate change impacts
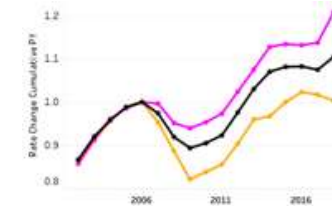
QA 10 mins

To the extent there is time, will pause for questions after each of the main sections. Otherwise, will have questions at the end.

Overlooking Tails

Case Study Introduction Slides

Overlooking Tails Submission

Illustrative

CARe 2018 - Overlooking Tails Submission
Illustrative Account Triangle - Skipper Insurance Company
Casualty Treaty Placement Slip

Looking for Expected Loss Costs for:
First Casualty Excess - 500x500k
ALAE ProRata
With and without AAD of 500k
With and without loss free discount

Management Info:
In business 20+ years
Relatively consistent book of niche countrywide Casualty business
Management and reserving philosophy consistency

Skipper

"We appreciate your business, and thanks for all the fish!"

Hypothetical Account – Information and amounts purely for illustration of reserving and pricing principles; all pictures from J. Buchanan

Illustrative

Data Provided:

Excess triangles - paid and incurred (Indemnity+ALAE PR), counts and amounts (8-year N-1, N-2,… - all detrended 3% to N-1)

Ultimate on-level earned premium and exposure trend (8-year; Subject premium = 20M)

Benchmark generic casualty "penguins" - 10/Fast/All/Slow/90 (Skipper one of hundreds of aggregated companies)

 - 4.9Mx100k, 400x100, 500x500; reported and paid (all detrended 3%)

Individual claims > 250k (indemnity only)

Policy limits and deductibles from Skipper

Benchmark policy limit distribution

Exercise #1

Estimate total reserves for loss portfolio transfer pricing (Aleksey)

Exercise #2

Price Policy year N losses and distribution (Dave)

Lining up for Penguin Limbo!!

Hypothetical Account – Amounts purely for illustration

Overlooking Tails Submission

The submission included aggregated 8x8 triangles, for 4.9Mx100k, 400x100k, and 500k500k, with relatively little overall credibility (89 claims>100k).

The total triangle, and underlying layer of 400x100 shows a fair amount of continuing development, the target layer of 500x500, did not. Inspecting the paid and incurred triangles also indicates a fair amount is still outstanding in the latter part of the triangles.

But how much credibility can you give this?

CARe 2018 - Overlooking Tails Submission
Illustrative Account Triangle - Skipper Insurance Company

4.9M x 100K

Incurred $ Indemnity+Alae (Prorata) Triangle

Threshold Min	Threshold Max		12	24	36	48	60	72	84	96
81,310	4,065,457	AY 2009	14,700	933,700	1,867,400	2,305,400	2,806,400	3,125,900	4,014,400	4,963,600
83,749	4,187,421	AY 2010	196,900	1,060,500	1,786,100	2,517,000	3,641,500	4,262,700	4,794,700	
86,261	4,313,043	AY 2011	459,000	1,369,100	2,158,000	2,684,000	2,805,600	2,744,700		
88,849	4,442,435	AY 2012	215,700	527,800	1,507,700	2,731,100	2,541,100			
91,515	4,575,708	AY 2013	332,100	1,508,100	3,096,400	3,965,300				
94,260	4,712,979	AY 2014	284,800	1,206,900	2,292,300					
97,088	4,854,368	AY 2015	132,800	262,100						
100,001	5,000,000	AY 2016	20,100							
			12,752,000	18,249,900	21,583,900					

Incurred # Occurrence Indemnity Triangle

Threshold Min	Threshold Max		12	24	36	48	60	72	84	96
81,310	4,065,457	AY 2009	1	4	7	9	11	14	16	19
83,749	4,187,421	AY 2010	3	8	12	15	16	19	21	
86,261	4,313,043	AY 2011	2	6	8	10	12	14		
88,849	4,442,435	AY 2012	2	5	7	10	11			
91,515	4,575,708	AY 2013	2	7	12	15				
94,260	4,712,979	AY 2014	2	6	7					
97,088	4,854,368	AY 2015	2	3						
100,001	5,000,000	AY 2016	1							
			55	75	89					

Illustrative

Submission from Skipper Insurance Company

Reported (paid+case) Development Triangles

400K x 100K

Incurred $ Indemnity+Alae (Prorata) Triangle

	12	24	36	48	60	72	84	96
AY 2009	14,700	462,500	1,082,700	1,675,200	2,156,100	2,458,500	3,347,000	4,296,200
AY 2010	196,900	1,033,300	1,758,900	2,517,000	3,455,800	3,891,300	4,423,300	
AY 2011	275,800	946,400	1,738,400	1,956,200	2,077,100	2,383,000		
AY 2012	215,700	527,800	1,192,700	2,126,000	2,009,200			
AY 2013	332,100	1,447,500	2,562,800	3,170,400				
AY 2014	284,800	1,141,400	1,758,600					
AY 2015	132,800	262,100						
AY 2016	20,100							

Number of Losses:　89

Age-to-Age (ATA) Factors

	12-24	24-36	36-48	48-60	60-72	72-84	84-96
AY 2009	31.463	2.341	1.547	1.287	1.140	1.361	1.284
AY 2010	5.248	1.702	1.431	1.373	1.126	1.137	
AY 2011	3.431	1.837	1.125	1.062	1.147		
AY 2012	2.447	2.259	1.783	0.945			
AY 2013	4.359	1.771	1.237				
AY 2014	4.008	1.541					
AY 2015	1.974						
Avg	4.007	1.816	1.373	1.172	1.136	1.224	1.284

500K x 500K

Incurred $ Indemnity+Alae (Prorata) Triangle

	12	24	36	48	60	72	84	96
AY 2009	-	322,700	537,600	431,700	450,900	468,000	468,000	468,000
AY 2010	-	27,200	27,200	-	185,700	371,400	371,400	
AY 2011	183,300	422,700	419,500	603,500	604,200	361,700		
AY 2012	-	-	315,300	605,100	531,900			
AY 2013	-	60,600	463,600	678,500				
AY 2014	-	65,500	482,900					
AY 2015	-	-						
AY 2016	-							

Number of Losses:　10.5

Age-to-Age (ATA) Factors

	12-24	24-36	36-48	48-60	60-72	72-84	84-96
AY 2009	inf	1.666	0.803	1.044	1.038	1.000	1.000
AY 2010	inf	1.000	0.000	inf	2.000	1.000	
AY 2011	2.306	0.992	1.439	1.001	0.599		
AY 2012	inf	inf	1.919	0.879			
AY 2013	inf	7.650	1.464				
AY 2014	inf	7.373					
AY 2015	inf						
Avg	4.903	2.499	1.315	1.081	0.968	1.000	1.000

Source: CARe June 2018 IT1- Dave Clark Presentation

Overlooking Tails Submission

Historical premium was on-leveled using historical rate changes. Benchmark policy limit information was given, with attachments and limits from submission also supplied on individual large claim listing.

If this information isn't supplied, adjustments would need to be made accordingly.

Ultimate On-Level Earned Premium

Accident Year

2009	18,432,700
2010	17,258,900
2011	17,916,600
2012	18,544,100
2013	18,470,700
2014	19,199,500
2015	19,157,800
2016	19,374,100
	148,354,400

Skipper

Policy Limit Distribution - from LOB Family of Benchmarks

	300k	1M	5M
2008	10.0%	85%	5.0%
2009	9.5%	85%	5.5%
2010	9.0%	85%	6.0%
2011	8.0%	85%	7.0%
2012	7.5%	85%	7.5%
2013	7.0%	85%	8.0%
2014	6.5%	85%	8.5%
2015	5.5%	85%	9.5%
2016	5.0%	85%	10.0%

Limits tend to cluster around 3 sizes

Submission from Skipper Insurance Company

Munich RE

Preliminaries: Check for Stability and Policy Limit Drift

Year	Onlevel Premium	Policy Limit Profile 300,000	Policy Limit Profile 1,000,000	Policy Limit Profile 5,000,000	Allocation of Premium to Layer 400 x 100	Allocation of Premium to Layer 500 x 500
2008	na	10.0%	85.0%	5.0%		
2009	18,432,700	9.5%	85.0%	5.5%	26.2%	11.6%
2010	17,258,900	9.0%	85.0%	6.0%	26.2%	11.6%
2011	17,916,600	8.0%	85.0%	7.0%	26.2%	11.7%
2012	18,544,100	7.5%	85.0%	7.5%	26.2%	11.8%
2013	18,470,700	7.0%	85.0%	8.0%	26.2%	11.8%
2014	19,199,500	6.5%	85.0%	8.5%	26.1%	11.9%
2015	19,157,800	5.5%	85.0%	9.5%	26.1%	12.0%
2016	19,374,100	5.0%	85.0%	10.0%	26.1%	12.0%
Future	20,000,000	5.0%	85.0%	10.0%	26.1%	12.0%

All numbers for illustration only

Mata & Verheyen "An Improved Method for Experience Rating Reinsurance Treaties using Exposure Rating Techniques" (2005)
http://www.casact.org/pubs/forum/05spforum/05spf171.pdf

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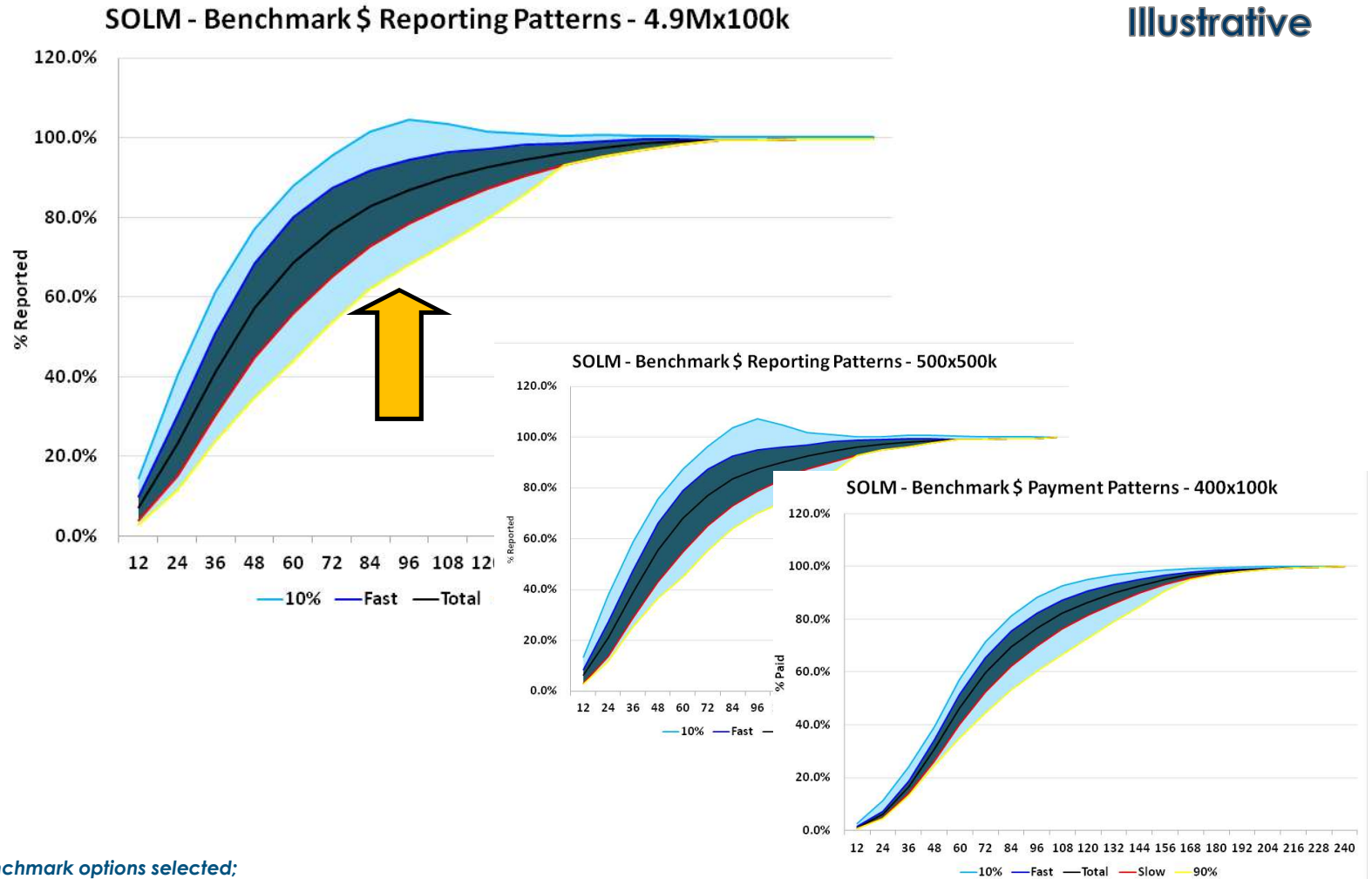*Source: CARe June 2018 IT1- Dave Clark Presentation*

Overlooking Tails Submission

A set of general casualty incurred and paid benchmark patterns by layer and "company speed" was supplied. These show the significant variation in company loss development factors.

