Enterprise Risk Management Symposium

April 19–20, 2018

Miami, FL

Session 23: Capital Model Benchmarking Findings for P&C Insurers

Moderator:
Berna Beekman FCAS,MAAA

Presenters:
Marcus Aikin FSA,MAAA
Stanislav Eratt FCAS,CERA

SOA Antitrust Disclaimer
SOA Presentation Disclaimer

Capital Model Benchmarking: Uses and Insights

Stanislav Eratt
April 20, 2018

Agenda

- Overview and Approach

- Benchmark Model Applications

- Insights

Overview and Approach

Understanding your risk profile requires an industry view

- Developing company strategy against increasingly competitive markets requires more insight then ever before

- Insurers are increasingly turning toward sophisticated capital models to monitor and measure their own risk profile

- A company's own experience may not be sufficient for company risk models

Corporate Strategy

Own risk models

Competitors

Risk Profile
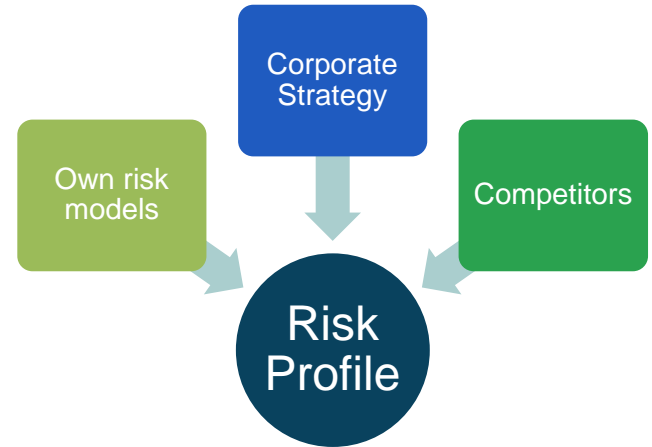
Methods for measuring required capital

There are multiple approaches for measuring the amount of required capital

- **Deterministic/Factors-based models**
  - **Pros:** Easier to use and explain to senior management
  - **Cons:** Capital factors are based on industry benchmarks and not based on own risk

- **Stochastic/Capital models**
  - **Pros:** Models are based on Company's own experience and based on company's own risk profile
  - **Cons:** Harder to setup, more difficult to communicate results

The capital benchmark model uses **stochastic approach** toward generating capital results but results are communicated through use of **capital factors**

Benefits of using the capital benchmarking

The industry benchmark data helps companies by providing a:

- Consistent method for comparing your company results to a selected peer group
- Simple method for identifying peer group companies and showing outlier results
- Provide data necessary for validating major model assumptions

Additional potential applications of the capital benchmark dashboard include:

- Use benchmark factors directly in place of building your own capital model
- Credibility weight with own capital modeling results
- Identifying competitive advantages
- Strategic planning initiatives

Overview of capital benchmarking dashboard

Overview:

- Relying on **publicly available** annual statement and Schedule P information, we have run an automated economic capital model for all available companies at a group level

- Capital modeling statistics by company, risk, and line of business have been saved and **exported into a dashboard**

- Have a **peer group selection tool** which allows the user to select a customized peer group. User can select between geography, size of business, and type of business.

Overview of capital benchmarking dashboard

Benchmarking tool focuses on the following key risks:

| Reserve Risk	Premium Risk	Market Risk
Uncertainty around claims from **prior** policy periods	Uncertainty around claims from **future** policy periods	Fluctuations in **market** asset values or income received

Overview of capital benchmarking dashboard

What are some of the key assumptions?

- Schedule P data
  - Lines are modeled with the available public data at the high level of detail

- Companies are modeled at a group-level
  - Excluded run-off or companies with negative policyholder surplus

- Modeling is performed net of reinsurance
  - Cat losses are only included to the extent that they are in the Schedule P data

- Used company experience when available…
  - For lines of business with limited, sparse, unusable data, we used stochastic BCAR type model instead

- Not all risks are included
  - Notably, we did not model reinsurance credit, operational risk

Overview of Risk Models

Main Model
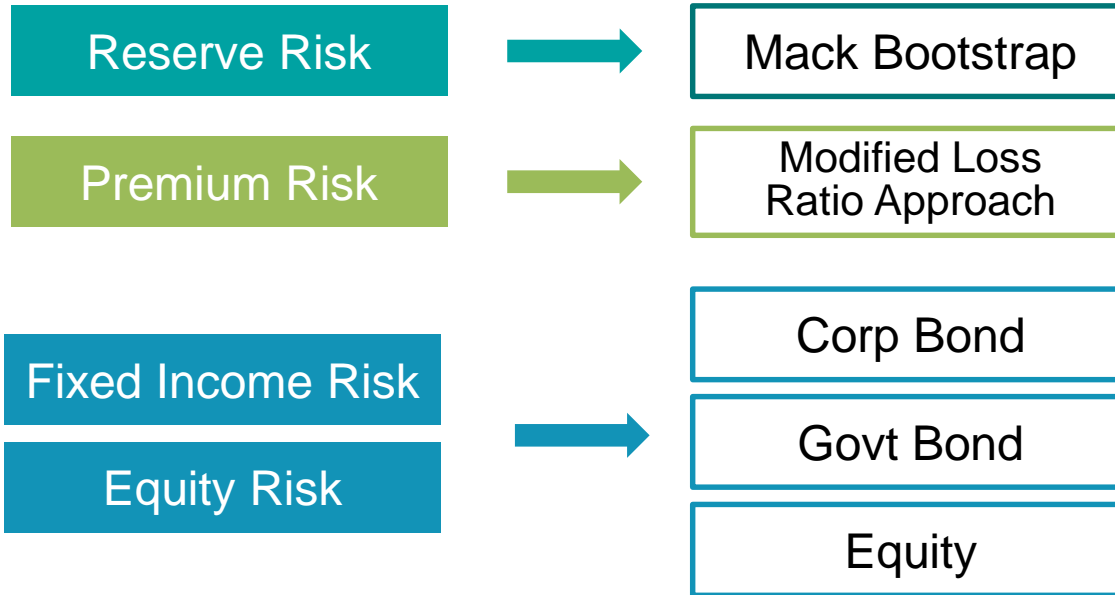
Benchmark Model Applications

Applications of benchmark dashboard

There are a number of applications of the dashboard including:

Benchmarking

Peer group/
competitor analysis

Enhance
capital modeling

Strategic planning

Assessment
of risk profile

Benchmark glossary

Exposure measures

- Underlying exposure balance for the specified risk. For example, net carried reserve balance for reserve risk
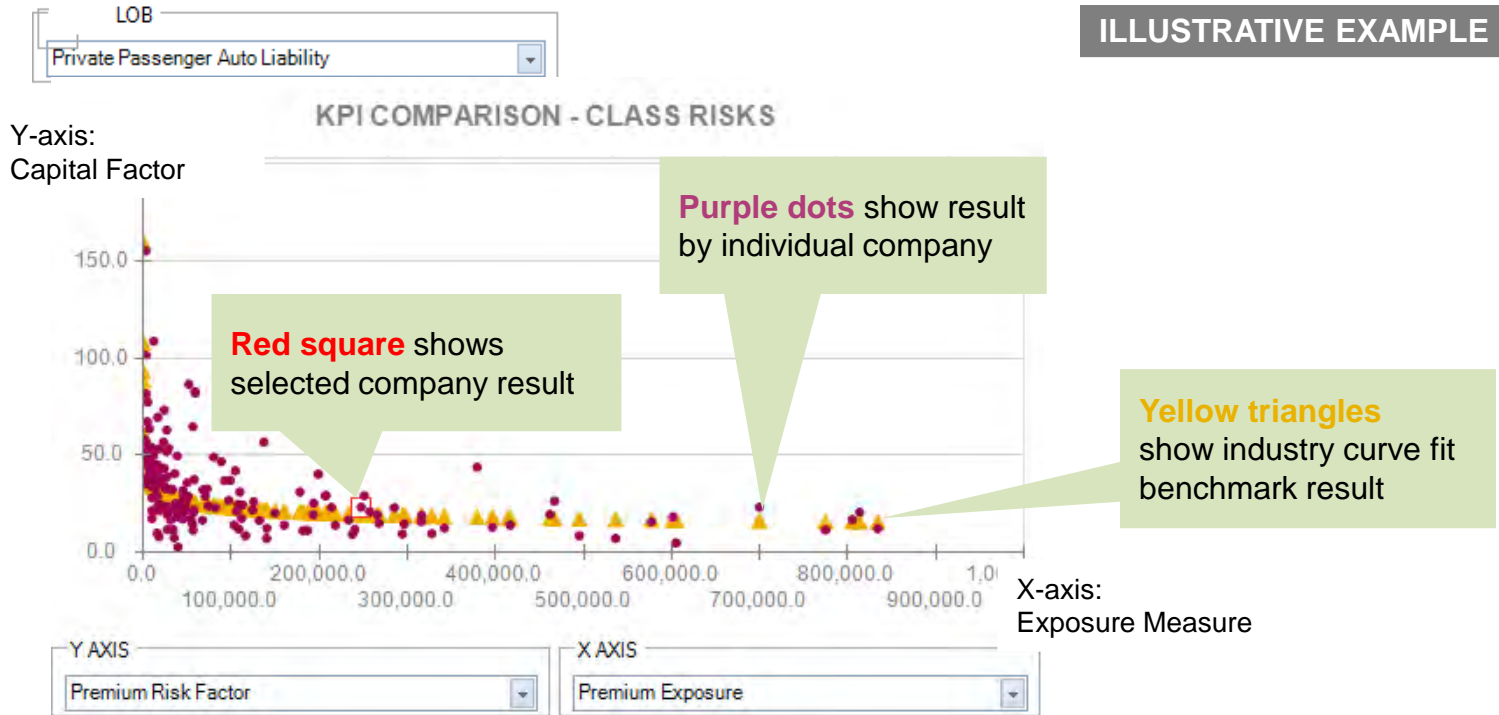
Capital factor or risk factor

