



GETTING THE MOST OUT OF YOUR CAPITAL MODEL

2019 ERM SYMPOSIUM

MAY 3, 2019

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Orlando, Florida

Introduction



Sarah Voit, FCAS
Senior Vice President
GC Analytics

Sarah is a Senior Vice President who leads Guy Carpenter's Philadelphia actuarial team. She is responsible for supporting clients with the design and pricing of reinsurance programs for a variety of property, casualty and specialty lines.

Sarah is a member of Guy Carpenter's Mutual Specialty team and provides insurance companies advice on enterprise risk management, with a focus on operationalizing capital models and drafting risk tolerances statements. In addition, she trains and provides technical support for companies building capital models in MetaRisk®.

Prior to joining Guy Carpenter in 2006, Sarah graduated from New York University with a Bachelor of Arts in Mathematics and History. She is a Fellow of the Casualty Actuarial Society and a Member of the American Academy of Actuaries.

Contact Information:

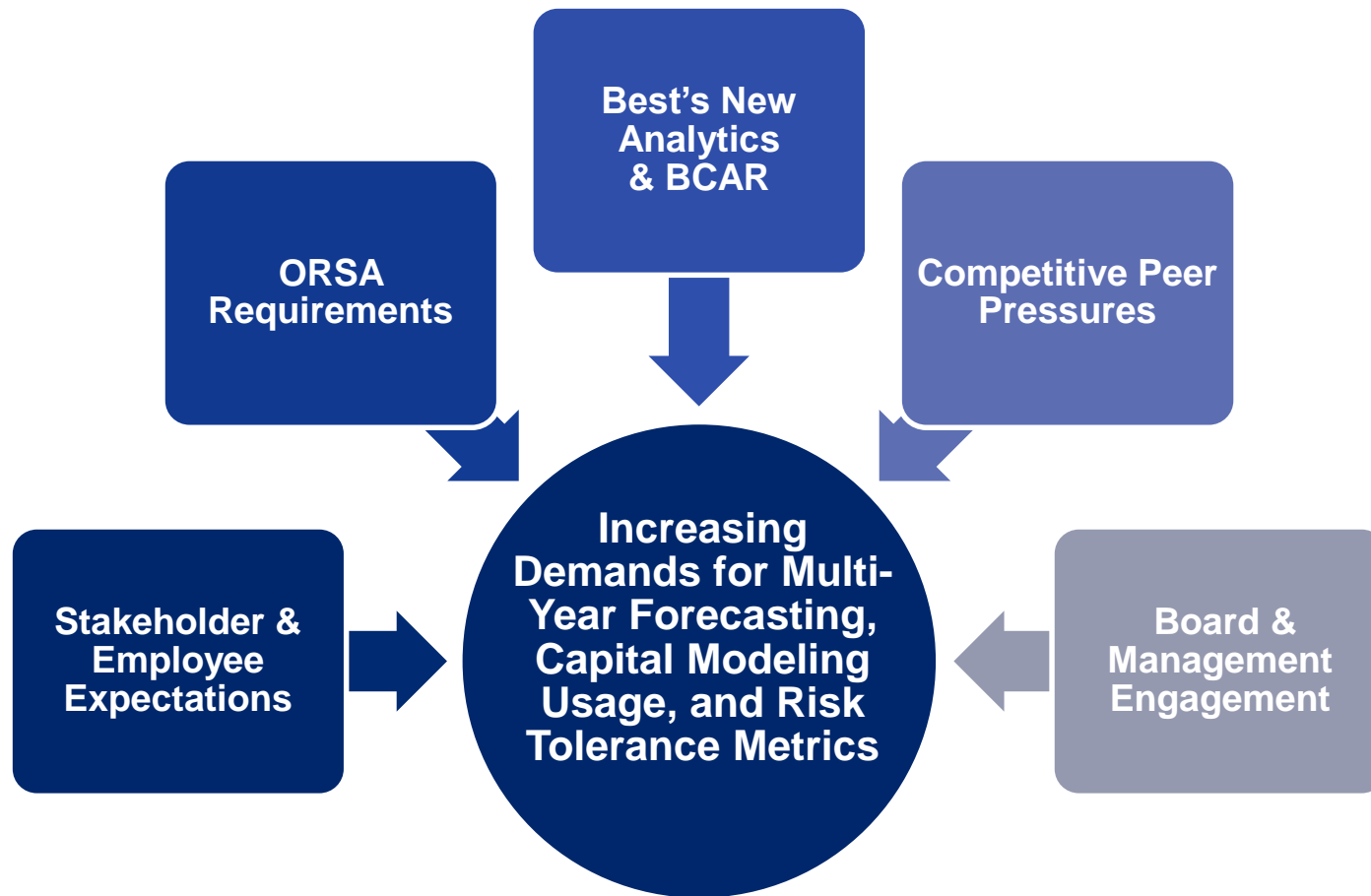
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Capital Modeling