Depending upon the market, these variations can be significant.

SOLM - Benchmark $ Reporting Patterns - 4.9Mx100k

SOLM - Benchmark $ Reporting Patterns - 500x500k
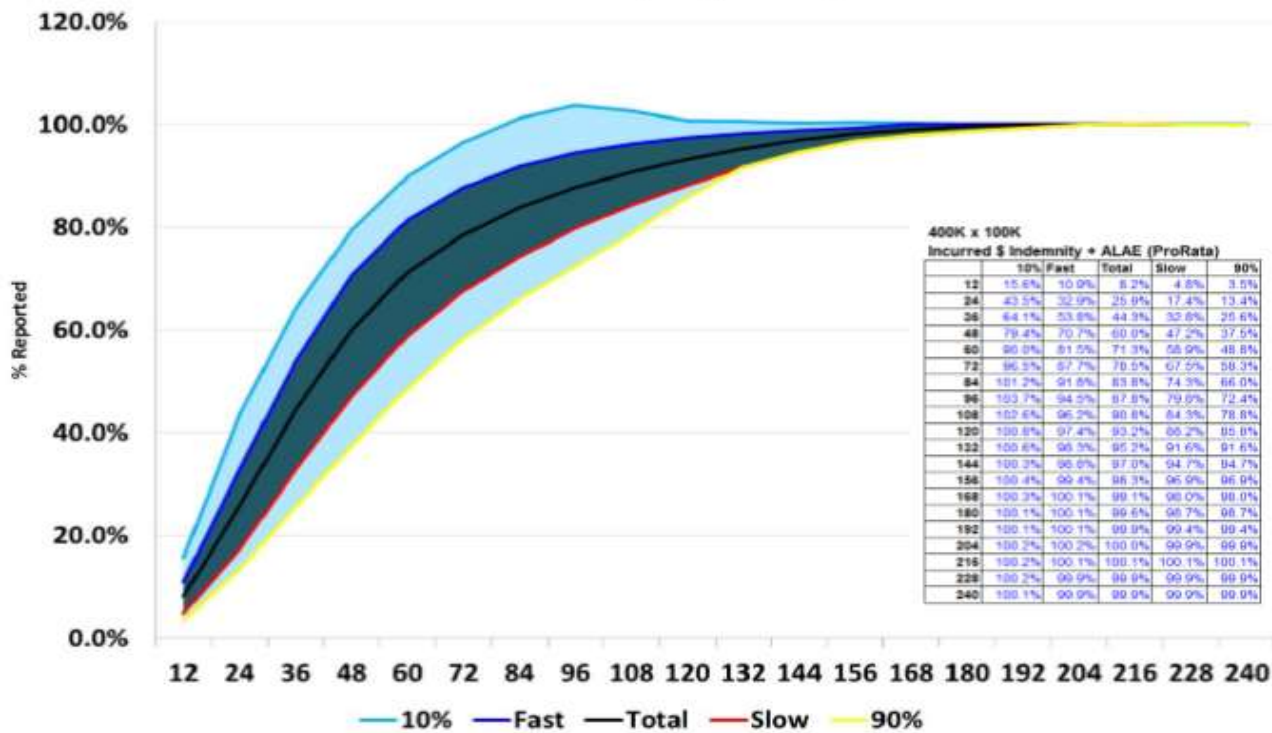
SOLM - Benchmark $ Payment Patterns - 400x100k

Note: Values shown may not match benchmark options selected;
See Verisk Monday Webinar on link between LDF Speed and Profitability (9/11/2017 – J. Buchanan and M. Wasserman

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Overlooking Tails Submission

The general casualty benchmarks were established through a company ranking exercise with 20-year triangles. The tail to pick at 8 years can run from close to only 60% reported for the slowest companies, to being over reserved for the fastest companies for this market.

The LDF speed can also dramatically affect profitability.
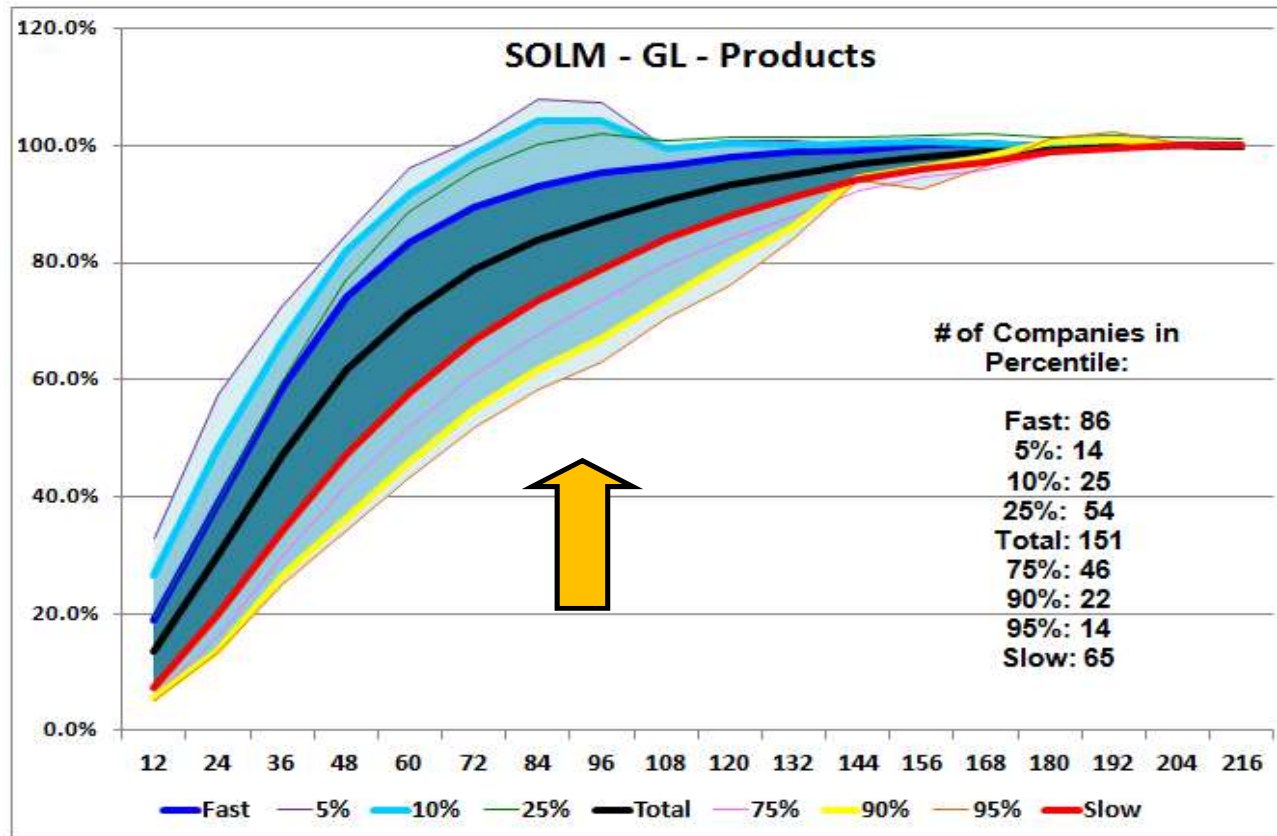
SOLM - GL - Products

# of Companies in Percentile:

Fast: 86
5%: 14
10%: 25
25%: 54
Total: 151
75%: 46
90%: 22
95%: 14
Slow: 65

Legend: Fast — 5% — 10% — 25% — Total — 75% — 90% — 95% — Slow

Note: Values shown may not match benchmark options selected;
See Verisk Monday Webinar on link between LDF Speed and Profitability (9/11/2017 – J. Buchanan and M. Wasserman

Credibility Theory: Creating a Prior Distribution

SOLM - Benchmark $ Reporting Patterns

400K x 100K
Incurred $ Indemnity + ALAE (ProRata)

	10% Fast	Total	Slow	90%
12	15.6% 10.9%	8.2%	4.6%	3.5%
24	43.5% 32.9%	25.9%	17.4%	13.4%
36	64.1% 53.8%	44.9%	32.8%	26.6%
48	78.4% 70.7%	60.0%	47.2%	37.5%
60	90.0% 81.5%	71.3%	58.9%	48.8%
72	96.5% 87.7%	70.5%	67.5%	58.3%
84	101.2% 91.6%	83.6%	74.3%	66.0%
96	103.7% 94.5%	87.6%	79.6%	72.4%
108	102.6% 96.2%	90.8%	84.3%	78.8%
120	100.8% 97.4%	93.2%	88.2%	85.0%
132	100.6% 96.5%	95.2%	91.6%	91.6%
144	100.2% 98.0%	97.0%	94.7%	94.7%
156	100.4% 99.4%	98.3%	96.9%	96.9%
168	100.3% 100.1%	99.1%	98.0%	98.0%
180	100.1% 100.1%	99.6%	98.7%	98.7%
192	100.1% 100.1%	99.9%	99.4%	99.4%
204	100.2% 100.2%	100.0%	99.9%	99.9%
216	100.2% 100.1%	100.1%	100.1%	100.1%
228	100.2% 99.9%	99.9%	99.9%	99.9%
240	100.1% 99.9%	99.9%	99.9%	99.9%

Legend: — 10% — Fast — Total — Slow — 90%

In addition to the "client" data for Skipper Insurance Company, we have "industry" data showing the range of patterns collected by ISO.

For example:
10% = the average of the quickest 10% of companies in the SOLM database.

The "variance of hypothetical means" would be narrower than this range if we could control for the variance from individual companies.

All numbers for illustration only

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Source: CARe June 2018 IT1- Dave Clark Presentation

CARe 2018 - Overlooking Tails Submission
Illustrative Account Triangle - Skipper Insurance Company

4.9M x 100K

Incurred $ Indemnity+Alae (Prorata) Triangle

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86,261	4,313,043	AY 2011	459,000	1,369,100	2,158,000	2,684,000	2,805,600	2,744,700		
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97,088	4,854,368	AY 2015	132,800	262,100						
100,001	5,000,000	AY 2016	20,100							
			12,752,000	18,249,900	21,583,900					

Illustrative

A wide array of benchmarks are available. The selection of the tail can often make or break an analysis.

How do you choose, and what adjustments do you make, with limited information?