- Total value at risk at the **specified percentile** for given company and line of business
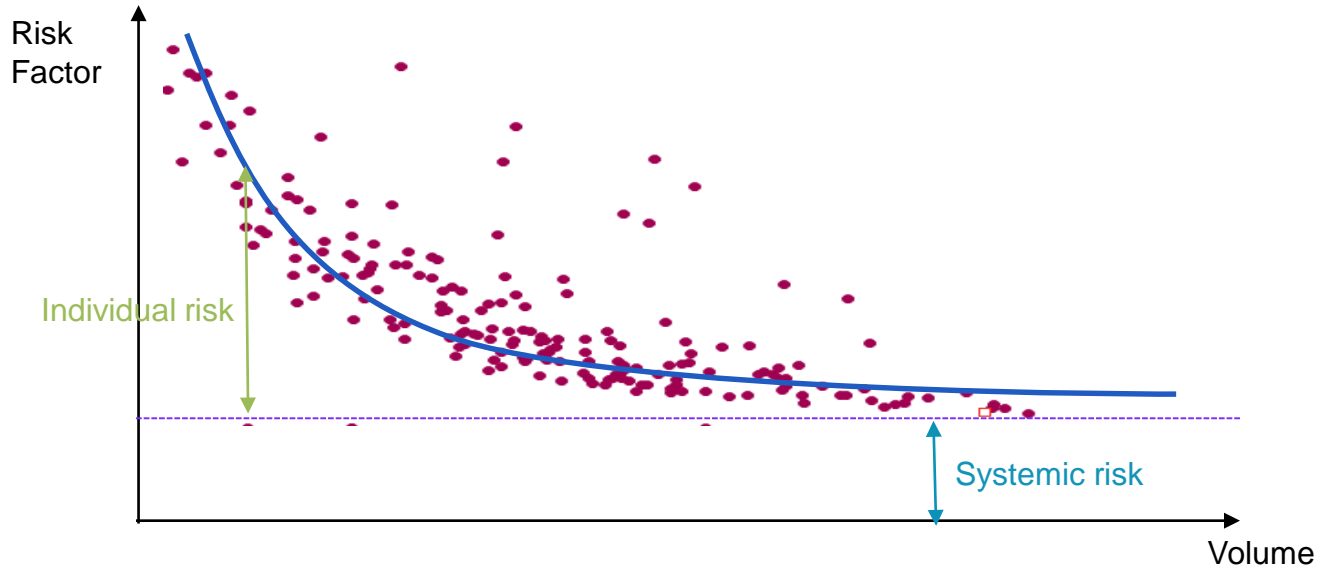- Equal to Value at Risk divided by Exposure Measure

Exposure = 425m

99.5%

VaR Capital 75m
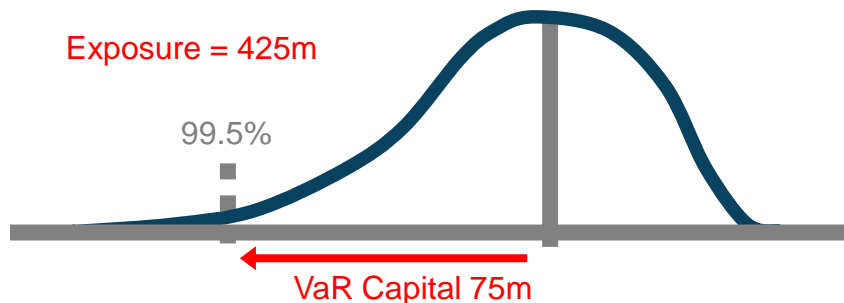
$$\text{Capital Factor} = \frac{\text{Value at Risk}}{\text{Exposure}} = \frac{75m}{425m} = \textbf{17.6\%}$$

Premium Risk by Class: Illustrative example

How to use the model results

- Observed results can be fitted to a distribution to create a **customized industry curve** by line of business and total
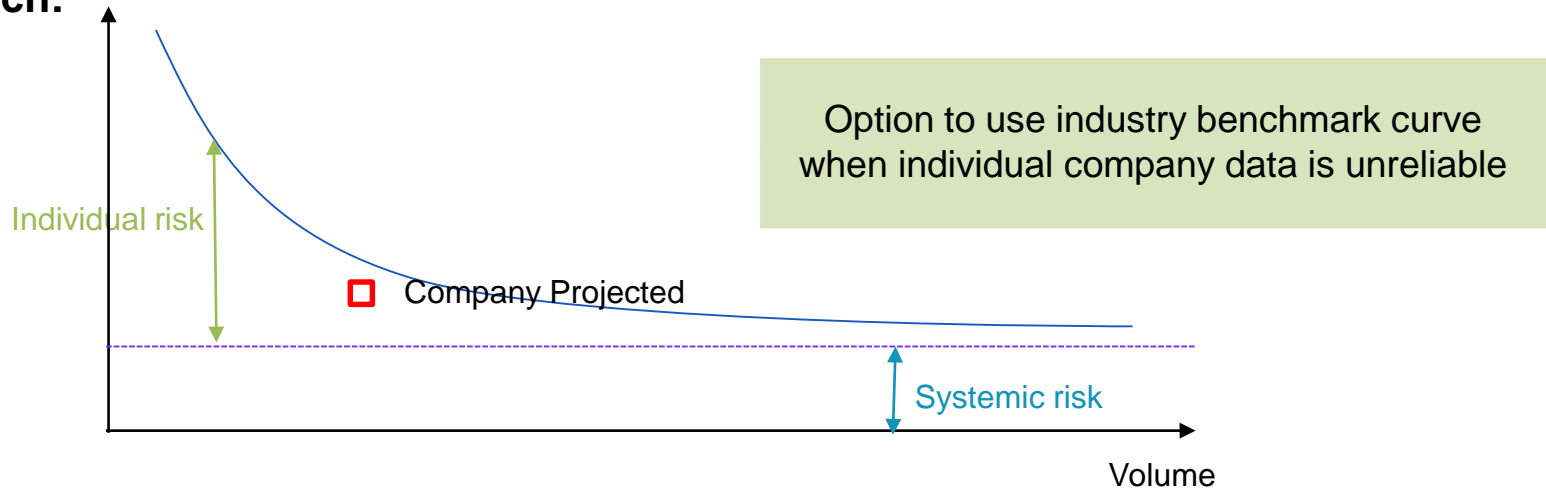
Benchmark applications:
Example #1 – Use benchmark factors directly
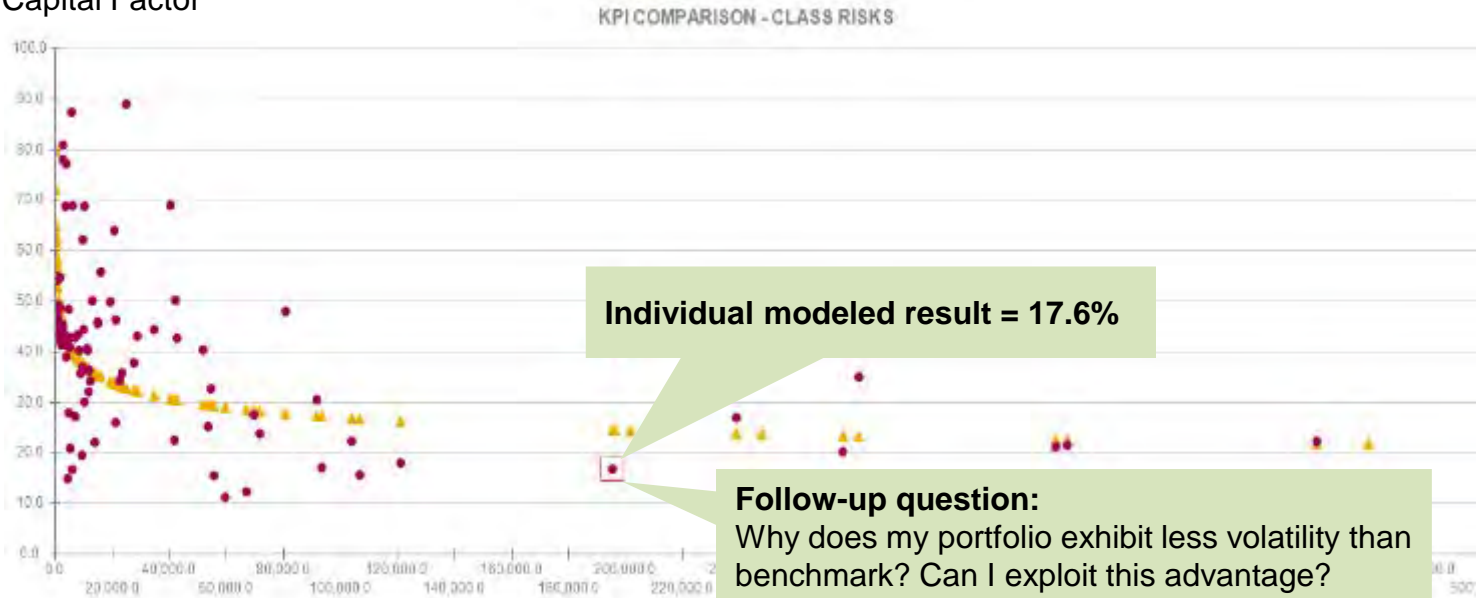
Scenario:

- Company does not perform its own capital modeling and currently relies on rating agency capital factors. There is concern that the rating agency factors are not representative of own risk.