External Drivers



“Due to the convergence of ORSA and Best’s new risk-based analytics, large and small US P&C insurers will be expected to further develop their financial forecasting, capital modeling, and risk tolerance metrics for both capital and earnings.” - GC Strategic Advisory

Reinsurance Decision Making

The background features a dark blue top section. Below it, there are three horizontal bands with wavy, undulating borders. The top band is a medium teal color, the middle band is a light cyan color, and the bottom band is a bright cyan color.

Reinsurance Decision Making

Pros / Cons

- Benefits
 - Considers the full range of probabilistic outcomes, rather than a point estimate or scenario testing
 - Compare reinsurer quotes to the model's technical price
- Challenges
 - Difficult to quantify tail or clash events (lack of data)
 - Different reinsurance structures are optimal based on different goals
 - Can be difficult to quantify the impact of the underwriting cycle and market relationships

Reinsurance Decision Making

Overview of UW Results and Volatility

	Gross	Option 1	Option 2
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Expected UW Results

	Gross	Option 1	Option 2
Net Premium	\$85.5M	\$78.3M	\$75.8M
Net Loss	\$50.3M	\$43.7M	\$43.2M
Net Loss Ratio	58.8%	55.8%	56.9%
Net Expense Ratio	30.9%	33.5%	34.6%
Net UW Profit	\$8.8M	\$8.4M	\$6.4M
Net Combined Ratio	89.7%	89.3%	91.5%

Volatility of Loss and ALAE

	Gross	Option 1	Option 2
Coefficient of Variation of Loss and ALAE	21.0%	16.2%	14.1%
VaR 1:10	\$64.3M	\$52.9M	\$51.7M
VaR 1:20	\$69.3M	\$55.9M	\$51.7M
VaR 1:100	\$79.5M	\$61.9M	\$51.7M
VaR 1:250	\$84.6M	\$64.9M	\$51.7M
TVaR 1:50	\$81.1M	\$62.8M	\$52.0M
TVaR 1:100	\$84.9M	\$65.1M	\$52.3M

Reinsurance Decision Making

Reinsurance Cost and Overview of Ceded Volatility

Option 1

Option 2

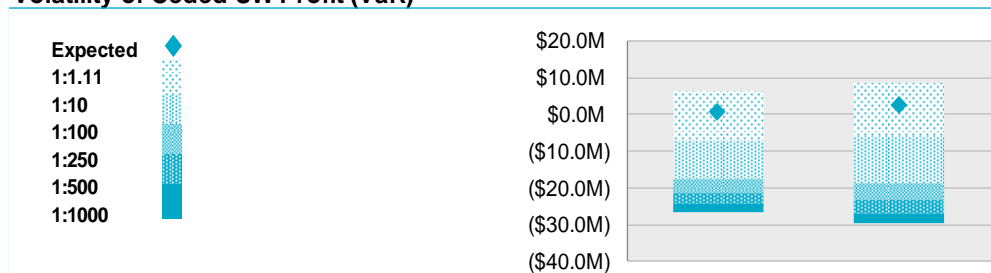
Expected Ceded Results

Ceded Premium	\$7.2M	\$9.7M
Deposit Premium	\$7.2M	\$9.7M
Reinstatement Premium	\$0.0M	\$0.0M
Ceded Losses	\$6.6M	\$7.1M
Ceded Loss Ratio	91.8%	73.5%
Ceding Commission	2.9%	2.2%
Ceded UW Profit (Loss)	\$0.4M	\$2.4M
Cost of Reinsurance: NPV Profit Cedant Perspective	\$0.8M	\$2.9M