What pattern do you give the reserving actuaries for their actual vs expected testing?
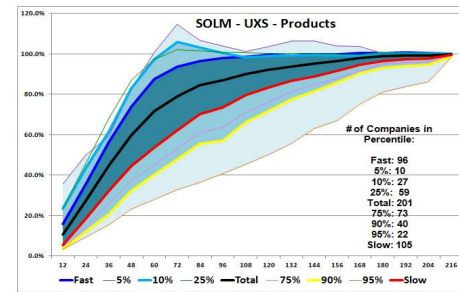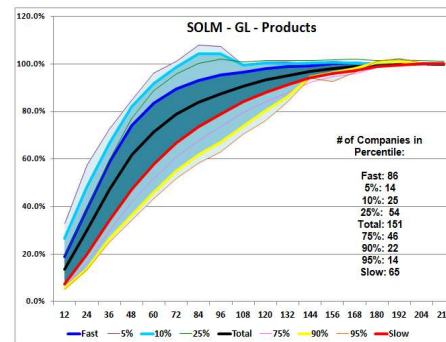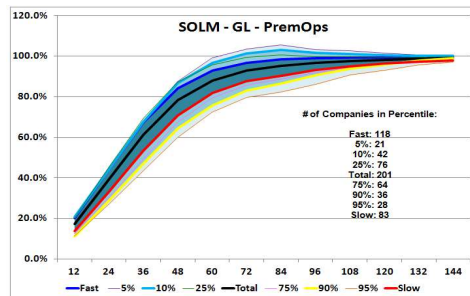
Note: Values shown may not match benchmark options selected

First: perform actual vs expected all industry LDF comparison on each individual company

Illustrative

4Mx1M - Payment Pattern (3% detrended threshold)

Devt	E&O				Company A			
	$ Num	$ Den	Actual ATA	Expected Actual	$ Num	$ Den	Actual ATA	Expected Actual
228								
216	105,531,247	105,531,247	1.000	105,531,247	8,198,446	8,198,446	1.000	8,198,446
204	293,942,535	293,942,535	1.000	293,942,535	18,923,710	19,045,099	0.994	19,045,099
192	475,642,114	472,575,957	1.006	475,642,114	31,612,986	31,551,259	1.002	31,755,969
180	705,566,867	705,479,590	1.000	705,566,867	45,409,833	45,493,492	0.998	45,499,120
168	1,024,718,508	1,020,904,699	1.004	1,024,718,508	57,494,522	57,458,763	1.001	57,673,413
156	1,388,421,724	1,383,081,587	1.004	1,388,421,724	66,378,209	65,253,074	1.017	65,505,019
144	1,688,270,963	1,677,909,614	1.006	1,688,270,963	73,712,551	73,181,641	1.007	73,633,549
132	1,973,912,149	1,968,595,712	1.003	1,973,912,149	80,527,589	80,389,627	1.002	80,606,729
120	2,339,797,103	2,319,972,111	1.009	2,339,797,103	87,793,749	86,799,305	1.011	87,541,036
108	2,726,649,787	2,679,039,960	1.018	2,726,649,787	93,348,932	92,564,040	1.008	94,209,017
96	3,209,684,397	3,096,986,698	1.036	3,209,684,397	104,252,613	104,864,603	0.994	108,680,570
84	3,580,259,532	3,432,496,791	1.043	3,580,259,532	112,582,200	114,178,679	0.986	119,093,863
72	3,863,973,715	3,566,658,852	1.083	3,863,973,715	124,331,344	128,478,419	0.968	139,188,314
60	4,111,432,098	3,647,257,265	1.127	4,111,432,098	149,898,550	149,394,828	0.996	158,183,518
48	4,065,488,874	3,219,405,713	1.263	4,065,488,874	150,806,971	151,100,620	0.998	190,810,958
36	3,541,277,111	2,318,984,920	1.527	3,541,277,111	157,533,788	148,561,557	1.060	228,400,445
24	2,522,512,650	1,205,975,660	2.092	2,522,512,650	155,221,988	140,510,957	1.105	293,903,665
12	1,354,693,563	298,927,949	4.532	1,354,693,563	143,717,469	139,258,281	1.032	631,096,214
Total (all)	38,971,774,937	33,413,646,968		38,971,774,937	1,651,545,453	1,628,212,690		2,433,024,946
Total (incl maturities)	31,553,291,613	29,589,838,431		31,553,291,613	1,195,072,208	1,198,881,895		1,279,624,621
Actual vs Expected	1,963,453,182	1.00		1,963,453,182	(3,809,687)	-0.05		80,742,726
Difference - Adverse (Fav)	-	0.0%			(84,552,413)	-7.1%		
Total Premium	52,596,745,930				221,005,118			
5yr Premium	19,590,875,897				73,547,439			
Total Loss	5,906,994,239				164,669,711			
5yr Loss	1,142,366,853				27,860,921			
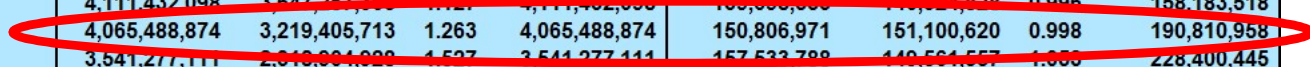
Second: rank all the companies from fastest to slowest and bifurcate so roughly equal volumes, with emphasis on tail area and excess layer 4.9m xs 100k

Illustrative

### SOLM 2018 v1- GL-Prem Ops - Bifurcation for Fast / Slow Selections (using 12/31/2017 data)

84:Ultimate

Split point				GL-PremOps	# Cos	Prem	XS Loss		57.7%	50.4%	54.4%	
1.00				4.9Mx100K	201	43,967,939,982	28,849,402,033		116	22,150,952,970	15,699,380,894	
									42.3%	49.6%	45.6%	
									85	21,816,987,012	13,150,021,139	

Total ATU	Fast ATU	Slow ATU	Incl/Excl	Devt	GL-PremOps $ Num	$ Den	Actual ATA	Expected	-1 Faster $ Num	$ Den	Actual ATA	Expected	1 Slower $ Num	$ Den	Actual ATA	Expected
1.004	0.996	1.019	1	240	1,661,547,084	1,654,234,622	1.004	1,661,547,084	1,038,808,755	1,043,163,084	0.996	1,047,774,334	622,738,329	611,071,538	1.019	613,772,749
1.008	0.997	1.027	1	228	3,384,483,858	3,371,351,494	1.004	3,384,483,858	2,090,397,933	2,087,350,967	1.001	2,095,481,788	1,294,085,925	1,284,000,526	1.008	1,289,002,070
1.011	0.998	1.032	1	216	5,106,153,079	5,094,693,509	1.002	5,106,153,079	3,139,899,869	3,137,881,350	1.001	3,144,939,434	1,966,253,210	1,956,812,158	1.005	1,961,213,645
1.013	0.999	1.036	1	204	6,820,113,248	6,806,580,867	1.002	6,820,113,248	4,201,033,013	4,197,797,055	1.001	4,206,142,829	2,619,080,235	2,608,783,812	1.004	2,613,970,418
1.014	0.999	1.040	1	192	8,448,638,173	8,433,413,372	1.002	8,448,638,173	5,207,190,767	5,203,502,489	1.001	5,212,896,347	3,241,447,405	3,229,910,883	1.004	3,235,741,825
1.017	1.000	1.044	1	180	9,804,469,955	9,783,743,333	1.002	9,804,469,955	6,020,140,947	6,015,830,635	1.001	6,028,575,025	3,784,329,008	3,767,912,698	1.004	3,775,894,929
1.019	1.001	1.051	1	168	11,030,540,631	10,999,833,006	1.003	11,030,540,631	6,730,665,775	6,727,408,353	1.000	6,746,188,886	4,299,874,855	4,272,424,654	1.006	4,284,351,745
1.022	1.001	1.056	1	156	12,234,012,463	12,205,984,415	1.002	12,234,012,463	7,395,394,683	7,389,041,653	1.001	7,406,008,774	4,838,617,780	4,816,942,763	1.004	4,828,003,689
1.024	1.003	1.058	1	144	13,490,438,306	13,465,044,264	1.002	13,490,438,306	8,058,034,121	8,045,124,602	1.002	8,060,297,091	5,432,404,185	5,419,919,661	1.002	5,430,141,215
1.027	1.005	1.063	1	132	14,821,263,701	14,776,647,337	1.003	14,821,263,701	8,735,843,540	8,719,041,591	1.002	8,745,367,721	6,085,420,162	6,057,605,746	1.005	6,075,895,980
1.033	1.007	1.075	1	120	16,345,288,400	16,249,539,428	1.006	16,345,288,400	9,442,628,945	9,423,378,087	1.002	9,478,904,508	6,902,659,455	6,826,161,340	1.011	6,866,383,892
1.039	1.007	1.091	1	108	17,729,260,707	17,616,677,265	1.006	17,729,260,707	10,126,061,932	10,124,905,740	1.000	10,189,611,287	7,603,198,775	7,491,771,525	1.015	7,539,649,420
1.048	1.009	1.110	1	96	19,023,780,446	18,859,815,680	1.009	19,023,780,446	10,829,164,300	10,804,706,219	1.002	10,898,640,918	8,194,616,146	8,055,109,462	1.017	8,125,139,528
1.066	1.015	1.144	1	84	20,286,233,464	19,961,590,512	1.016	20,286,233,464	11,498,303,185	11,432,167,337	1.006	11,618,093,030	8,787,930,279	8,529,423,175	1.030	8,668,140,434
1.091	1.032	1.182	0	72	21,437,639,012	20,935,078,236	1.024	21,437,639,012	12,151,583,867	11,950,243,363	1.017	12,237,117,073	9,286,055,145	8,984,834,873	1.034	9,200,521,939
1.154	1.077	1.272	0	60	22,279,509,217	21,070,489,894	1.057	22,279,509,217	12,612,261,718	12,088,662,630	1.043	12,782,307,001	9,667,247,499	8,981,827,264	1.076	9,497,202,216
1.297	1.189	1.465	0	48	22,569,080,671	20,079,255,180	1.124	22,569,080,671	12,836,629,051	11,629,982,634	1.104	13,072,099,234	9,732,451,620	8,449,272,547	1.152	9,496,981,437
1.652	1.484	1.921	0	36	21,541,571,344	16,907,421,185	1.274	21,541,571,344	12,384,707,471	9,923,315,927	1.248	12,643,194,706	9,156,863,873	6,984,105,258	1.311	8,898,376,639
2.559	2.244	3.079	0	24	18,067,232,726	11,665,472,585	1.549	18,067,232,726	10,567,368,199	6,985,997,540	1.513	10,819,762,548	7,499,864,527	4,679,475,045	1.603	7,247,470,178
5.767	4.829	7.462	0	12	12,385,531,409	5,495,647,499	2.254	12,385,531,409	7,387,511,271	3,433,472,460	2.152	7,738,011,036	4,998,020,138	2,062,175,039	2.424	4,647,520,373
Total (all)					278,466,787,896	255,432,513,683		278,466,787,896	162,453,629,345	150,362,973,716		164,171,413,573	116,013,158,551	105,069,539,967		114,295,374,323
Total (incl maturities)					160,186,223,515	159,279,149,103		160,186,223,515	94,513,567,767	94,351,299,162		94,878,921,974	65,672,655,748	64,927,849,941		65,307,301,541
Actual vs Expected					907,074,412	1.00		907,074,412	162,268,605	0.31		527,622,812	744,805,807	1.96		379,451,600
Difference - Adverse (Favorable)					-	0.0%			(365,354,207)	-0.4%			365,354,207	0.6%		

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How are "Penguins" Put Together? – Resulting Split Patterns