Approach:

Option to use industry benchmark curve when individual company data is unreliable

Benchmark applications:
Case Study #1 – Premium Risk Commercial Auto Liability

Y-axis: Capital Factor

KPI COMPARISON - CLASS RISKS

Individual modeled result = 17.6%

Follow-up question:
Why does my portfolio exhibit less volatility than benchmark? Can I exploit this advantage?

X-axis: Exposure Measure

Scenario:

- Company has developed its own capital modeling results and would like to compare to industry-benchmark assumptions

Approach:

How does my own capital modeling results compare to industry curve?

Own ECM result

Company

Volume

Benchmark applications:
Case Study #1 – Premium Risk Commercial Auto Liability

Y-axis: Capital Factor

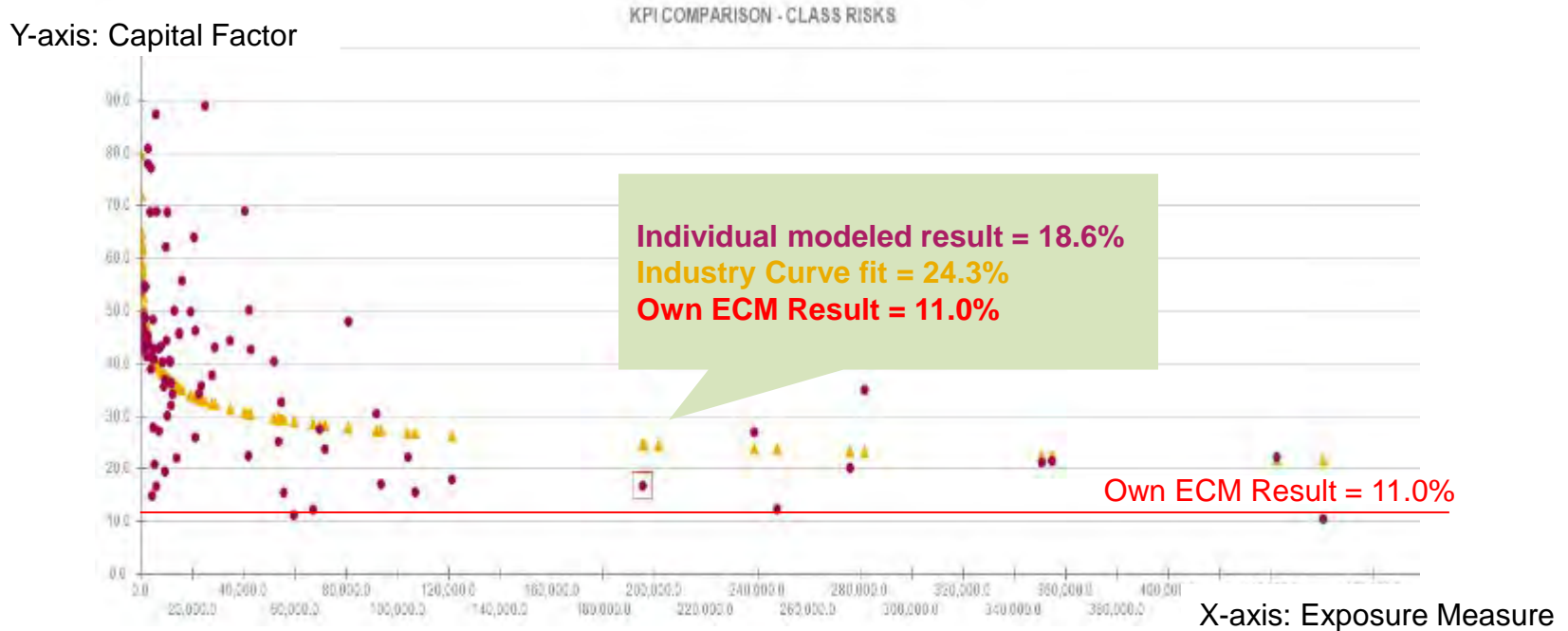KPI COMPARISON - CLASS RISKS

Individual modeled result = 18.6%
Industry Curve fit = 24.3%
Own ECM Result = 11.0%

Own ECM Result = 11.0%

X-axis: Exposure Measure

Scenario:

- Company only writes a small amount of volume in Line of Business X. Company would like to supplement the current analysis with benchmark factors

Approach:

Supplement your current analysis by adding credibility for lines with limited data

|	Premium Exposure	Modeled CoV	Benchmark CoV	Credibility Factor	Selected CoV
	[1] Premium volume	[2] Based on modeling	[3] Based on Benchmark model	[4] Based on [1], full credibility value	[5] weighted avg of [2],[3]
LOB 1	250	10.5%	14.5%	70%	**13.3%**

13.3% = 10.5%x0.3 + 14.5%x(1-0.3)

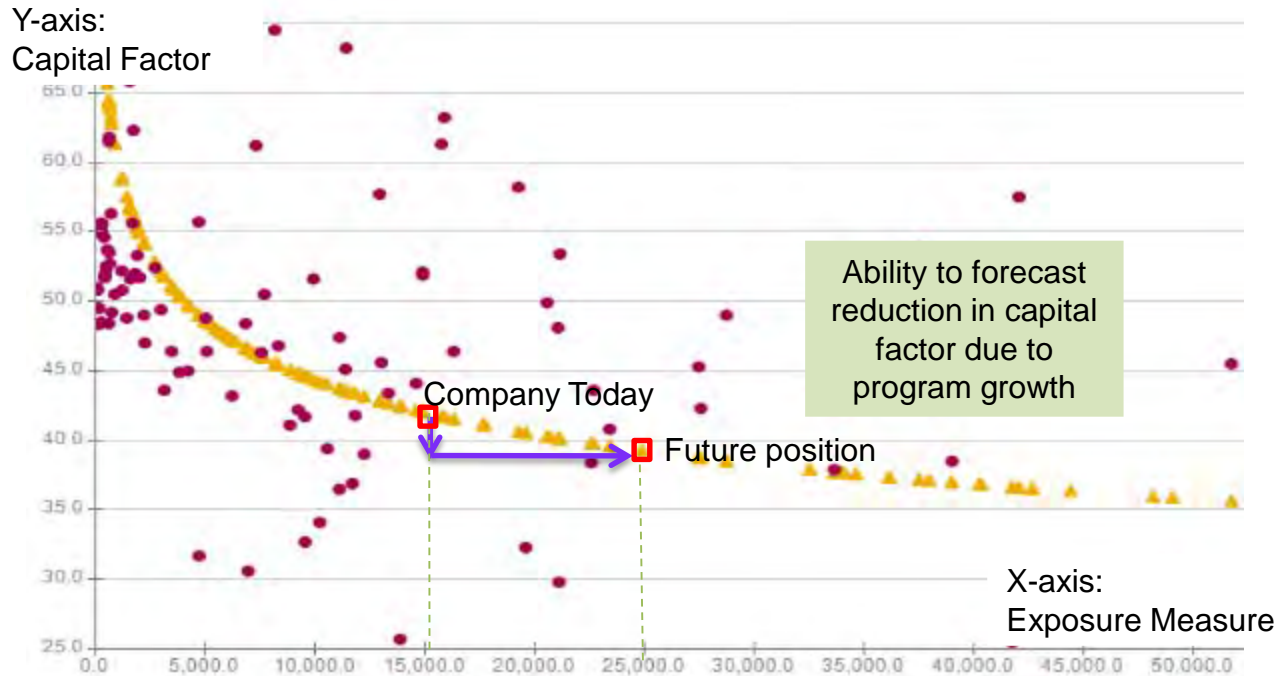**ERM** Enterprise Risk Management Symposium

Scenario:

- Company is looking to grow in lines of business and would like to understand the impact on capital requirements

Approach:
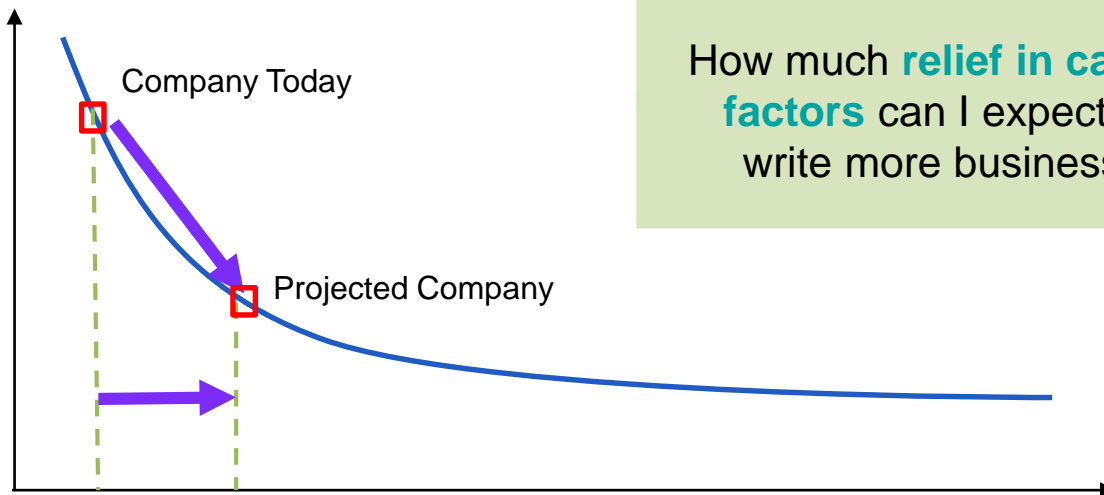
How much **relief in capital factors** can I expect if I write more business?