Volatility of Loss and ALAE

Coefficient of Variation of Ceded Loss and ALAE	87.0%	90.1%
VaR 1:10	\$14.6M	\$15.8M
VaR 1:20	\$17.9M	\$19.8M
VaR 1:100	\$25.0M	\$28.4M
VaR 1:250	\$28.6M	\$33.1M
TVaR 1:50	\$26.1M	\$29.9M
TVaR 1:100	\$28.9M	\$33.4M

Volatility of Ceded UW Profit (VaR)



Reinsurance Decision Making

Reinsurance Cost and Overview of Ceded Volatility: Option 1

	LOB1 Layer 1	LOB1 Layer 2	LOB1 Layer 3	LOB1 Layer 4	LOB2 Layer 1	Option 1
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Placement Percentage	25.0%	100.0%	92.8%	98.0%	100.0%	
Probability of Attaching	90.0%	77.1%	30.0%	0.6%	80.4%	
Probability of Exhausting	1.9%	0.0%	0.0%	0.0%	0.0%	

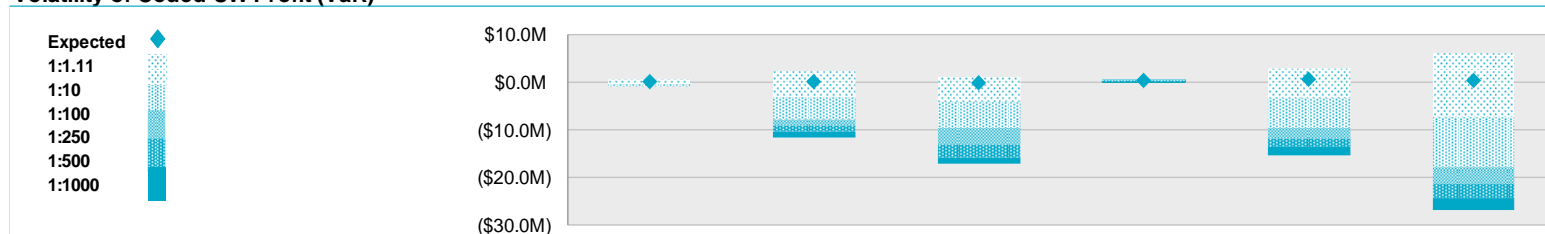
Expected Ceded Results

	\$0.5M	\$2.8M	\$0.9M	\$0.2M	\$2.7M	\$7.2M
Ceded Premium	\$0.5M	\$2.8M	\$0.9M	\$0.2M	\$2.7M	\$7.2M
Deposit Premium	\$0.5M	\$2.8M	\$0.9M	\$0.2M	\$2.7M	\$7.2M
Reinstatement Premium	\$0.0M	\$0.0M	\$0.0M	\$0.0M	\$0.0M	\$0.0M
Ceded Losses	\$0.5M	\$2.7M	\$1.2M	\$0.0M	\$2.2M	\$6.6M
Ceded Loss Ratio	109.8%	96.0%	127.6%	0.4%	80.1%	91.8%
Ceding Commission	0.0%	7.4%	0.0%	(0.0%)	0.0%	2.9%
Ceded UW Profit (Loss)	(\$0.0M)	(\$0.1M)	(\$0.3M)	\$0.2M	\$0.5M	\$0.4M
Cost of Reinsurance: NPV Profit Cedant Perspective	(\$0.0M)	\$0.1M	(\$0.2M)	\$0.2M	\$0.7M	\$0.8M