Third: aggregate all the grouped companies, including doing the same procedure using percentiles as well as faster/slower companies
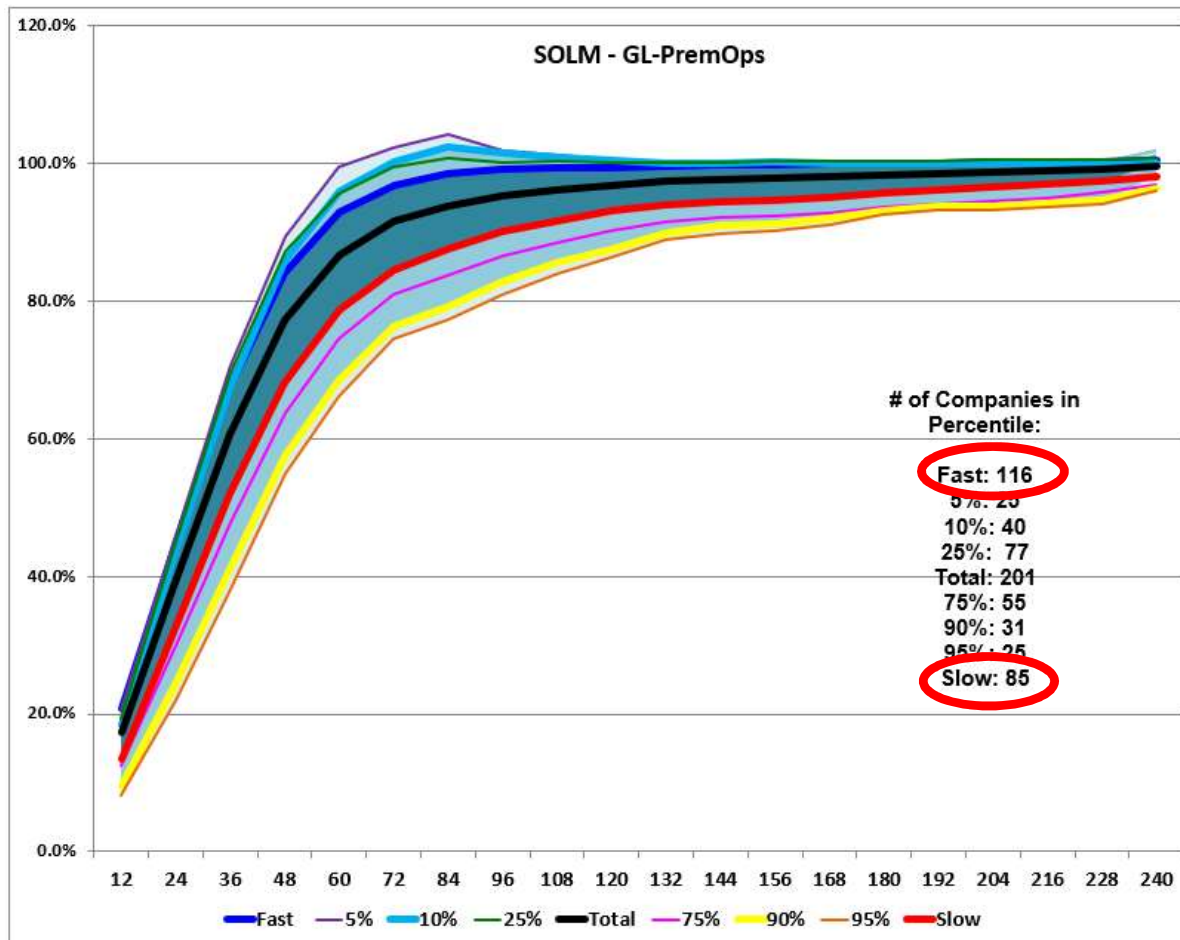
Illustrative

John's Wrap-up Slides

Credibility Theory: Application

The same procedure is followed for the 500x500 layer.

Instead of the initial 33.33% weights for each benchmark, however, we can start with the result from the 400x100 layer. Because of the low credibility for the 500x500 layer, the final pattern is close to the "slow" benchmark.

Loss Development Factors (LDF to Ultimate)

	12	24	36	48	60	72	84	96	108	120
Fast	9.909	3.242	1.866	1.399	1.203	1.084	1.038	1.025	1.020	1.015
Medium	16.705	4.811	2.474	1.760	1.462	1.286	1.195	1.143	1.109	1.081
Slow	33.051	7.635	3.480	2.416	1.965	1.638	1.454	1.343	1.267	1.201
Average	29.273	7.087	3.303	2.303	1.880	1.582	1.414	1.313	1.244	1.184

A Posteriori Weights

Fast	0.16%
Medium	12.81%
Slow	87.03%

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Final Pricing: Experience Rating 500x500 Layer

Experience Rating 500K xs 500K

Accident Year	Onlevel Premium	Exposure Trend	Trended Premium	LDF	Premium / LDF	500x500 Reported	Severity Trend	Frequency Trend	Policy Limit Drift	500x500 Trended	Rate
2009	18,432,700	1.083	19,959,973	1.313	15,201,243	468,000	1.267	1.000	1.037	615,038	4.05%
2010	17,258,900	1.072	18,503,877	1.414	13,086,268	371,400	1.230	1.000	1.033	471,909	3.61%
2011	17,916,600	1.062	19,018,832	1.582	12,025,363	361,700	1.194	1.000	1.025	442,533	3.68%
2012	18,544,100	1.051	19,490,035	1.880	10,365,628	531,900	1.159	1.000	1.020	629,230	6.07%
2013	18,470,700	1.041	19,220,684	2.303	8,345,310	678,500	1.126	1.000	1.016	776,103	9.30%
2014	19,199,500	1.030	19,781,264	3.303	5,988,474	482,900	1.093	1.000	1.012	534,101	8.92%
2015	19,157,800	1.020	19,542,872	7.087	2,757,550	0	1.061	1.000	1.004	0	0.00%
2016	19,374,100	1.010	19,567,841	29.273	668,468	0	1.030	1.000	1.000	0	0.00%
	148,354,400		155,085,378		68,438,304	2,894,400				3,468,914	5.07%
Prospective	20,000,000									1,013,735	5.07%

400xs100 Rate:	32.17%
Exposure-Rating Relativity:	0.461
Expected 500xs500 Rate:	14.83%
Credibility:	75%
Selected 500xs500 Rate:	7.51%
Selected 500xs500 Expected Loss:	1,501,765

All numbers for illustration only

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Source: CARe June 2018 IT1- Dave Clark Presentation

SERVE | ADD VALUE | INNOVATE

Overlooking Tails Wrap-up

Skipper actual pattern behaves like 75th percentile. The two case study selections were slower than 50th% and close to the Slow pattern (about 67th). Both selections were a bit faster than the actual pattern. With 1st presenter (Heads and Tails) through "machine learning fingerprinting exercise" also accurately determining that mystery LOB was indeed "GL-Products C".

Importantly neither presenter was fooled by the apparent lack of development in the 500x500 layer. Instead both relied heavily on the 400x100 layer which had significant indications of longer tail.

Illustrative

SOLM - Benchmark Reporting Patterns

Legend:
- Fast
- 5%
- 10%
- 25%
- Total
- 75%
- 90%
- 95%
- Slow
- Skipper
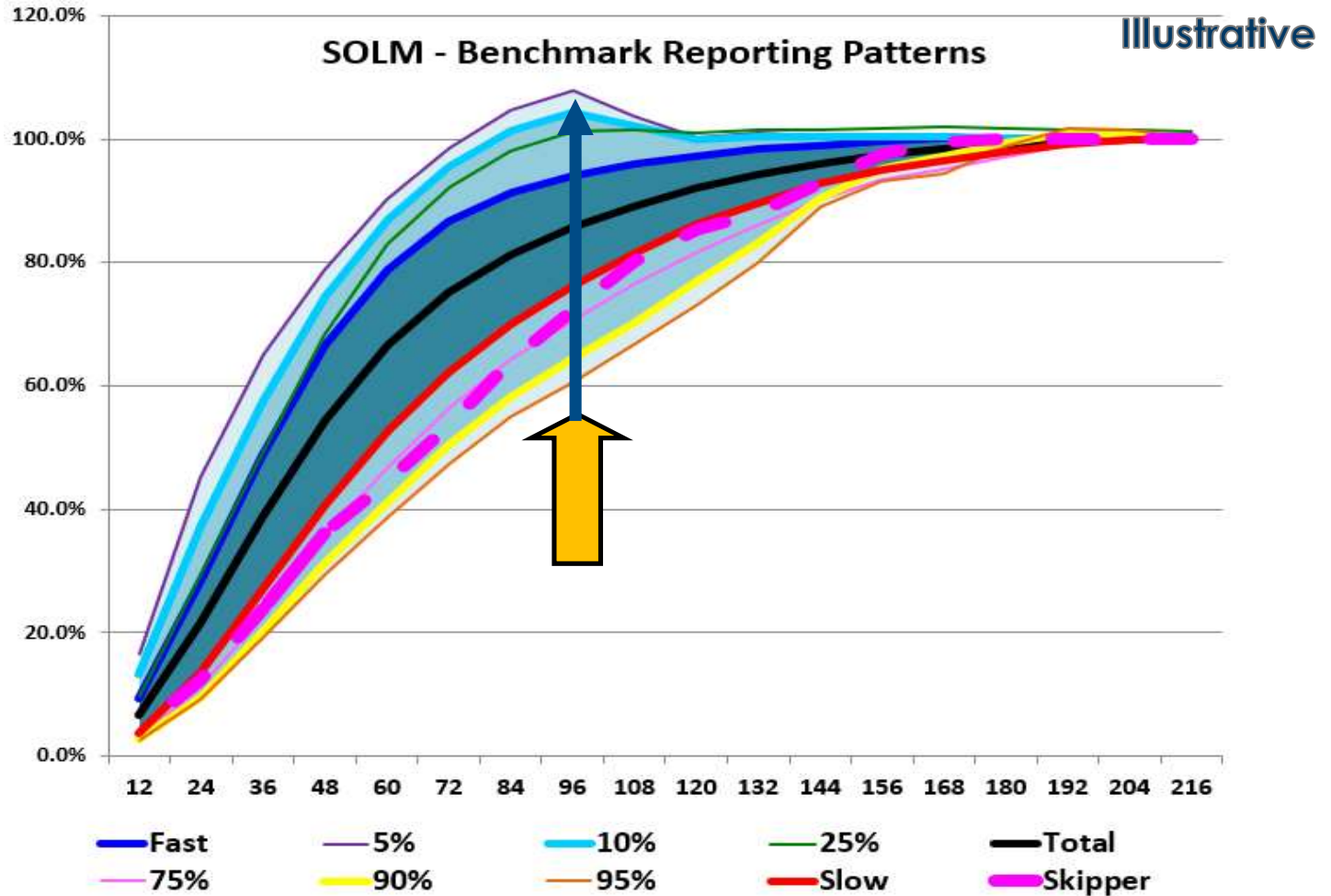
Note: Values shown may not match benchmark options selected;
See Verisk Monday recorded Webinar on link between LDF Speed and Profitability (9/11/2017 – J. Buchanan and M. Wasserman)

Illustrative

Before establishing your "penguins" or "marlins" you should test if benchmarks are getting longer by using an actual vs. expected LDF test.

As illustration with CY 2016, all casualty lines combined excess benchmark LDFs show higher than expected losses for all AYs 2011 to 2015 (27.5% for AY 2013), indicating a lengthening tail.

There was some deterioration for all calendar years from 2012 to 2017, with calendar year 2014 at highest with 16%.

CY=2016   2 Ex Ante

AY	Actual n-2	Actual n-1	7-Yr ATA	Expected n-1	AY	Actual increase	Expected	Actual - Expected	%
1999	3,094,341,139	3,095,984,629	1.001	3,097,322,415	1999	1,643,490	2,981,276	(1,337,786)	-44.9%
2000	3,119,151,694	3,119,389,192	1.001	3,123,808,636	2000	237,498	4,656,942	(4,419,444)	-94.9%
2001	4,186,972,630	4,189,099,690	1.000	4,188,597,889	2001	2,127,060	1,625,259	501,801	30.9%
2002	3,759,246,507	3,763,793,107	1.001	3,762,639,100	2002	4,546,600	3,392,593	1,154,007	34.0%
2003	3,654,492,395	3,655,353,745	1.001	3,658,502,149	2003	861,350	4,009,754	(3,148,404)	-78.5%
2004	3,638,344,690	3,641,830,902	1.002	3,644,049,116	2004	3,486,212	5,704,426	(2,218,214)	-38.9%
2005	3,843,230,912	3,847,056,091	1.002	3,850,075,957	2005	3,825,179	6,845,045	(3,019,866)	-44.1%
2006	4,026,545,702	4,036,659,678	1.002	4,036,169,249	2006	10,113,976	9,623,547	490,430	5.1%
2007	4,296,936,347	4,322,919,389	1.003	4,310,253,005	2007	25,983,042	13,316,658	12,666,384	95.1%
2008	3,985,387,439	3,994,543,554	1.004	4,001,850,825	2008	9,156,114	16,463,386	(7,307,272)	-44.4%
2009	3,775,033,095	3,798,410,795	1.006	3,796,278,022	2009	23,377,699	21,244,927	2,132,773	10.0%
2010	4,003,426,206	4,042,108,064	1.010	4,045,043,725	2010	38,681,858	41,617,519	(2,935,661)	-7.1%
2011	3,940,943,218	4,052,295,946	1.024	4,034,205,065	2011	111,352,728	93,261,847	18,090,881	19.4%
2012	3,636,241,542	3,907,565,271	1.063	3,865,361,479	2012	271,323,729	229,119,557	42,204,172	18.4%
2013	3,261,271,035	3,907,137,548	1.155	3,767,651,769	2013	645,866,513	506,380,734	139,485,779	27.5%
2014	2,580,575,601		1.369	2,540,073,347	2014	4,954,078,948			13.4%
2015	1,099,904,223	2,575,545,051	2.277	2,504,011,844	2015	1,475,640,828	1,404,107,621	71,533,207	5.1%
Sum x2015	58,802,140,353	61,008,802,342		60,691,880,749	Sum x2015	2,206,661,989	1,889,740,395	316,921,594	16.8%
1999-2003	17,814,204,365	17,823,620,364		17,830,870,189	1999-2003	9,415,998	16,665,824	(7,249,826)	-43.5%
2004-2008	19,790,445,091	19,843,009,614		19,842,398,151	2004-2008	52,564,523	51,953,061	611,462	1.2%
2009-2014	21,197,490,897	23,342,172,364		23,018,612,408	2009-2014	2,144,681,467	1,821,121,511	323,559,957	17.8%