Benchmark applications:
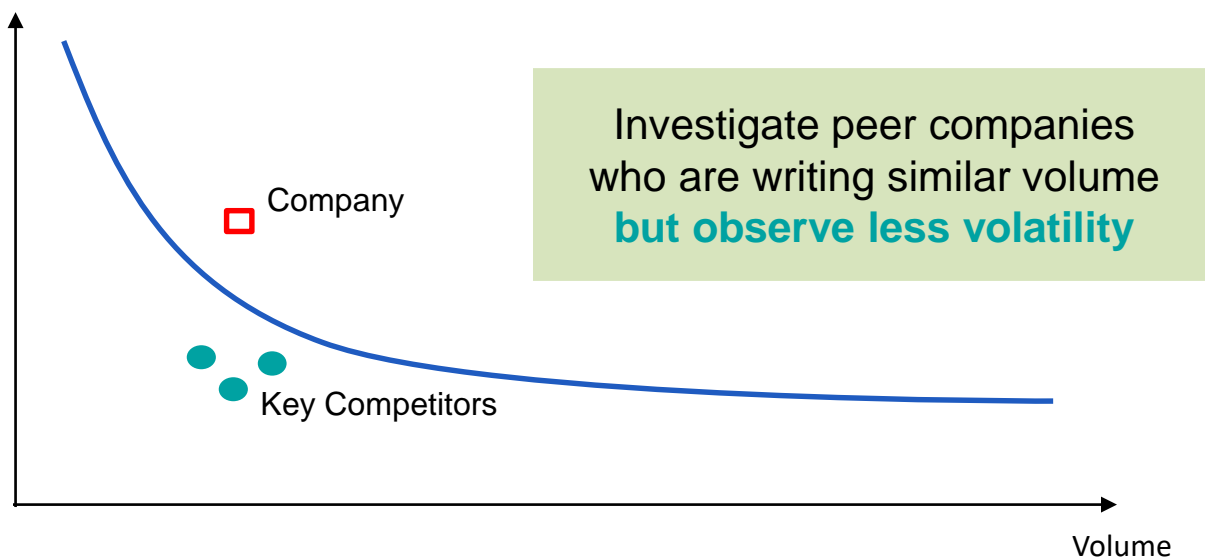## Case Study #1 – Premium Risk Commercial Auto Liability

Benchmark applications:
Example #5 – Competitive analysis

Scenario:

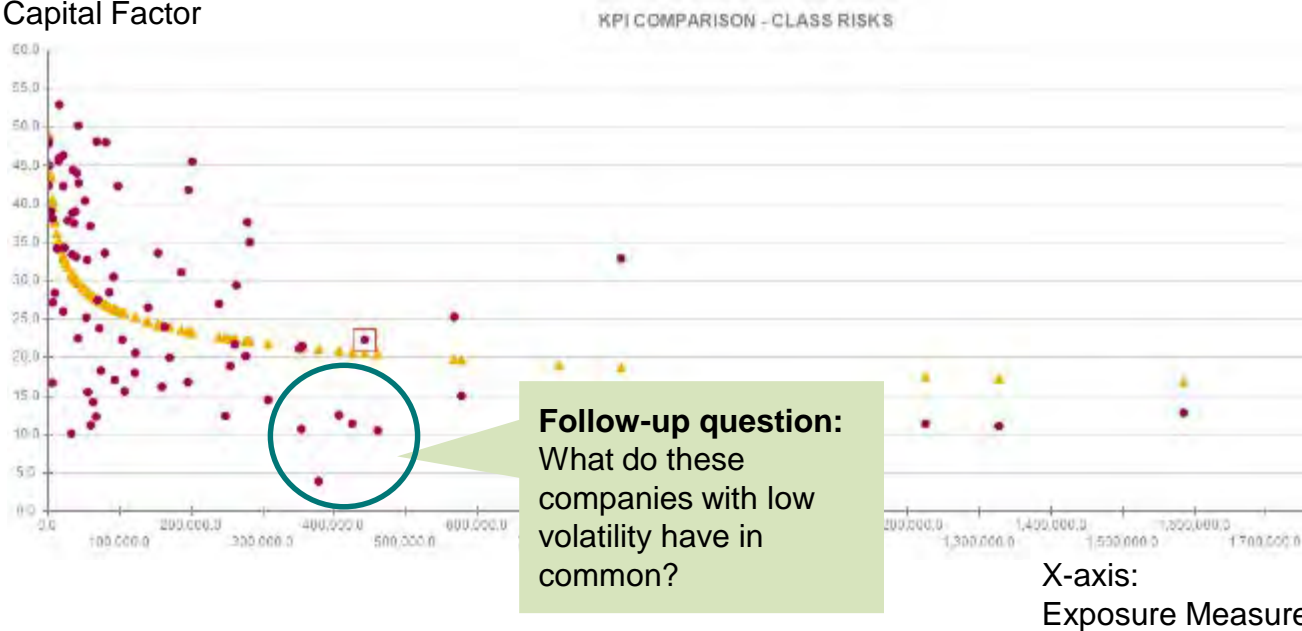- Company would like to identify companies who exhibit less volatility at similar premium volumes

Approach:

Investigate peer companies who are writing similar volume **but observe less volatility**

Benchmark applications:
Case Study #2 – Premium Risk Commercial Auto Liability Example

Y-axis:
Capital Factor

KPI COMPARISON - CLASS RISKS

Follow-up question:
What do these companies with low volatility have in common?

X-axis:
Exposure Measure

Insights

Systemic Risk

Dispersion

Reserve Risk - WC

Reserve Risk - CMP
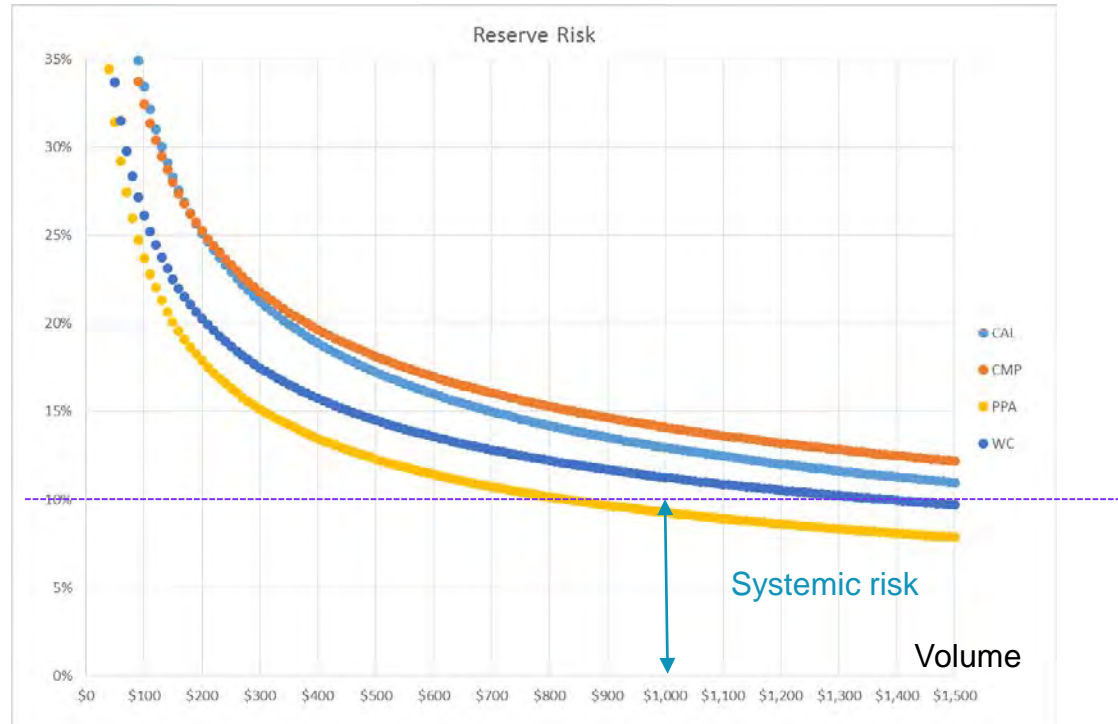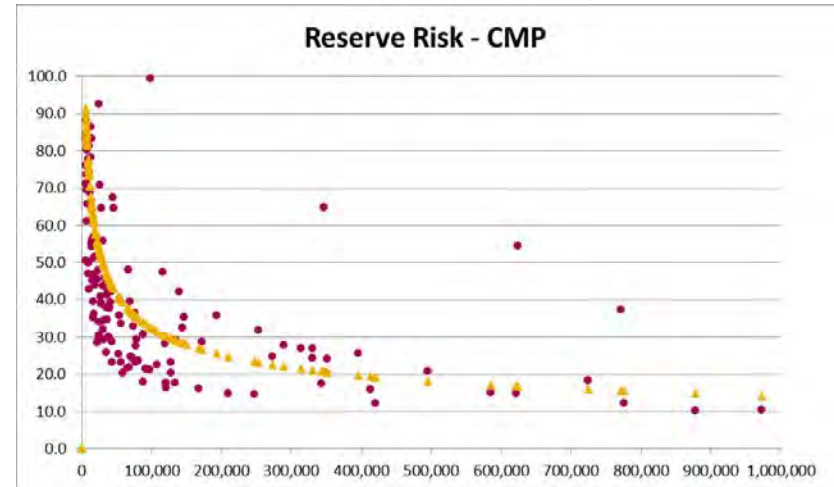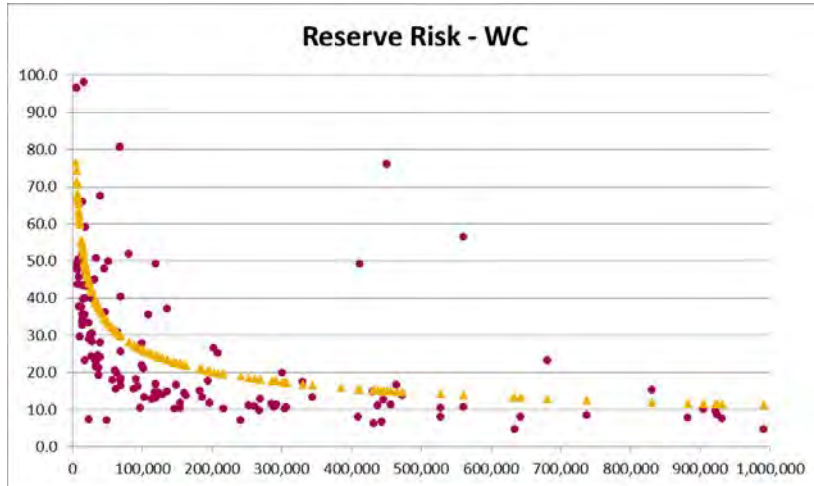
- Comparing the same lines as in the prior slide we observed that WC has the higher dispersion and CMP has the lowest