Volatility of Loss and ALAE

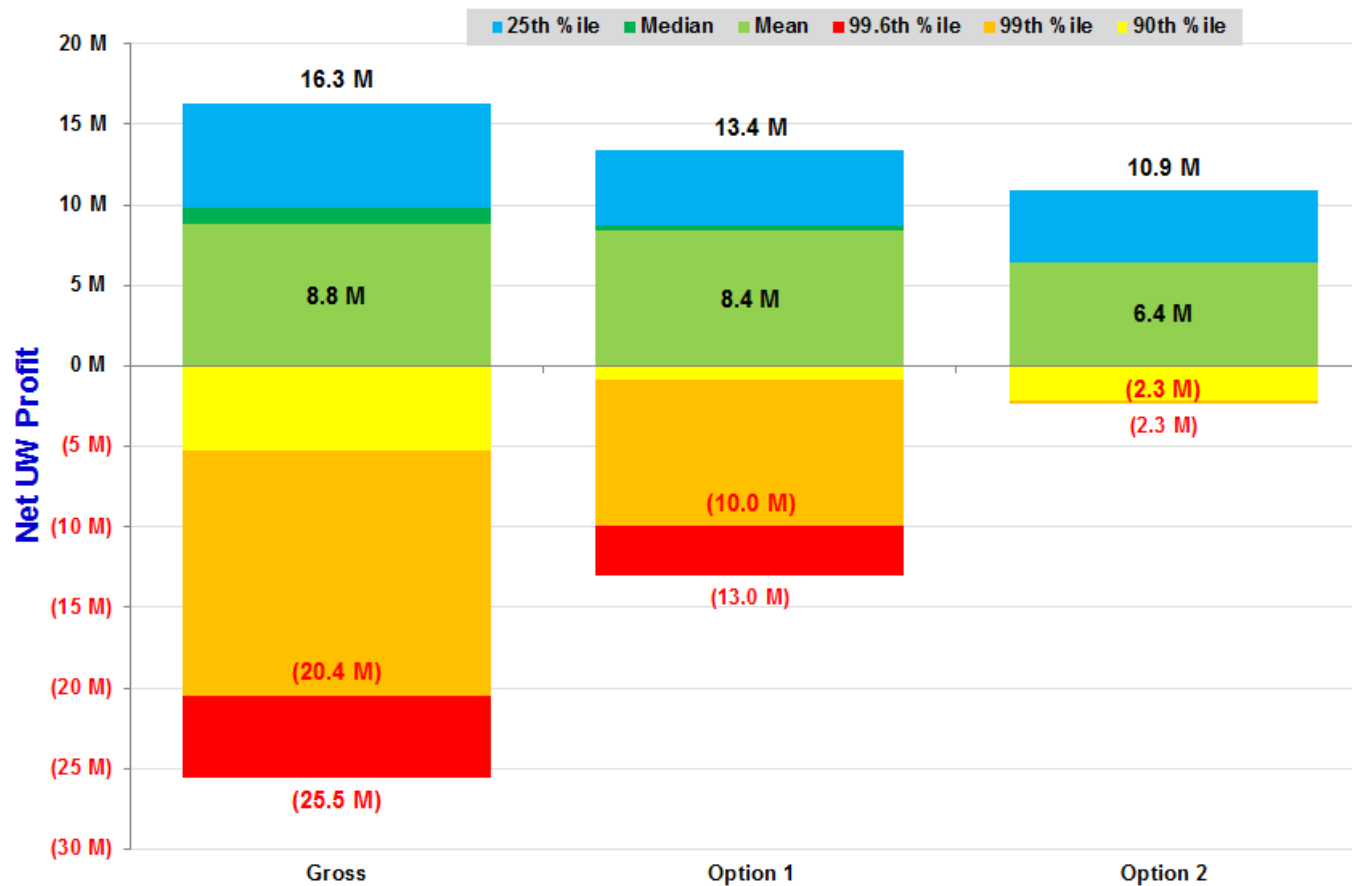
	68.0%	98.0%	231.3%	1702.5%	133.2%	87.0%
Coefficient of Variation of Ceded Loss and ALAE	68.0%	98.0%	231.3%	1702.5%	133.2%	87.0%
VaR 1:10	\$1.0M	\$6.1M	\$5.0M	\$0.0M	\$6.1M	\$14.6M
VaR 1:20	\$1.2M	\$8.0M	\$8.6M	\$0.0M	\$8.5M	\$17.9M
VaR 1:100	\$1.4M	\$10.9M	\$10.6M	\$0.0M	\$12.4M	\$25.0M
VaR 1:250	\$1.4M	\$12.0M	\$14.1M	\$0.1M	\$14.7M	\$28.6M
TVaR 1:50	\$1.4M	\$11.2M	\$12.1M	\$0.1M	\$13.1M	\$26.1M
TVaR 1:100	\$1.4M	\$12.4M	\$14.5M	\$0.1M	\$14.8M	\$28.9M

Volatility of Ceded UW Profit (VaR)