CY tots–2014,2015,2016,2017:   60,966,899,121   65,386,260,791   70,233,055,501   75,392,043,543

	24/12	36/24	48/36	60/48
AY 2001	2.231	1.388	1.183	1.054
AY 2002	2.027	1.394	1.164	1.050
AY 2003	2.162	1.367	1.144	1.051
AY 2004	2.170	1.331	1.143	1.061
AY 2005	2.226	1.316	1.157	1.057
AY 2006	2.172	1.318	1.141	1.050
AY 2007	2.115	1.342	1.125	1.045
AY 2008	2.209	1.338	1.135	1.076
AY 2009	2.301	1.313	1.181	1.071
AY 2010	2.168	1.364	1.152	1.076
AY 2011	2.365	1.350	1.181	1.069
AY 2012	2.277	1.418	1.178	1.075
AY 2013	2.444	1.401	1.198	1.085
AY 2014	2.206	1.408	1.187	
AY 2015	2.342	1.436		
AY 2016	2.334			
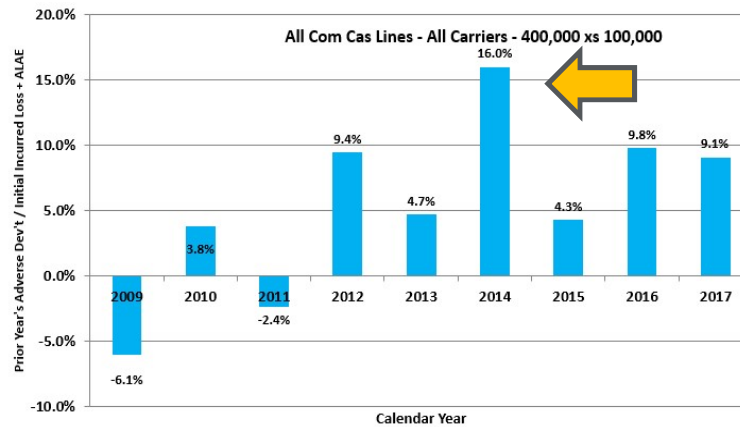
All Com Cas Lines - All Carriers - 400,000 xs 100,000

Prior Year's Adverse Dev't / Initial Incurred Loss + ALAE (Y-axis, -10.0% to 20.0%)

Calendar Year (X-axis):
- 2009: -6.1%
- 2010: 3.8%
- 2011: -2.4%
- 2012: 9.4%
- 2013: 4.7%
- 2014: 16.0%
- 2015: 4.3%
- 2016: 9.8%
- 2017: 9.1%

Sources: Using pre-release SOLM 2018 v2 – mechanical selections of VWA (100% 7-year)
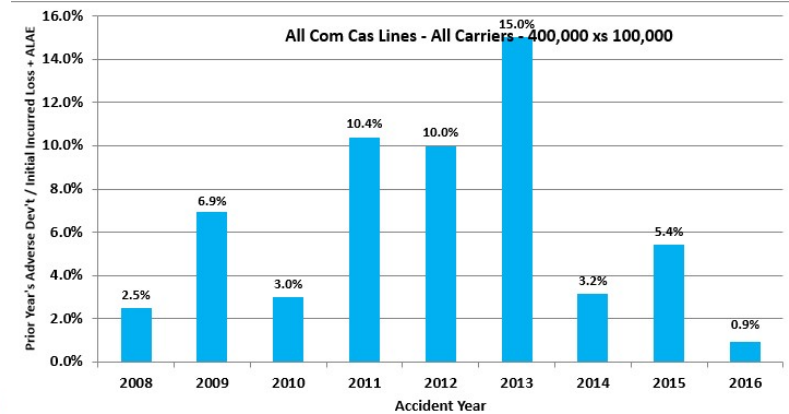
Overlooking Tails Submission – Additional Info – Overall Excess Casualty

Further analyzing across all CY x AY combinations can yield additional indications if tails are lengthening.

The excess LDFs for each accident year from 2008 to 2016 shows some adverse development. Accident year 2013 has lengthened the most thus far, by a total of 15% from an initial estimate of $3.6B for 400x100k.

Illustrative

All Com Cas Lines - All Carriers - 400,000 xs 100,000

Accident Year	Value
2008	2.5%
2009	6.9%
2010	3.0%
2011	10.4%
2012	10.0%
2013	15.0%
2014	3.2%
2015	5.4%
2016	0.9%

ISO SOLM 2018 v1.99a - Development Triangle and Analysis
Ex-ante Reserving Analysis Runoff Tests (through 12/31/2017)

Market Analysis: All Com Cas Lines - All Carriers
Assumptions: Incurred $ Indemnity+Alae (Prorata); 400,000 xs 100,000; 7 yr VWA (100% wt); 3.0% detrended threshold

Runoff % Adv (Fav)	Ultimate Est. INCURRED @12 mos	Adverse (Fav) Devt	AY	CY2017 (1)	CY2016 (2)	CY2015 (3)	CY2014 (4)	CY2013 (5)	CY2012 (6)	CY2011 (7)	CY2010 (8)	CY2009 (9)	CY2008 (10)	CY2007 (11)	CY2006 (12)	CY2005 (13)	CY2004 (14)
0.1%	2,478,154,761	1,793,156	2000	3,560,099	(4,419,444)	29,002	2,860,901	4,305,828	(8,330,668)	1,823,921	(14,339,632)	(1,834,988)	4,842,246	8,289,156	(28,841,380)	(24,586,970)	(37,820,881)
-13.8%	4,313,571,410	(597,384,561)	2001	(822,648)	501,801	(6,602,404)	12,092,613	(13,933,631)	852,575	(15,811,297)	(21,801,320)	(19,853,995)	(10,035,712)	(24,048,207)	(97,941,793)	(14,907,937)	(139,309,537)
-13.7%	4,663,425,672	(640,437,434)	2002	2,575,928	1,154,007	772,498	7,936,744	(7,323,930)	(8,625,358)	4,334,791	(15,140,290)	(20,514,644)	(17,095,661)	(67,390,229)	(126,383,826)	(145,868,544)	(95,752,382)
-10.5%	4,434,989,791	(465,126,068)	2003	1,459,811	(3,148,404)	(1,883,563)	6,952,204	(4,811,807)	(11,744,822)	(4,742,707)	(24,747,424)	(40,819,984)	(5,368,195)	(94,204,234)	(171,492,507)	(131,123,002)	20,548,564
-10.6%	4,418,031,191	(467,368,877)	2004	1,812,394	(2,218,214)	(7,987,820)	(2,489,682)	(10,326,188)	(6,969,837)	(11,966,073)	(34,401,602)	38,265,218	(45,852,023)	(144,411,647)	(189,297,381)	25,004,415	
-6.7%	4,406,220,050	(294,999,927)	2005	(98,618)	(3,019,866)	(8,617,586)	6,687,355	(9,268,111)	2,727,765	(555,887)	(38,797,260)	(45,770,592)	(82,422,429)	(197,548,806)	81,684,107		
-6.9%	4,719,106,744	(325,049,873)	2006	3,836,769	490,438	(8,329,122)	(10,173,961)	9,698,180	5,000,333	(12,821,752)	(54,600,282)	(113,919,530)	(157,758,909)	13,527,971			
-5.0%	5,044,582,911	(249,720,202)	2007	11,658,717	12,666,384	(3,674,259)	3,876,299	8,930,600	23,281,280	(49,726,105)	(138,024,181)	(59,064,915)	(59,644,022)				
2.5%	4,223,338,071	104,908,538	2008	6,574,525	(7,307,272)	(4,631,086)	22,249,847	26,270,226	82,632,162	(48,321,187)	(28,545,382)	55,986,704					
6.9%	3,701,231,232	256,127,853	2009	(81,493)	2,132,773	(10,018,896)	26,310,583	53,854,998	109,216,873	(65,380,747)	140,093,764						
3.0%	4,076,043,385	122,004,788	2010	(342,804)	(2,935,661)	(12,358,499)	65,766,358	21,567,232	74,271,492	(23,963,330)							
10.4%	3,648,922,789	379,271,178	2011	16,437,670	18,090,881	26,210,882	106,156,159	41,761,534	170,614,053								
10.0%	3,614,335,236	361,173,931	2012	298,903	42,203,792	79,690,003	180,933,350	58,047,883									
15.0%	3,641,158,282	546,527,906	2013	75,024,258	139,485,779	122,000,079	210,017,790										
3.2%	4,649,834,487	146,951,391	2014	86,361,727	124,582,394	(64,012,730)											
5.4%	4,427,403,856	239,126,288	2015	167,593,081	71,533,207												
0.9%	4,799,418,439	43,731,246	2016	43,731,246													

Minimum	Maximum	Actual vs Expected Development: AY x CY
-4.5%	-1.3%	Favorable development
-1.3%	-0.5%	Somewhat favorable
-0.5%	0.5%	Within +-.5% of original estimate
0.5%	1.8%	Somewhat adverse
1.8%	5.8%	Adverse development

Sources: Using pre-release SOLM 2018 v2 – mechanical selections of VWA (100% 7-year)

Overlooking Tails Submission – Excess Casualty Tail Lengthening Test

Illustrative

We then tested to see how widespread across the lines is this lengthening tail phenomenon.