Q&A

Uses of Annual Statement Data

- Can be used as a complementary data source to parameterize ECM
  - Correlation across lines of business and between accident years often requires an additional data source

- Sufficient in detail to define a high-level economic capital model
  - Approach theoretically replicates evaluation by AM Best
  - If framework is applied consistently, comparisons can be made between companies/segments

Industry Database

- GC database contains Schedule P fillings from from 1989 to 2016, for 1,078 companies, with experience back to 1980

- Composites are also created in order to investigate trends in companies with similar geographic distributions and companies with concentrations in similar lines of business

- 266 companies were excluded because they were not allocated to a market segment or lack of credible loss history

Industry Database

- Segmenting industry companies into one or more segments allows for parameters to be measured based on companies with a similar focus

- Guy Carpenter's research has defined two segments:
  - Divisional Segments: Divisional segments breakdown the industry into mutually exclusive categories that pertain to geographic attributes
  - Functional Segments: Functional segments breakdown the industry into ownership structure and product strategy

Divisional Segments

Divisional Segment	Number of Companies	Total DWP (Millions)		
		2014	2015	2016
Top 15 Writers	15	314,380	327,822	338,480
National	44	79,163	84,263	92,584
Multi Regional	17	19,802	20,786	21,687
Northeast/Atlantic	279	31,569	32,666	33,969
West	154	24,070	25,746	27,863
Midwest	201	21,799	23,003	23,946
Southeast/Gulf	341	37,806	40,816	43,142
Other*	27	82	84	85
ASR Industry**	1078	528,671	555,186	581,757

Functional Segments

Functional Segment	Number of Companies	Total DWP (Millions)		
		2014	2015	2016
E&S	140	28,144	29,359	30,030
WC Specialty	100	18,453	20,244	22,208
Mutual	298	44,864	46,874	48,805
Public	106	258,889	276,289	289,515
Reciprocals/Risk Retention Groups	203	55,535	58,242	61,782
NE Personal	28	6,845	7,275	7,587
Large Commercial	19	136,387	141,175	142,725
Small Commercial	678	79,629	85,290	90,318
Large Personal	15	197,270	208,384	222,927
Small personal	299	49,289	52,465	55,819
FL Property	52	6,297	7,154	8,079
CA WC	11	5,101	5,243	5,404
Non Standard Auto	119	11,144	12,028	12,801

Enterprise Risk Management Symposium

"Ultimate" Loss Ratio – Workers Compensation

- Ultimate Loss Ratio in this context is defined as the Schedule P booked loss (& ALAE) ratio for an accident year at 10 years of development
  - Schedule P does not track accident years older than 10 years

- 10th Percentile, Median and 90th Percentile are shown for the 50 Largest writers, net of reinsurance
  - Dashed line indicates accident years that have not yet reached "ultimate"
  - Red line is the maximum loss ratio to achieve an underwriting profit at the average industry expense ratio

- Provides illustration of the underwriting cycle of each line of business and context for a cursory inspection of correlation amongst lines

ERM Enterprise Risk Management Symposium

"Ultimate" Loss Ratio – Workers Compensation
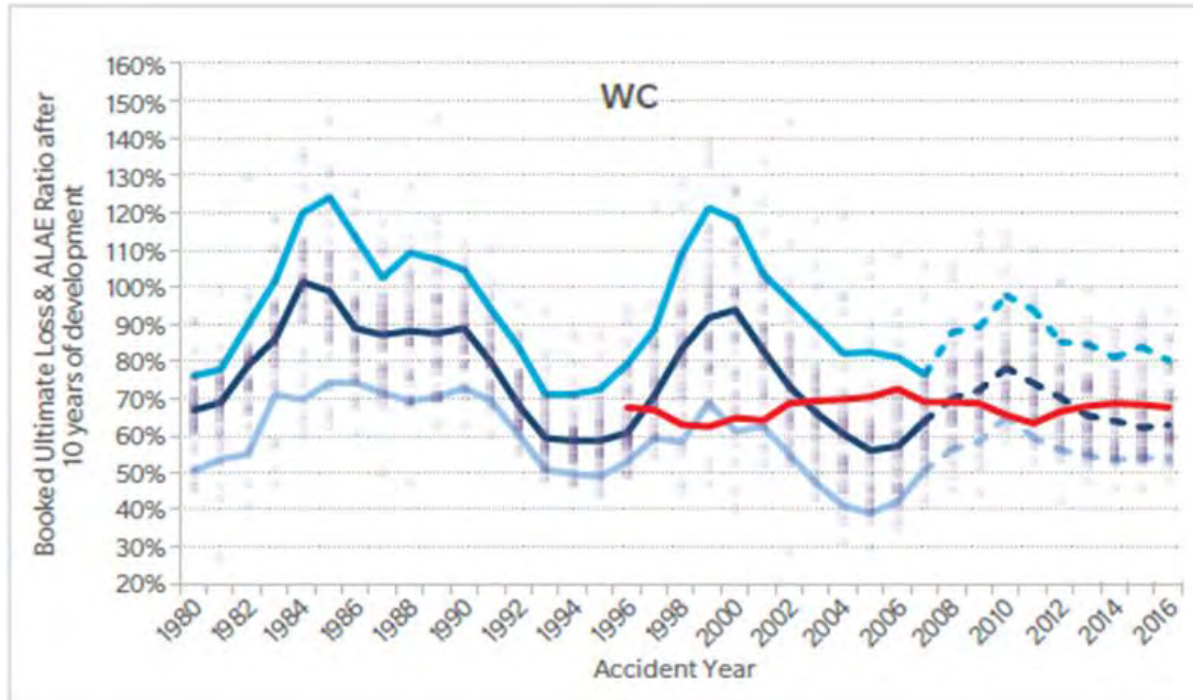
# "Ultimate" Loss Ratio Development – All Lines

- Loss and ALAE ratio is summarized for the entire industry by accident year
  - Blue line shows the initial booked loss and ALAE ratio
  - Red line shows the "ultimate" loss and ALAE ratio
  - Grey line shows the calendar year loss & ALAE ratio
  - Shaded area in between shows reserve development

- Gives perspective into how reserve development is recognized over multiple calendar years