Reinsurance Decision Making

Risk/Reward By Structure Alternative



Reinsurance Decision Making

Summary of Reinsurance Decision Metrics in MetaRisk®

	Gross	Option 1	Option 2	Goal	Weight
Price and Profitability					
Ceded UW Profit (Loss)	\$0.0M	\$0.4M	\$2.4M	↓	10%
Ceded Premium	\$0.0M	\$7.2M	\$9.7M	↓	10%
Ceded Loss	\$0.0M	\$6.6M	\$7.1M	↑	10%
Net Loss	\$50.3M	\$43.7M	\$43.2M	↓	5%
Volatility					
Standard Deviation of UW Result	\$10.6M	\$7.1M	\$6.1M	↓	5%
Coefficient of Variation of UW Result	120.2%	84.8%	95.6%	↓	5%
VaR 1:20 Combined Ratio	112.0%	105.0%	103.1%	↓	10%
Capital					
VaR 1:100 Combined Ratio	123.9%	112.7%	103.1%	↓	15%
VaR 1:100 UW Profit (Loss)	(\$20.4M)	(\$10.0M)	(\$2.3M)	↑	15%
Reinsurance Cost/Benefit					
UW Reward-to-Risk Multiple	7.2	17.7	18.9	↑	5%
Tail Benefit of Reinsurance (1:200 VaR)		\$11.2M	\$19.6M	↑	5%
Reinsurance Capital Value		\$9.4M	\$12.0M	↑	5%
Optimization Score (10=Best, 1=Worst)	2.80	7.29	8.16		100%

UW Reward-to-Risk Ratio = (Probability of UW Profit x Average of UW Profit Scenarios) / (Probability of UW Loss x Average of UW Loss Scenarios)

Tail Benefit of Reinsurance = Change to a VaR percentile due to change in reinsurance

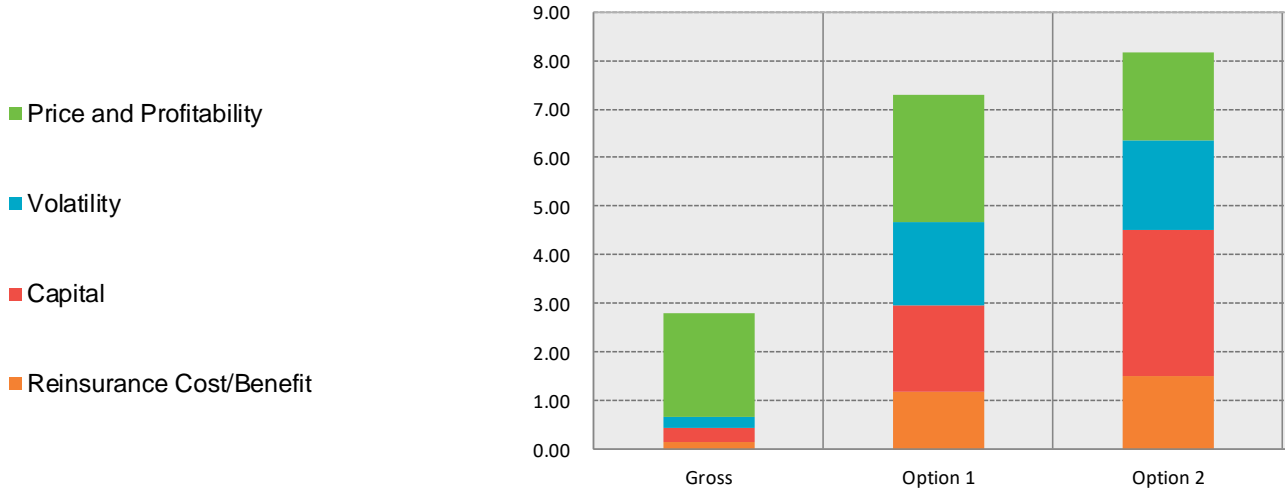
Tail Benefit Multiple = Tail Benefit of Reinsurance / Mean Ceded Underwriting Profit

Reinsurance Capital Value = Cost of capital saved over time from reinsurance less Mean Ceded Profit

Reinsurance Decision Making

Reinsurance Decision Tool

	Gross	Option 1	Option 2	Optimization Weight
Price and Profitability	6.14	7.47	5.14	35%
Volatility	1.00	8.51	9.31	20%
Capital	1.00	6.01	10.00	30%
Reinsurance Cost/Benefit	1.00	7.79	10.00	15%
Optimization Score	2.80	7.29	8.16	100%



Risk Profile Benchmarking

The background features a dark blue top section. Below it, there are three horizontal bands with wavy, undulating borders. The top band is a medium teal color, the middle band is a light cyan color, and the bottom band is a bright cyan color.