The adverse development in recent years is being driven by casualty lines: Commercial Auto, General Liability, Umbrella (24 Markets out of 54 total Markets analyzed). Here, on average, 55.7% of the 1,116 data points show adverse development, while only 30.6% show favorable development.
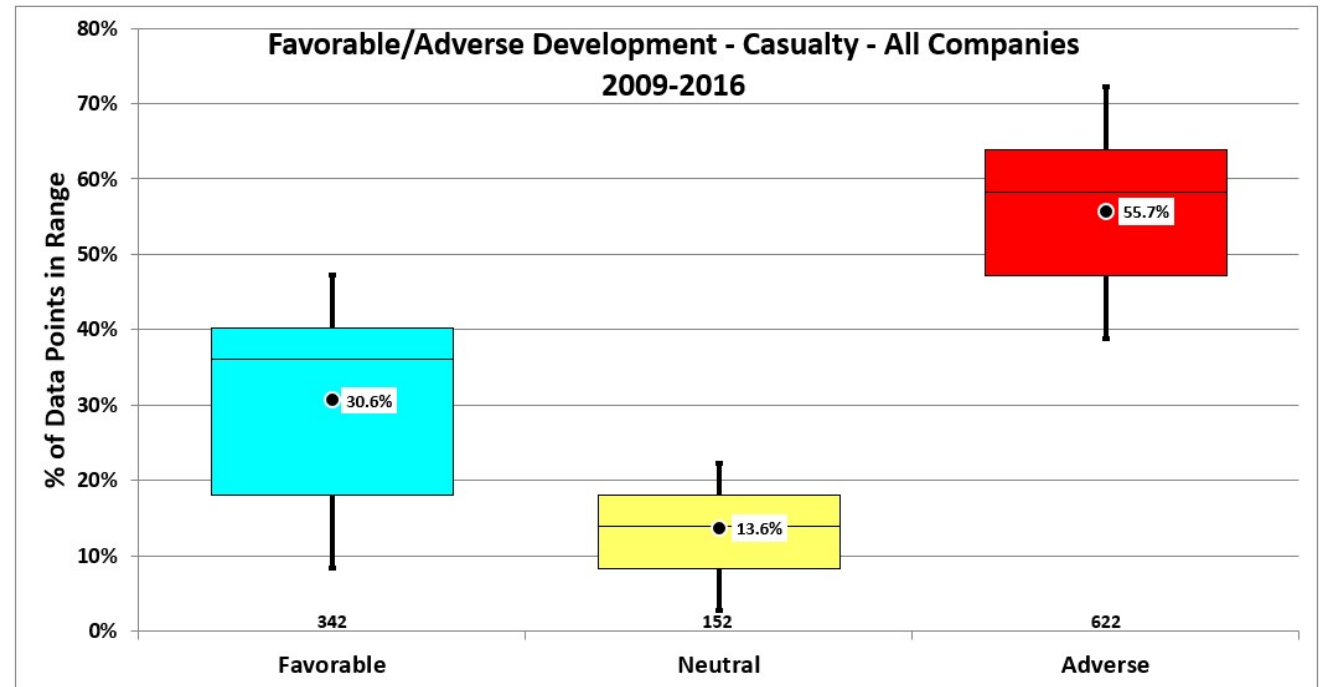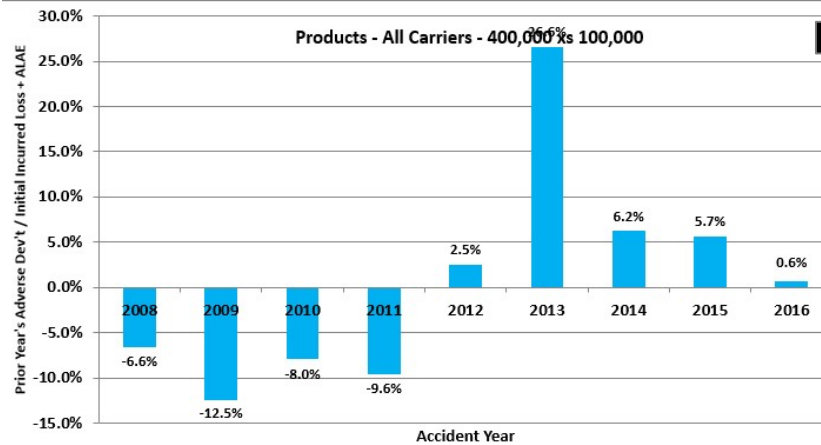

Favorable/Adverse Development - Casualty - All Companies 2009-2016

Overlooking Tails Wrap-up – Submission Lower Layer

The benchmark group where Skipper belongs, Products-C, shows downward development in the lower layers for AY's 2011 and prior. But some adverse development in all subsequent years 2012+ for 400x100.

Illustrative

Products - All Carriers - 400,000 xs 100,000

Chart (Prior Year's Adverse Dev't / Initial Incurred Loss + ALAE vs Accident Year):
- 2008: -6.6%
- 2009: -12.5%
- 2010: -8.0%
- 2011: -9.6%
- 2012: 2.5%
- 2013: 26.6%
- 2014: 6.2%
- 2015: 5.7%
- 2016: 0.6%

ISO SOLM 2018 v1.99a - Development Triangle and Analysis
Ex-ante Reserving Analysis Runoff Tests (through 12/31/2017)

Market Analysis: Products - All Carriers   Class Group C
Assumptions: Incurred $ Indemnity+Alae (Prorata); 400,000 xs 100,000; 7 yr VWA (100% wt); 3.0% detrended threshold

Select Metric here:

Runoff % Adv (Fav)	Ultimate Est. INCURRED @12 mos	Adverse (Fav) Devt	AY	CY2017 (1)	CY2016 (2)	CY2015 (3)	CY2014 (4)	CY2013 (5)	CY2012 (6)	CY2011 (7)	CY2010 (8)	CY2009 (9)	CY2008 (10)	CY2007 (11)	CY2006 (12)	CY2005 (13)	CY2004 (14)
6.5%	58,682,589	3,793,200	2000	793,355	540,262	818,827	(1,262,145)	447	(844,921)	(421,750)	(3,971,031)	1,098,524	(2,368,280)	2,127,724	(837,040)	(4,804,105)	244,894
-3.4%	81,181,111	(2,733,734)	2001	(535,499)	711,906	(1,057,400)	65,708	(789,960)	(1,767,121)	(205,800)	(631,553)	(84,306)	(356,002)	5,899,148	(5,244,411)	(2,429,502)	5,217,882
-8.5%	77,861,395	(6,644,325)	2002	2,092,298	507,476	383,582	(78,407)	1,071,262	(2,619,701)	(1,183,932)	(1,438,675)	1,687,090	85,968	(2,122,361)	(4,163,894)	(7,962,861)	6,717,965
-17.1%	126,192,825	(21,634,844)	2003	(241,044)	(287,086)	(46,205)	683,429	449,330	(2,527,794)	(1,711,375)	(2,208,639)	3,949,562	(1,234,728)	1,956,543	(1,500,307)	(11,287,400)	(7,629,129)
3.2%	78,574,142	2,480,278	2004	(594,325)	272,469	(2,091,142)	147,391	(1,405,143)	1,234,294	1,891,873	(4,992,663)	3,357,223	4,767,790	(2,937,909)	(2,290,347)	5,120,768	
-3.1%	93,853,764	(2,926,086)	2005	290,525	1,796,824	(1,141,683)	1,284,533	1,642,278	(2,400,323)	846,293	(607,593)	1,849,869	(1,444,408)	(6,157,432)	1,115,032		
-2.0%	110,359,789	(2,189,133)	2006	663,155	(679,492)	(1,140,261)	1,746,558	433,164	523,212	196,254	1,009,909	(3,571,004)	822,299	(2,192,928)			
-10.2%	132,543,275	(13,548,150)	2007	1,592,036	(755,053)	(2,031,285)	(1,759,240)	(1,998,628)	4,627,822	5,729,468	(11,364,580)	(3,186,599)	(4,402,092)				
-6.6%	122,721,831	(8,116,600)	2008	1,684,377	(2,187,278)	(872,455)	41,332	(1,626,002)	6,228,820	(2,519,488)	(8,938,101)	72,195					
-12.5%	179,064,728	(22,411,704)	2009	(1,594,955)	3,412,898	(2,529,670)	(1,288,781)	(1,311,764)	3,343,909	(7,259,981)	(15,183,359)						
-8.0%	118,184,694	(9,403,142)	2010	(814,816)	(1,234,638)	(5,450,375)	(1,193,777)	9,834,247	(5,242,240)	(5,301,543)							
-9.6%	112,348,260	(10,806,732)	2011	(1,674,911)	(1,553,825)	(7,279,641)	666,261	1,679,619	(2,644,234)								
2.5%	78,764,731	2,008,005	2012	1,433,079	(6,960,193)	(1,732,669)	8,046,257	1,221,531									
26.6%	75,234,082	20,032,267	2013	2,290,997	9,285,875	5,805,544	2,649,850										
6.2%	91,896,756	5,721,652	2014	1,410,250	(2,136,105)	6,447,507											
5.7%	72,386,107	4,114,914	2015	2,186,374	1,928,539												
0.6%	81,069,414	521,152	2016	521,152													

Actual vs Expected Development: AY x CY

Minimum	Maximum	
-10.2%	-3.2%	Favorable development
-3.2%	-0.5%	Somewhat favorable
-0.5%	0.5%	Within +-.5% of original estimate
0.5%	4.5%	Somewhat adverse
4.5%	14.1%	Adverse development

Sources: Using pre-release SOLM 2018 v2 – mechanical selections of VWA (100% 7-year)
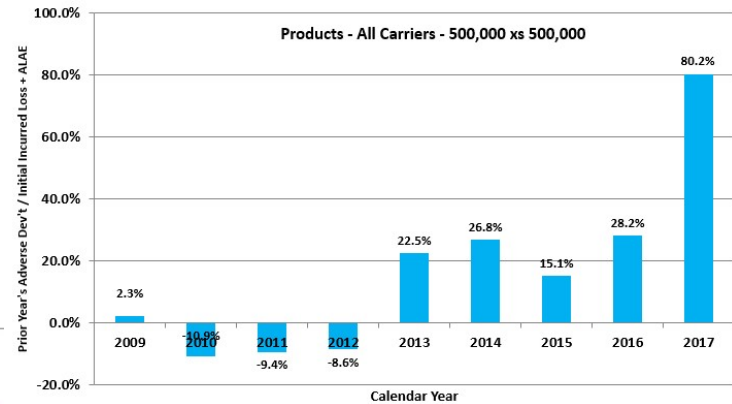
However, the 500x500 layer shows significant and growing lengthening of the LDF tails in all calendar years from 2013 to 2017. Most troubling is that calendar year 2017 shows adverse development in this layer of 80%.

This information should be reflected in the final selection of benchmarks for pricing and reserving

Illustrative

Products - All Carriers - 500,000 xs 500,000

Prior Year's Adverse Dev't / Initial Incurred Loss + ALAE

Calendar Year	Value
2009	2.3%
2010	-10.8%
2011	-9.4%
2012	-8.6%
2013	22.5%
2014	26.8%
2015	15.1%
2016	28.2%
2017	80.2%

ISO SOLM 2018 v1.99a - Development Triangle and Analysis
Ex-ante Reserving Analysis Runoff Tests (through 12/31/2017)

Market Analysis: Products - All Carriers   Class Group C
Assumptions: Incurred $ Indemnity+Alae (Prorata); 500,000 xs 500,000; 7 yr VWA (100% wt); 3.0% detrended threshold

Runoff % Adv (Fav)	Ultimate Est. INCURRED @12 mos	Adverse (Fav) Devt	AY	CY2017 1	CY2016 2	CY2015 3	CY2014 4	CY2013 5	CY2012 6	CY2011 7	CY2010 8	CY2009 9	CY2008 10	CY2007 11	CY2006 12	CY2005 13	CY2004 14
19.4%	18,346,120	3,556,657	2000	(332,180)	54,621	546,109	(139,127)	(290,153)	(886,831)	426,483	(1,732,104)	(1,194,277)	319,150	(678,532)	1,290,191	(863,145)	(1,886,320)
-6.7%	44,962,770	(3,024,411)	2001	112,346	68,774	(822,211)	(514,561)	989,766	(167,043)	761,206	(1,390,172)	686,276	1,557,646	922,218	(63,442)	94,739	3,399,839
-2.3%	37,661,017	(853,717)	2002	1,776,942	1,022,015	(165,554)	95,983	913,213	1,313,307	(211,233)	(2,041,093)	(1,717,316)	780,565	(1,216,852)	1,590,202	(4,007,317)	1,220,889
-22.3%	63,202,440	(14,095,609)	2003	(414,085)	(398,468)	59,617	418,592	732,263	(1,875,229)	740,455	(1,812,441)	1,888,806	(2,106,787)	(4,648,076)	821,045	(4,405,985)	(3,095,316)
-1.7%	27,687,105	(465,439)	2004	(673,279)	237,263	246,399	(1,248,349)	1,506,765	(712,100)	(76,013)	(1,982,761)	26,988	(266,639)	(747,537)	156,911	3,066,912	
15.5%	32,094,688	4,969,701	2005	1,351,802	492,679	1,593,836	377,299	2,274,936	(572,411)	206,381	(2,735,432)	2,923,964	(809,758)	(3,174,337)	3,040,743		
-7.5%	65,842,815	(4,949,378)	2006	(829,194)	30,645	(142,708)	9,335	1,302,042	(731,215)	2,172,020	2,126,116	(1,755,339)	(2,816,521)	(4,314,558)			
-5.0%	51,697,282	(2,572,663)	2007	675,957	980,563	(496,112)	434,477	(1,835,678)	1,061,695	616,449	(6,203,517)	3,604,345	(1,410,842)				
-18.2%	60,359,175	(10,989,654)	2008	998,600	(1,662,103)	218,622	(1,498,481)	(2,863,279)	1,647,918	(1,021,024)	(4,007,552)	(2,802,355)					
-14.3%	103,903,842	(14,841,377)	2009	419,725	2,014,957	(1,183,793)	1,851,281	691,885	(2,402,761)	(4,932,645)	(11,300,027)						
9.7%	36,917,852	3,563,239	2010	(217,545)	182,631	(867,130)	1,172,403	4,252,434	752,368	(1,711,923)							
-13.1%	63,122,673	(8,273,318)	2011	10,699	1,759,894	(5,433,997)	(1,554,905)	2,184,517	(5,239,527)								
17.2%	25,343,634	4,357,936	2012	2,511,084	(1,729,487)	1,837,538	(1,051)	1,739,852									
117.5%	12,533,203	14,732,751	2013	6,700,259	3,922,885	1,062,811	3,046,795										
7.0%	30,442,720	2,127,026	2014	956,738	(2,315,116)	3,485,404											
19.7%	27,767,949	5,465,787	2015	3,766,591	1,699,195												
0.3%	23,648,502	80,470	2016	80,470													