"Ultimate" Loss Ratio Development – All Lines

All Lines

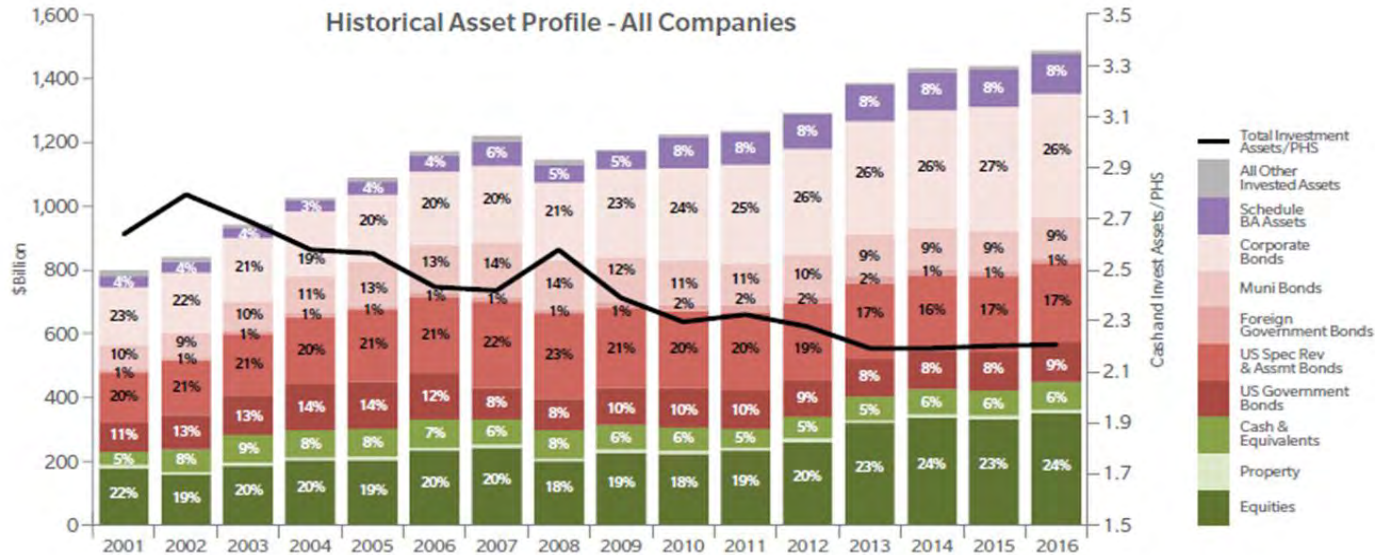Adverse Development

Reserves Released

CY Loss Ratio   Initial Loss Ratio   Ultimate Loss Ratio
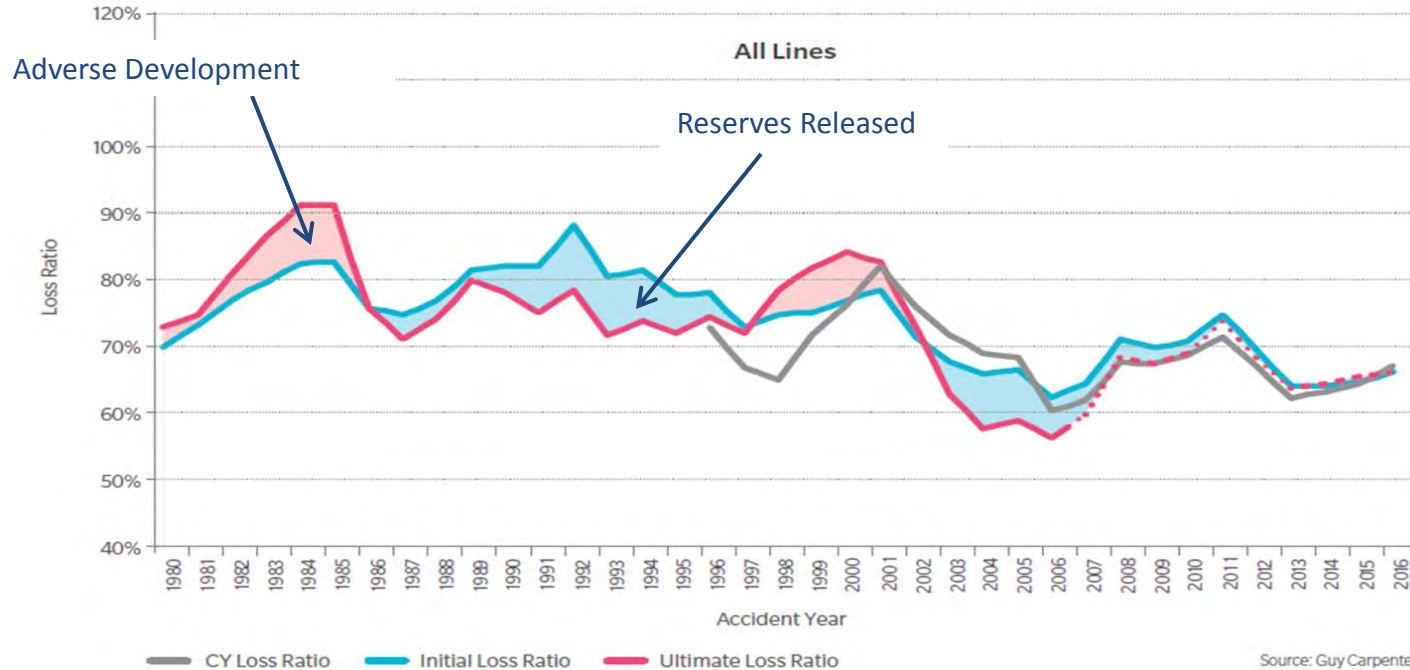
Source: Guy Carpenter

Payment Pattern: Mean and Volatility
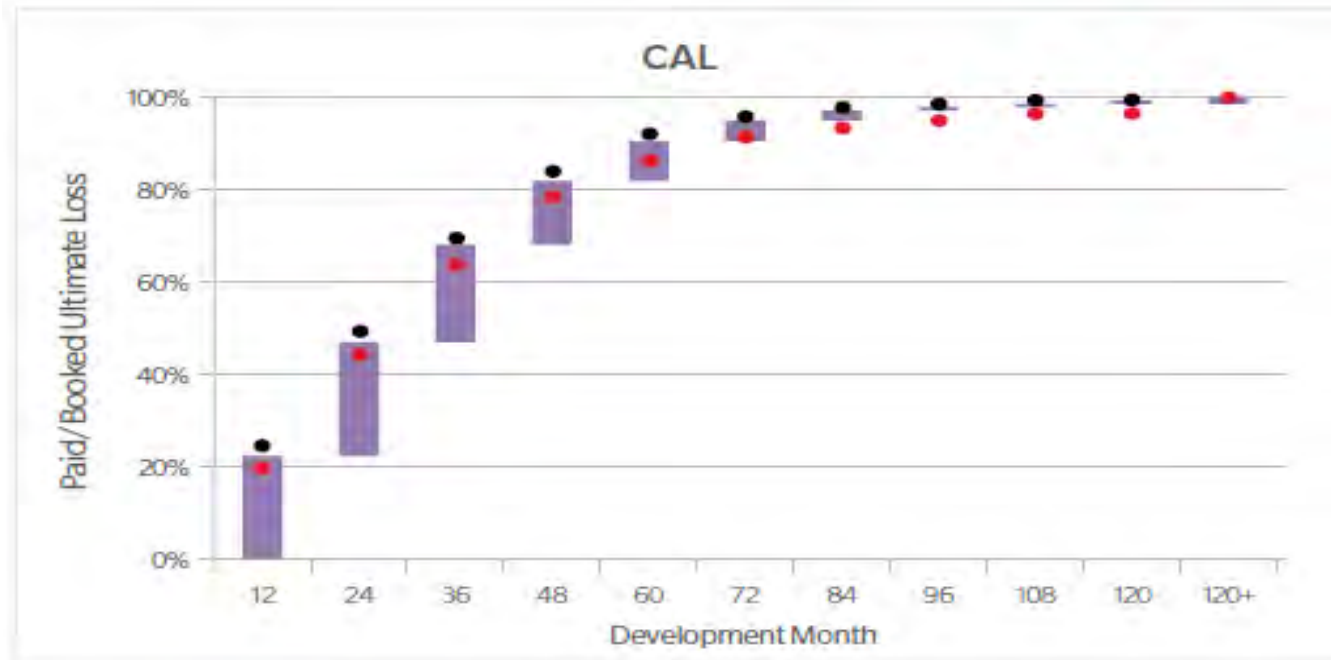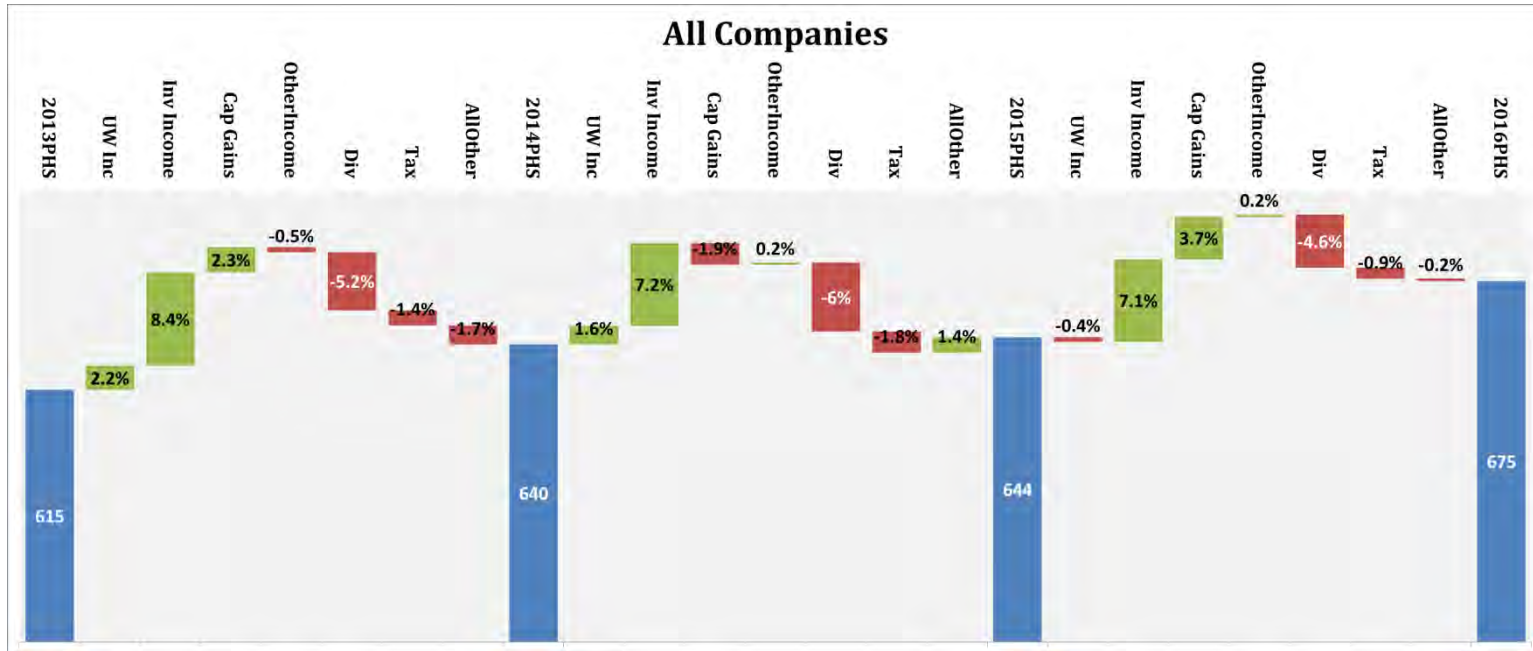
Historical Asset Profile

Historical Asset Profile - All Companies

Equities and Corporate Bonds are Comprising a larger piece of Total Assets in recent years

Industry Contributions to Surplus: 2013 - 2016

Majority of growth in surplus from 2013-2016 was due to Investment Income

Process of Measuring Correlation

- Correlation amongst Schedule P lines is measured based on "ultimate" loss ratio at the aggregated industry level as well as for each individual company

- Individual companies are bucketed by premium volume (Small, Medium, Large) and percentiles of measured correlation are summarized
  - As companies become larger they should have higher correlations between lines since process risk diminishes as volume increases