Risk Profile Benchmarking

Pros / Cons

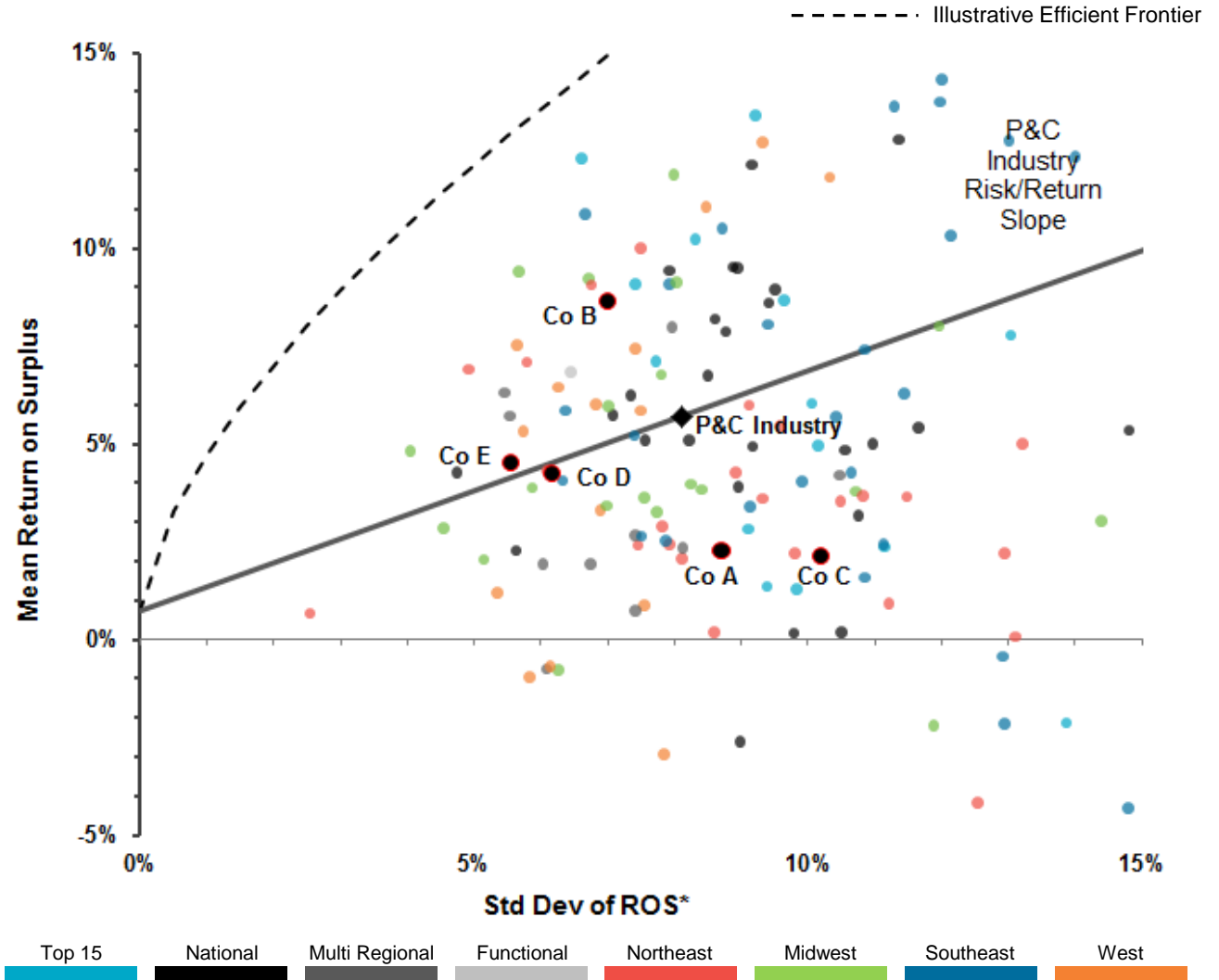
- Benefits
 - Compare a company versus peers or industry segments
 - Confirm if the company's risk profile aligns with their risk tolerance statements
 - Evaluate potential growth and/or M&A scenarios
- Challenges
 - Similar assumptions across peers is essential to be able to compare results
 - Limited customizations for peer companies since their analysis is based on publically available information

Risk Profile Benchmarking

Prospective Risk and Return Framework in BenchmaRQ®

Performance (return) and volatility (risk) can be viewed as a tradeoff and need to be evaluated together.