Actual vs Expected Development: AY x CY

Minimum	Maximum	
-16.3%	-5.3%	Favorable development
-5.3%	-0.5%	Somewhat favorable
-0.5%	0.5%	Within +-.5% of original estimate
0.5%	17.7%	Somewhat adverse
17.7%	53.5%	Adverse development

Sources: Using pre-release SOLM 2018 v2 – mechanical selections of VWA (100% 7-year)

SERVE | ADD VALUE | INNOVATE

Further Investigation of Profit, LDF Speed, and Rate Change Responses:
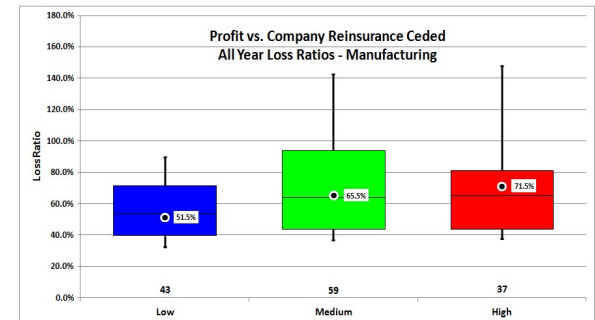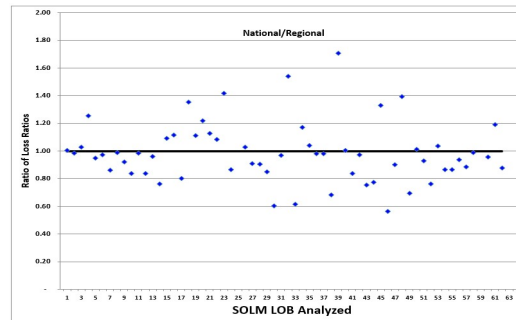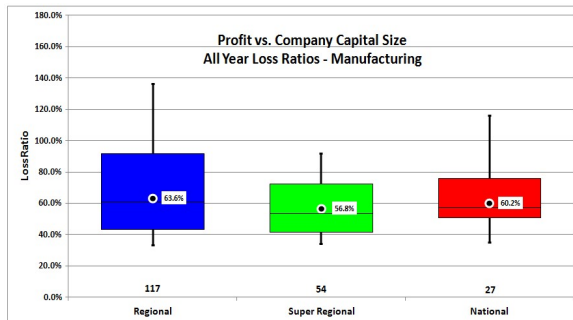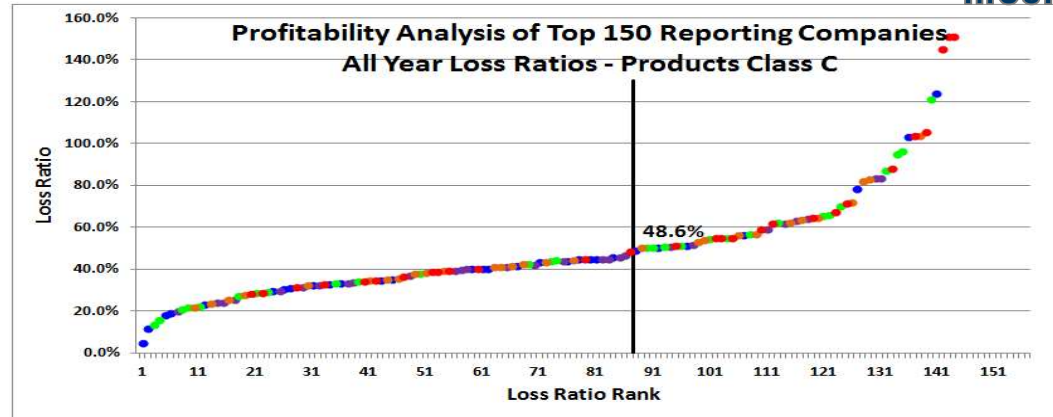
Competitive Marketplace

Overlooking Tails – Initial Investigation

Research done over the last few years was centered around investigating why company results were so dramatically different from each other. Like the LDF patterns, we found companies had strikingly different results.

We investigated things like how correlated are capital size and reinsurance ceded to results. We did find there was some impact of each, but not overwhelming.

Profitability Analysis of Top 150 Reporting Companies
All Year Loss Ratios - Products Class C

Profit vs. Company Capital Size
All Year Loss Ratios - Manufacturing

National/Regional

Profit vs. Company Reinsurance Ceded
All Year Loss Ratios - Manufacturing

Note: Total loss ratios (2001-2016) use 20 year loss triangles and all-year LDFs; each individual company uses credibility weighted all-year industry factors, split between Fast and Slow for apriori

Source: Verisk Monday Webinar – 10/1/2018 – John Buchanan, Marni Wasserman (recorded)

Overlooking Tails – Further Investigation Profit / LDF Speed

However when investigating LDF Speed and Profitability, we found a significant correlation. Companies that don't recognize the are longer than industry LDFs, very strongly have much worse ultimate loss ratios. Almost every one of the 44 markets we analyzed (besides short-tail property lines) experienced this important connection.

Illustrative

Profit vs. Company Development Speed
All Year Loss Ratios - Manufacturing

SOLM - Benchmark Reporting Patterns

Fast | 5% | 10% | 25% | Total
75% | 90% | 95% | Slow | Skipper

Slow/Fast

Note: See Verisk Monday Webinar on link between LDF Speed and Profitability (9/11/2017 – J. Buchanan and M. Wasserman)

This infographic shows one of the 54 markets we reviewed with loss ratios split between companies that are faster reporting, vs. those that are slower reporting. The faster companies have about 8% losses reported (ground-up) beyond 5 years, while the slower companies have about 18% unreported.

For this market, overall loss ratios for faster reporting companies are overall 55.1%, while slower reporting companies are almost 20 points worse at 75.4%. The current estimated 2017 loss ratio for slower companies are about 10% worse.

ISO Size-of-Loss Matrix — Illustrative — **Fast/Slow Loss Ratio Analytics**

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Market Segment: General Liability
Manufacturers
All Companies - All Hazard Groups
All Causes of Loss
Unlimited xs 0   Countrywide
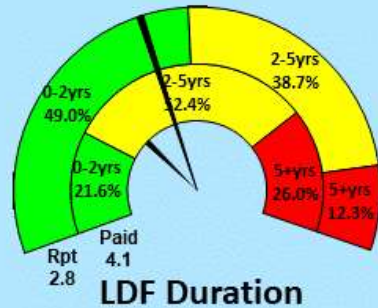
Est All Yr/Curr Yr LR: 62.7% / 68.3%
7 Year Severity Trend: 5.46%
All Year Trend: 4.13%
Avg Rep / Pay Duration: 2.8 / 4.1 Years

SOLM 2018 v2

Total Premium 12/2017: 10,891,901,811
Total Incurred $ Indemnity+Alae (Prorata): 7,822,477,979
Total Occurrences: 317,655

On Level Loss Ratio — 62.7% / 68.3%

Faster On Level Loss Ratio — 55.1% / 64.2%

Slower On Level Loss Ratio — 75.4% / 74.4%

LDF Duration
Rpt 2.8   Paid 4.1
0-2yrs 49.0%   2-5yrs 32.4%   2-5yrs 38.7%
0-2yrs 21.6%   5+yrs 26.0%   5+yrs 12.3%

Faster LDF Duration
Rpt 2.5   Paid 3.8
0-2yrs 53.3%   2-5yrs 52.5%   2-5yrs 38.3%
0-2yrs 24.6%   5+yrs 22.9%   5+yrs 8.3%

Slower LDF Duration
Rpt 3.3   Paid 4.6
0-2yrs 43.8%   2-5yrs 51.7%   2-5yrs 38.6%
0-2yrs 18.1%   5+yrs 30.2%   5+yrs 17.6%

Illustrative
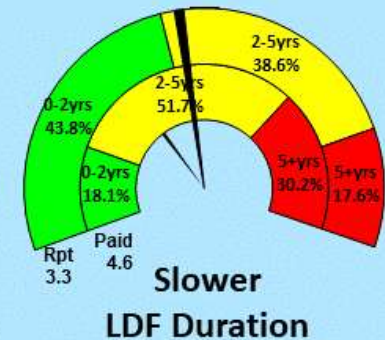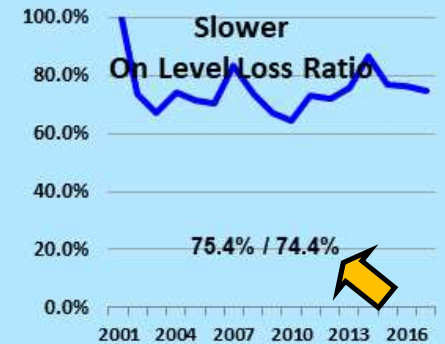
We are further investigating "why" profit is often strongly correlated to loss development speed. We have a few competitive marketplace hypotheses:

- The first is that faster reporting companies may get an earlier more accurate reading of results, and be able to reprice their business more quickly when circumstances change
- The second is that slower companies, especially those that don't know they are slow, may have a downward bias in establishing lower loss development parameters for their models
- Especially in a highly competitive environment, slower LDF companies may for example assume that losses are fully reported by 8 years rather than the full length of the pattern at 20+ years
- These companies may ultimately have higher loss ratios when the losses do indeed emerge against lower charged premiums
- There may also be an additional pricing component for longer tailed companies to factor in additional investment income. But this may be mitigated by lower interest rates and payment patterns that don't vary as much as the reporting patterns
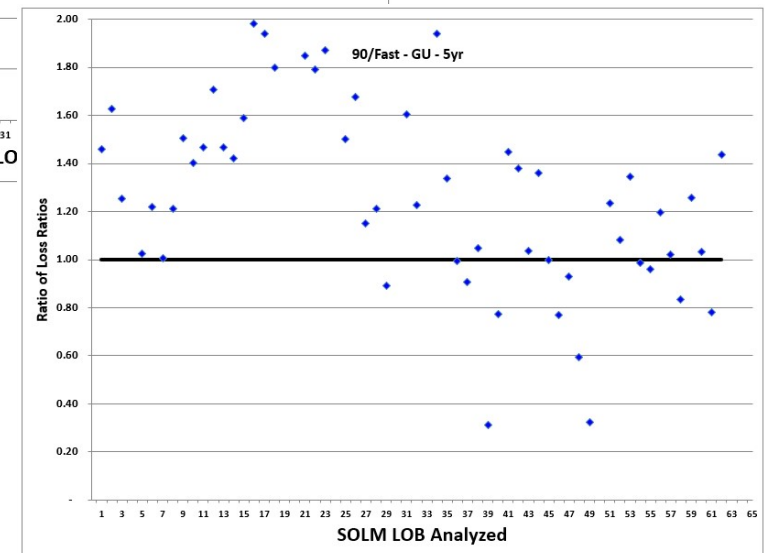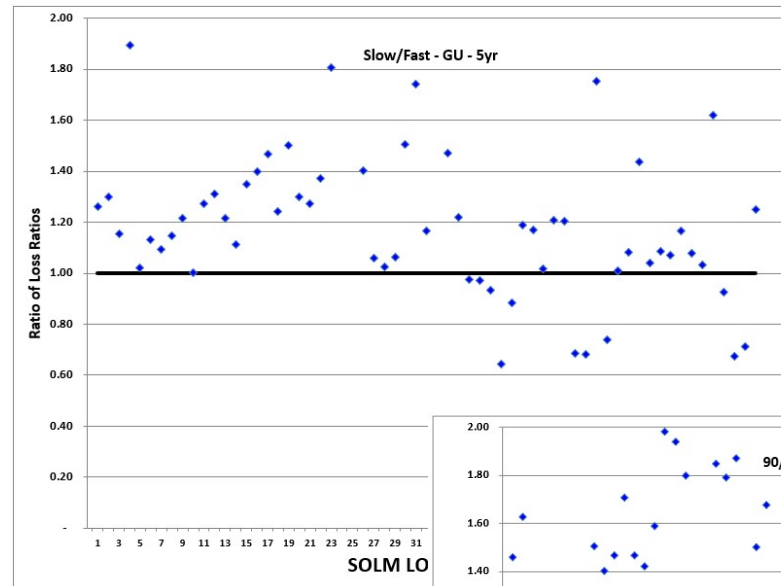
Illustrative

To test out some of those competition marketplace possibilities, we are broadening our Profit / LDF investigation to include reactive rate changes.