- Statistical significance of each correlation is measured

- Autocorrelation between accident years is also measured and summarized

Correlation Considerations

- **Policy Limits Profile:** higher limits in casualty mean higher exposure to severity surprises
- **Incurred by Not Reported Losses (IBNR):** the threat of true IBNR, due to coverage triggers or policy coverages, means exposure to correlation from frequency contagion
- **Geographic Concentration**
- **Class Strategy**: For example, pursuing high severity classes of business in Workers Compensation can mean more exposure to correlation
- **Market Pressures:** Competitive markets drive premium trends and place pressure on loss ratios

Enterprise
Risk Management
Symposium

Standardized Economic Capital Modeling

Basis of Standardized Economic Capital Modeling Framework

- Annual Statement Data

- Parameters based on analysis of Annual Statement database

- Economic scenarios to stochastically model assets

- Industry cat event files, scaled to reflect market share

Benefits of a Standardized Capital Modeling Framework

- Provides unique insight into company risk profile among 4 key dimensions – asset, underwriting, catastrophe, and reserve

- Enables peer comparison and market study in a transparent, prospective framework

- Flexible model construction and extensive underlying industry database allows testing of a company's strategic options (including growth, asset allocation, & reinsurance strategy)

Risk vs. Return: Peer Comparison
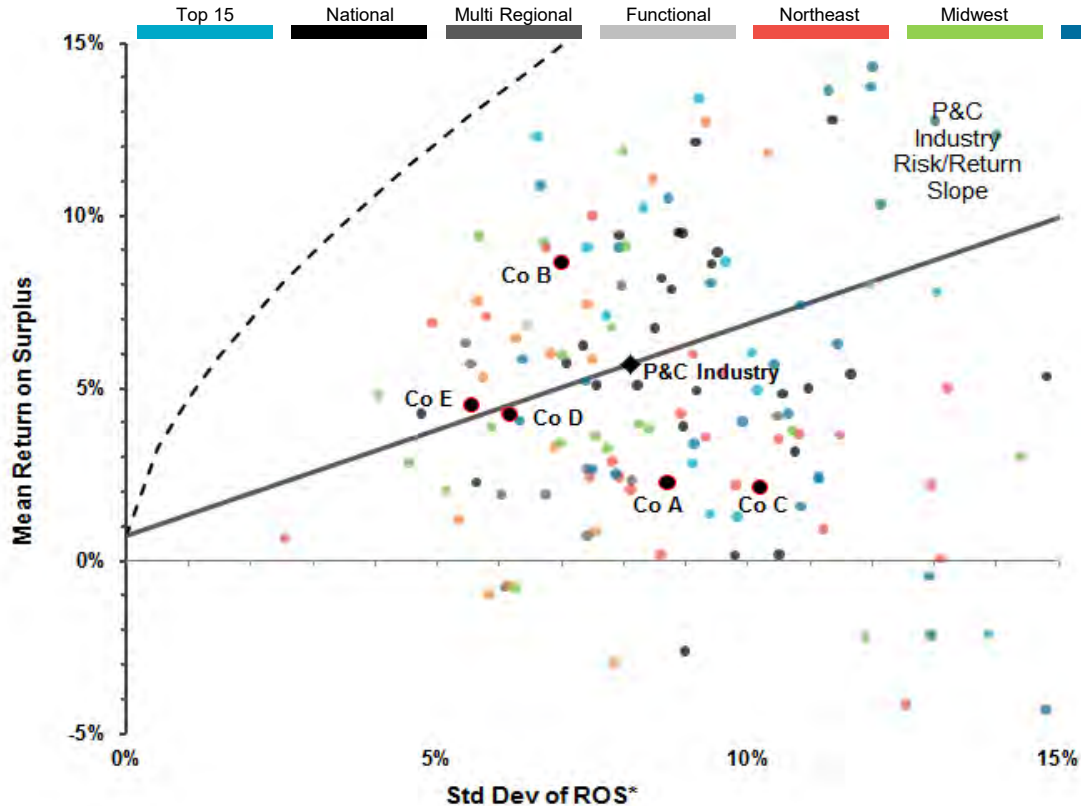
Company A has a lower return and slightly higher volatility than the industry

Simulated Performance: Income Statement

	2017 Simulated Mean	1 in 2 Favorable Year	1 in 10	1 in 20	1 in 100	1 in 250	
Net Earned Premium	87.6	87.6	87.6	87.6	87.6	87.6	87.6
Net Incurred Loss	61.0	55.3	70.1	72.8	78.8	81.7	81.7
Net Underwriting Expenses	25.6	25.6	25.6	25.6	25.6	25.6	25.6
Underwriting Gain	**1.0**	**6.6**	**(8.1)**	**(10.9)**	**(16.9)**	**(19.8)**	**(19.8)**
Investment Income	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Realized Capital Gains	0.1	0.1	0.1	(0.0)	(0.3)	(0.4)	(0.4)
Other Income	(0.9)	(0.9)	(0.9)	(0.9)	(0.9)	(0.9)	(0.9)
Policyholder Dividends	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Income Tax	0.3	1.7	(2.0)	(2.8)	(3.2)	(3.2)	(3.2)
Net Income	**1.6**	**5.9**	**(5.2)**	**(7.4)**	**(13.2)**	**(16.2)**	**(16.2)**
Change in Unrealized Capital Gains	(0.1)	0.3	(0.8)	(0.9)	(1.0)	(1.2)	(1.2)
Deferred Taxes & Other Changes	(0.0)	0.1	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)
Change In Surplus	**1.5**	**6.1**	**(5.8)**	**(8.1)**	**(14.0)**	**(17.2)**	**(17.2)**

Combined Ratio

Co A		98.9%	98.9%	109.5%	112.9%	119.4%	122.0%	122.6%
Co B		94.0%	91.0%	98.5%	100.5%	100.0%	103.6%	103.6%
Co C		102.6%	102.3%	109.3%	112.2%	120.9%	152.0%	152.6%

Simulated Performance: Income Statement

	2017 Simulated Mean	1 in 2 Favorable Year	1 in 10	1 in 20	1 in 100	1 in 250	
Investment Income	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Realized Capital Gains	0.1	0.1	0.1	(0.0)	(0.0)	(0.3)	(0.4)
Other Income	(0.9)	(0.9)	(0.9)	(0.9)	(0.9)	(0.9)	(0.9)
Policyholder Dividends	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Income Tax	0.3	1.3	(2.0)	(2.0)	(2.8)	(3.2)	(3.2)
Net Income	**1.6**	**5.9**	**(5.9)**	**(7.2)**	**(13.4)**	**(16.2)**	**(16.2)**

Net Earned Premium	87.6	87.6	87.6	87.6	87.6	87.6	87.6
Net Incurred Loss	98.9%	92.9%	105.3%	113.8%	119.4%	124.9%	124.6%
Net Underwriting Expenses	94.0%	91.0%	98.8%	100.5%	102.4%	103.4%	103.6%
Co C	102.6%	99.0%	107.4%	110.7%	120.2%	152.9%	152.6%
Co D	98.7%	94.7%	104.8%	106.4%	110.7%	115.7%	115.9%
Co E	99.6%	94.9%	107.3%	109.3%	114.7%	117.5%	117.7%
Investment Income	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Realized Capital Gains	0.1	0.1	0.1	(0.0)	(0.0)	(0.3)	(0.4)
Other Income	(0.9)	(0.9)	(0.9)	(0.9)	(0.9)	(0.9)	(0.9)
Policyholder Dividends	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Income Tax	0.3	1.3	(2.0)	(2.0)	(2.8)	(3.2)	(3.2)
Net Income	**1.6**	**5.9**	**(5.9)**	**(7.2)**	**(13.4)**	**(16.2)**	**(16.2)**

Change in Unrealized Capital Gains	(0.3)	(0.3)	(0.8)	(1.0)	(1.2)	(1.2)	(1.2)
Deferred Taxes & Other Changes	(0.1)	(0.1)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)
Change In Surplus	**1.5**	**5.5**	**(6.8)**	**(8.8)**	**(14.0)**	**(17.2)**	**(17.2)**
Combined Ratio							
Co A	98.9%	92.9%	105.5%	109.3%	119.2%	122.6%	122.6%
Co B	94.0%	91.0%	98.5%	100.5%	102.0%	103.5%	103.6%

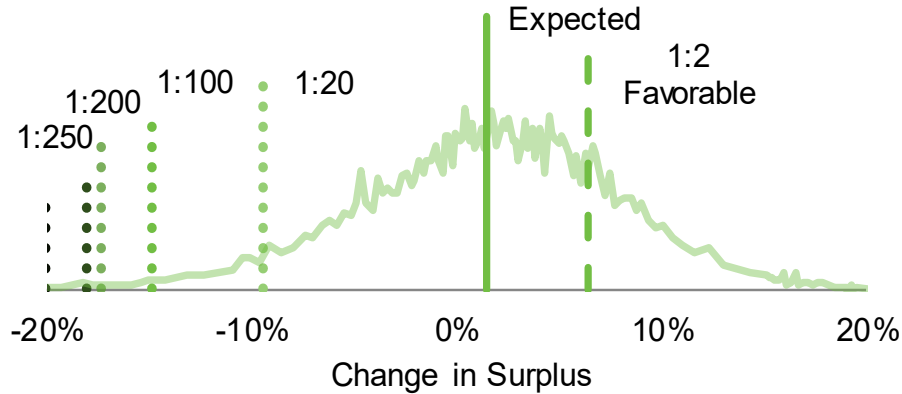# Simulated Performance: Income Statement

Simulated Performance: Income Statement
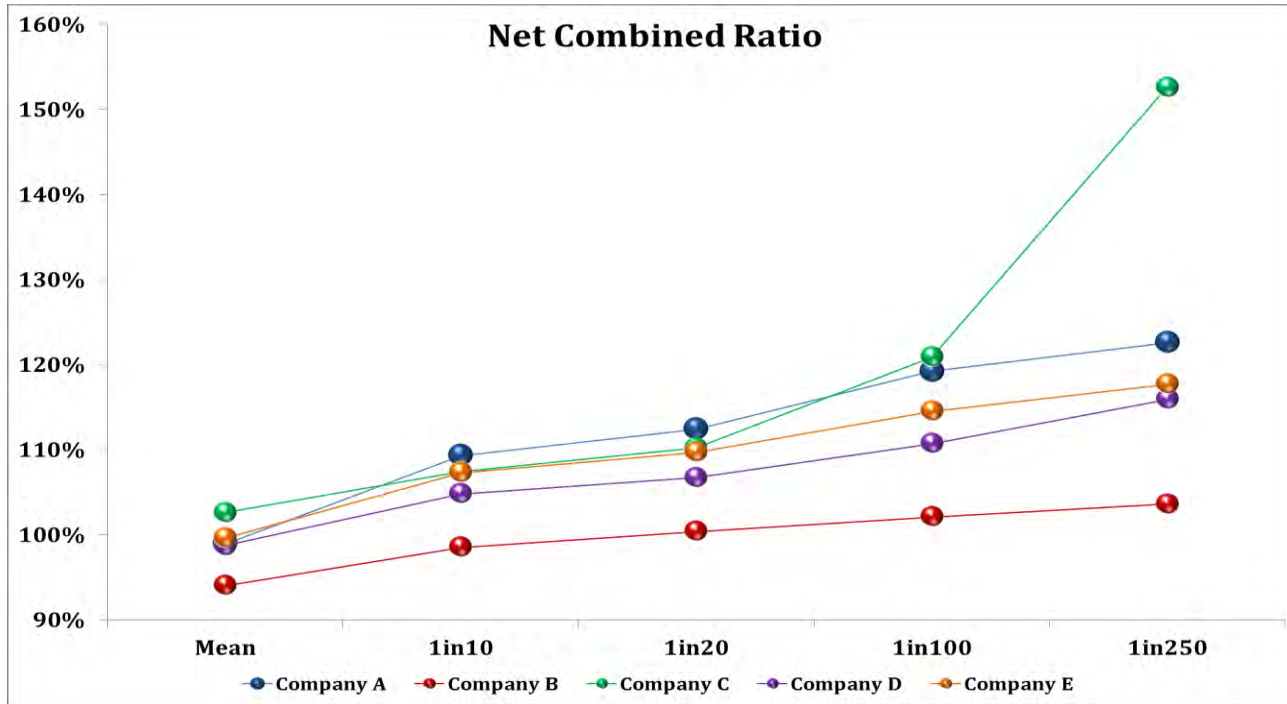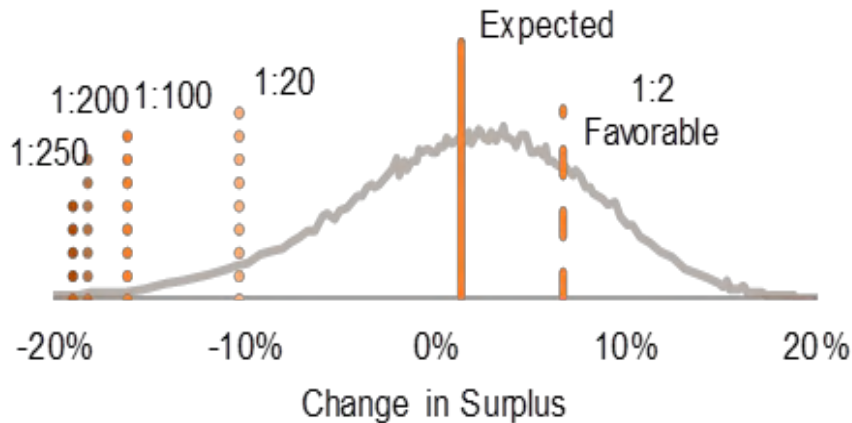
Summary Risk Appraisal – Asset Risk

Company A

Risk Measure	Definition	Co A	Co B	Co C	Co D	Co E
Leverage	Inv Assets / PHS	2.27	1.97	1.68	1.72	1.71
1:20 Event	Asset Loss / PHS	9%	11%	13%	7%	5%
1:100 Event	Asset Loss / PHS	15%	18%	22%	12%	8%
1:250 Event	Asset Loss / PHS	18%	22%	25%	15%	11%

Summary Risk Appraisal – Pricing Risk (Excluding Cat)

Company A

Risk Measure	Definition	Co A	Co B	Co C	Co D	Co E
Leverage	NWP / PHS	1.31	0.85	0.87	1.17	1.02
1:20 Event	UW Loss / PHS	10%	2%	9%	9%	11%
1:100 Event	UW Loss / PHS	16%	4%	12%	13%	15%
1:250 Event	UW Loss / PHS	19%	5%	13%	15%	18%

Summary Risk Appraisal – Cat Risk

Company A
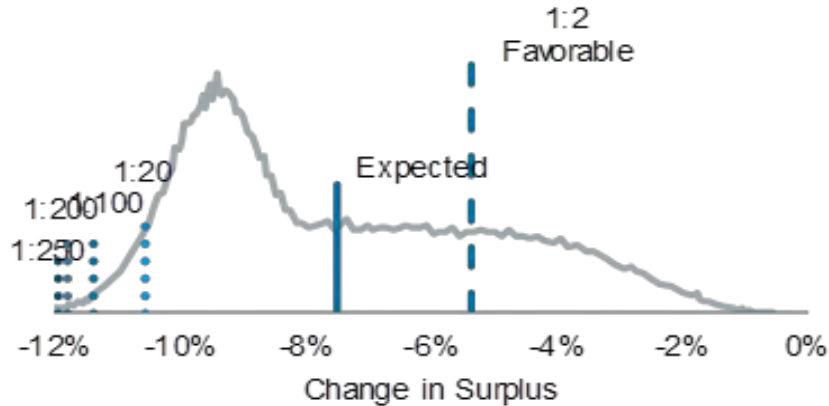
Risk Measure	Definition	Co A	Co B	Co C	Co D	Co E
Leverage	AAL / PHS	0.07	0.03	0.06	0.07	0.04
1:20 Event	Net AEP PML / PHS	11%	4%	17%	12%	8%
1:100 Event	Net AEP PML / PHS	11%	5%	31%	16%	11%
1:250 Event	Net AEP PML / PHS	12%	6%	55%	25%	12%

Summary Risk Appraisal – Reserve Risk

Company A
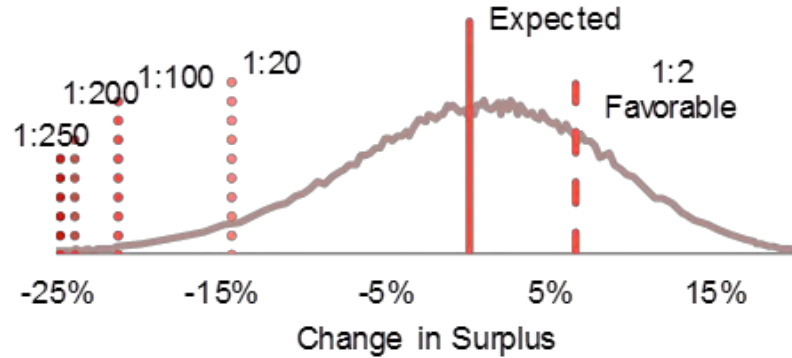
Risk Measure	Definition	Co A	Co B	Co C	Co D	Co E
Leverage	Net Res / PHS	0.80	0.77	0.46	0.35	0.48
1:20 Event	1-Yr Res Dev / PHS	14%	6%	4%	3%	3%
1:100 Event	1-Yr Res Dev / PHS	21%	10%	6%	5%	6%
1:250 Event	1-Yr Res Dev / PHS	25%	12%	6%	6%	7%
1:20 Event	*Ult Res Dev / PHS*	25%	16%	5%	9%	9%
1:100 Event	*Ult Res Dev / PHS*	37%	25%	7%	13%	14%
1:250 Event	*Ult Res Dev / PHS*	43%	29%	9%	16%	17%

Disclaimers

- Guy Carpenter & Company, LLC provides this report for general information only. The information contained herein is based on sources we believe reliable, but we do not guarantee its accuracy, and it should be understood to be general insurance/reinsurance information only. Guy Carpenter & Company, LLC makes no representations or warranties, express or implied. The information is not intended to be taken as advice with respect to any individual situation and cannot be relied upon as such. Please consult your insurance/reinsurance advisors with respect to questions pertaining to your specific book of business.

- Readers are cautioned not to place undue reliance on any historical, current or forward-looking statements. Guy Carpenter & Company, LLC undertakes no obligation to update or revise publicly any historical, current or forward-looking statements, whether as a result of new information, research, future events or otherwise.

- Statements concerning tax, accounting, legal or regulatory matters should be understood to be general observations based solely on our experience as reinsurance brokers and risk consultants, and may not be relied upon as tax, accounting, legal or regulatory advice, which we are not authorized to provide. All such matters should be reviewed with your own qualified advisors in these areas.

- This document or any portion of the information it contains may not be copied or reproduced in any form without the permission of Guy Carpenter & Company, LLC, except that clients of Guy Carpenter & Company, LLC need not obtain such permission when using this report for their internal purposes.

- The assessments and recommendations we make in this report are based on our professional judgment and experience with rating agencies and our understanding of the key issues that the rating agencies focus upon. However, because the ratings process is both complex and involves significant quantitative and qualitative evaluations performed by different individuals applying various judgments and weightings, we can not guarantee that our recommendations will result in a particular ratings outcome or risk-adjusted capitalization score.

- The trademarks and service marks contained herein are the property of their respective owners.

- © 2017 Guy Carpenter & Company, LLC. All rights reserved.