Recently we have greatly expanded our ability to analyze aggregated rate changes for 54 markets in over 14,000 18-year time series (and 4 million cells), from 1.3 billion policies. We are investigating rate changes that are now split between faster and slower LDF companies.

As the illustrative exhibit shows for Skippers Products-C LOB, there are significantly different rate changes indicated for faster vs slower companies. For example, the graph shows that since 2006 for this relatively longer tailed line of business, the overall rates have increased by over 20% for faster reporting companies, while slower reporting companies end up at roughly the same starting point, or no increase, during that time-period.

MarketWatch Product	Estimated #Time Series	Estimated #Cells	Scope
MW Standard *(quarterly release March 2019)*	405	150,318	Monthly / state
MW Expanded *(semi-annual release December 2018)*	97	2,941	Annual / CW
MW Standard + Expanded	502	53,047	Quarterly / state (std)
MWDB Current *(February 2019)*	7,249	1,971,848	Quarterly / state
MWDB 2019 v1 *(June 2019)*	14,500	4,176,000	Quarterly / state
MWDB 2019 v2 *(December 2019)*	51,000	15,100,000	Quarterly / state

Source / expected additional expansions:
MWDB Current: 18-year quarterly values starting 2001 use Method 2 from **1.3 Billion policies for 54 Markets**.
MWDB 2019 v1: Fast/Slow LDF Split, Method 1&3 Rate Changes, BOP Splits.
MWDB 2019 v2: Premium Size Splits, Additional Market Splits: PAuto, CAuto PhD Splits,
 CIM, Umbrella, GL and CP Class Splits from **2.0 Billion policies and 70 Markets**.
All MWDB cell counts contain at least **50 aggregated policy counts and premiums in each cell**.

ISO MarketWatch - High Level Summary

Selected Markets: GL-Products C
Selected States: Alabama, Alaska, Arizona and 48 more
Company Group: Total, Faster, Slower

2018, 2017: 3.3%, -0.3%
All Year Premium:6,781,247,354   Current Year Premium: 275,098,235
All Year Policy Count: 3,652,328   Current Year Policy Count: 122,726
All Year Avg Prem: 1,856   Current Year Avg Prem: 2,241

33
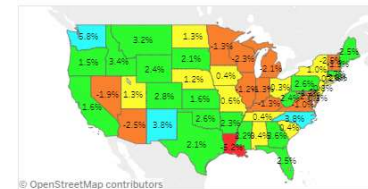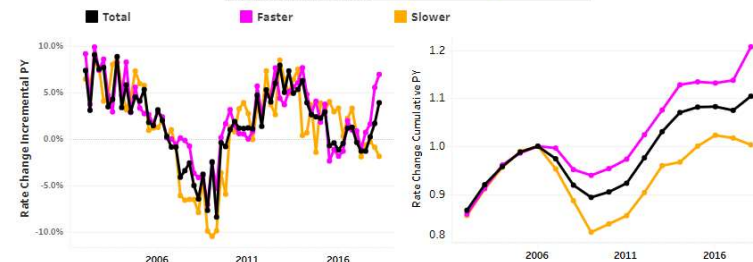
Overlooking Tails - Impact of Wrong Signals

To help illustrate the intricacies of the competitive markets and various signals, this exhibit shows how companies can react incorrectly to early AY or CY indications.

Companies that inappropriately perceive a good market from faulty early signals based on underestimating tails or rate levels, may end up writing business at the wrong time for their long-term detriment.

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

Source: Physicians Insurance Association of America – The MPL Cycle-Entering Hot Water? – JBuchanan 4th Quarter 2011 Edition

Illustrative

This exhibit shows one way we are looking to link in the profit / LDF and rate change picture for a cohesive analysis.

Appropriately linking the pieces can help provide a more full picture on past and expected future profitability levels under various apparent and actual market conditions.

Emergence Lag Analysis

Market #1 - Slower Carriers

Incurred $ Indemnity+Alae (Prorata); Unlimited xs 0; 7 yr VWA (100% wt); 3.0% detrended threshold

Year	CY	AY @2017	CY vs. AY Difference	Breakeven	Apparent Market	Actual Market	Incremental Rate Change
2001	119.8%	182.6%	62.8%	95.0%	Soft	Soft	
2002	318.8%	176.2%	-142.6%	95.0%	Soft	Soft	13.37%
2003	154.4%	208.9%	54.6%	95.0%	Soft	Soft	11.73%
2004	152.8%	133.9%	-18.9%	95.0%	Soft	Soft	4.72%
2005	72.8%	123.8%	51.0%	95.0%	Hard	Soft	-0.58%
2006	118.6%	110.4%	-8.2%	95.0%	Soft	Soft	-0.02%
2007	150.8%	115.0%	-35.8%	95.0%	Soft	Soft	-4.03%
2008	64.5%	94.8%	30.4%	95.0%	Hard	Transitional	-11.41%
2009	43.3%	79.8%	36.4%	95.0%	Hard	Hard	-13.02%
2010	126.4%	97.3%	-29.2%	95.0%	Soft	Transitional	-6.73%
2011	34.9%	95.3%	60.5%	95.0%	Hard	Transitional	-1.97%
2012	144.7%	98.4%	-46.4%	95.0%	Soft	Transitional	1.89%
2013	77.4%	96.0%	18.6%	95.0%	Hard	Transitional	7.43%
2014	99.6%	117.3%	17.7%	95.0%	Transitional	Soft	8.26%
2015	104.1%	123.9%	19.8%	95.0%	Transitional	Soft	3.52%
2016	135.9%	95.9%	-39.9%	95.0%	Soft	Transitional	-0.29%
2017	87.7%	89.2%	1.5%	95.0%	Transitional	Transitional	-0.18%

SOLM: Pre-release 2019 v1

ISO's Size-of-Loss Matrix 2018 v2 includes data on the following lines of business:

Commercial Auto Liability (8)
- buses
- composite-rated risks
- garages
- miscellaneous
- private passenger types
- publics
- trucks, tractors, and trailers
- trucks, tractors, and trailers –
  zone-rated

Commercial Auto Physical Damage

Commercial Property (3)
- commercial
- manufacturing
- residential

Commercial Inland Marine (5)
- builder's risk
- contractor's equipment
- motor truck cargo
- wireless communications
  equipment
- other

General Liability (12)
- completed operations
- composite-rated risks
- contractors (countrywide)
- contractors (CA, FL, IL, NJ, NY, NYC, PA, TX)
- liquor
- local products
- manufacturers (countrywide)
- manufacturers (CA, NY)
- owners, landlords, and tenants
- pollution
- premises operations combined
  - Classes 1, 2, and 3
- products combined – Classes A, B, and C

Businessowners

Umbrella and Excess (4)
- premises/operations only
- commercial auto only
- premises/operations and
  commercial auto
- products

Professional Liability (13)
- accountants
- agents
- architects and engineers
- directors and officers – for profit
- directors and officers – not for profit
- employment practices liability
- lawyers professional liability
- medical – allied health claims-made
- medical – allied health occurrence
- medical – dentists claims-made
- medical – hospital claims-made
- medical – physicians and
  surgeons claims-made
- other errors and omissions

Total Commercial Lines (47)

Homeowners (3)
- forms 2&3
- forms 4&6
- form 5

Personal Umbrella (4)
- auto excess
- homeowners and
  other excess
- primary
- other

Total Personal Lines (7)

New for SOLM 2018 v2; each market (54) contains more than $1B of either premiums or losses in triangles from 2001-2017

Bios

John W. Buchanan
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John Buchanan, FCAS, MAAA, is a principal in charge of ISO's Excess and Reinsurance Division. He has over 30 years of experience as a front-line pricing actuary and consultant in the US, London, and other international reinsurance marketplaces.

In John's career, he has conceptualized, developed and implemented extensive benchmarking and modeling services for various reinsurers, excess carriers, and industry groups. He has pioneered extensive work to extend information gathered in mature benchmarking markets, and applying the information to other International markets making use of local and customized knowledge. He was a frontline sign-off actuary for many domestic and international lines of business. While a consultant, he was also the main contact for many years for the Reinsurance Association of America and the Reinsurance Research Council of Canada as well as having worked extensively with the London and European reinsurance market through the Casualty Actuaries in Reinsurance in London.   He also formed and is the chairperson of the joint IFoA-CAS International Pricing Research Working Party. The paper prepared for the 2016 GIRO Conference, *"Analyzing the Disconnect Between the Reinsurance Submission and Global Underwriter's Needs - Property Per Risk"*, won the UK Brian Hey award for best paper presented at the conference.   The paper has also been given the CAS Hachemeister award for 2019.

John's professional accomplishments also include being heavily involved with many international meteorological groups including NOAA, UK-Met, GLOBE, ACRE, and was chairperson of the CAS Climate Change Student Outreach subcommittee. He is on the CARe committee responsible for many of the annual CARe conference educational tracks, and previously at the CAS Ratemaking Seminar. He has been a moderator and panelist at dozens of industry seminars on the topic of domestic and international reinsurance pricing, the underwriting cycle, international benchmarking, etc.

Prior to joining Verisk, John was a Senior Vice President at Platinum Underwriters (previously St. Paul Reinsurance), a Principal at Tillinghast (now Towers Watson), and a Senior Consultant at KPMG, Peat Marwick. He has also competed as an amateur in the annual Miami World Salsa Summit championships, and is determined to write the book "The Mathematician's Guide to Salsa Dancing". He has also written and directed a few sponsored films entitled "Franklin Climate Change" and "Cuba People to People" with the former being used to incentivize middle and high school students around the world to investigate the connection between old weather records and today, and the latter selected to run at various in-person and on-line film festivals in the short documentary category in 2017 and 2018. The *Actuarial Review* prepared a 2018 article on these downtime pursuits.

Aleksey Popelyukhin
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Aleksey Popelyukhin is a Head of Actuarial Data Services at Swiss Re US Casualty Hub. Prior to that, he held positions ranging from SVP of Information Systems to the Head of Quantitative Analytics Group with various reinsurance and financial companies. He holds a Ph.D. in Mathematics and Physics from Moscow Lomonosov University and is an active member of American Mathematical Society. Aleksey actively participates in CAS research and is frequent presenter on CAS conferences and a member of various CAS committees. CAS recognized Aleksey's contributions by awarding him "Best Actuarial Paper" prize in the very first Data Management papers competition, and by inviting him to the very first CAS Working Party (on presentation of results of actuarial modeling).

In addition to numerous publications, Aleksey helps to advance actuarial science by building convenient software tools for actuaries such as Triangle Maker®, Affinity and Actuarial Toolchest™ as well as proprietary systems for his numerous employers and clients. For those actuaries having troubles explaining statistics to the management Aleksey built a DRM presentation template available from CAS website. For those having troubles fitting clean models to dirty data Aleksey developed an advanced data quality service called Data Quality Shield^{SM}. For those needing help with visualizing actuarial reports Aleksey wrote a white paper as part of "Good Actuarial Report" working party. Aleksey strongly believes in gamezation of activity: his integrated pricing/reserving modeling system for reinsurance looks and feels like an action/adventure video game and suitably called "SimActuary".

He also utilizes his fine-arts background by working on huge painting depicting our Ultimate Destination which he tentatively named "Actuarial Judgment Day."

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http://www.verisk.com/iso/excess-reinsurance