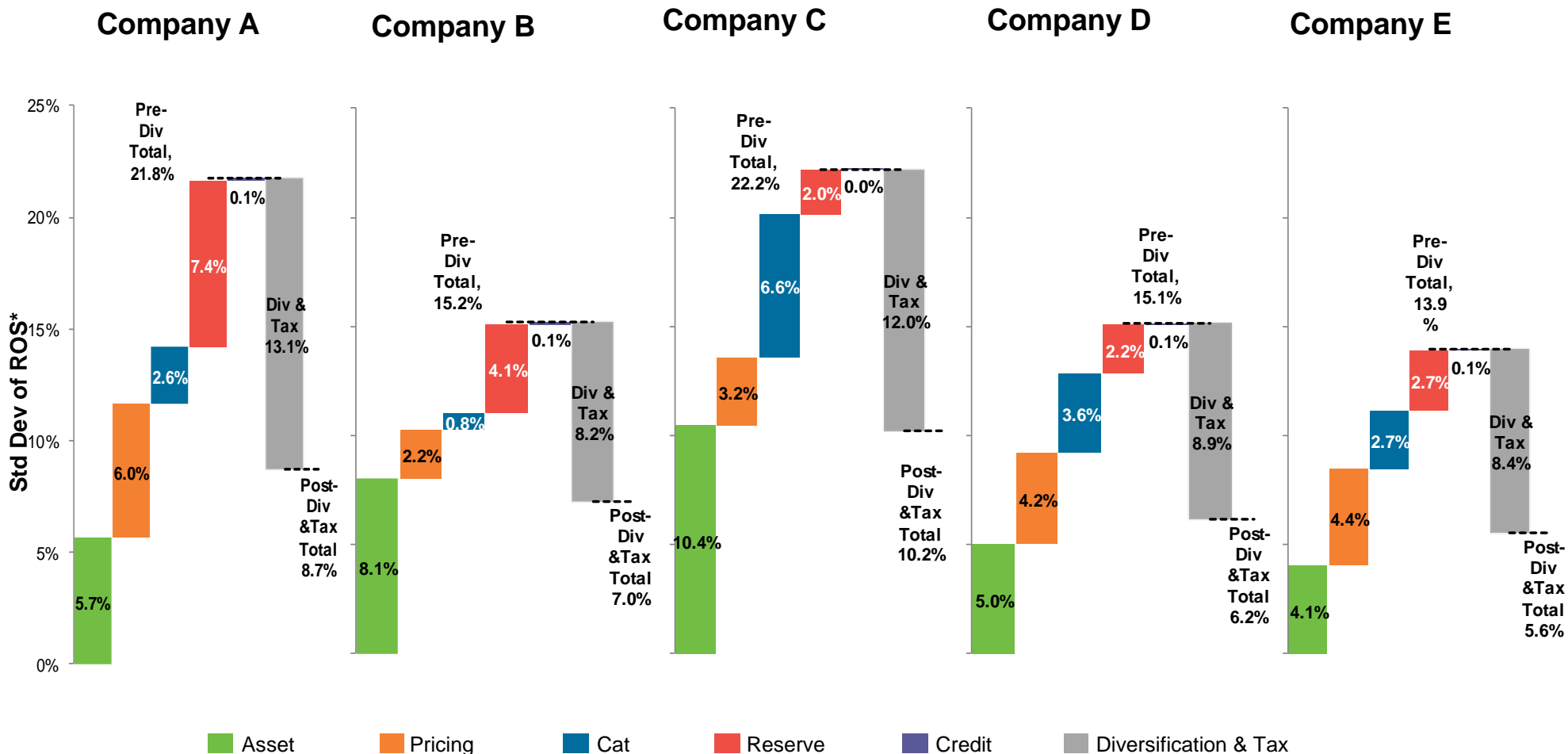
This analytic efficient frontier compares average modeled return to volatility of surplus across the industry. This framework provides a robust platform to manage risk/reward preferences and benchmark peer profiles.



* We allow bonds to be stated at market value to illustrate liquidity risk.

Risk Profile Benchmarking

Visualizing Risk Profiles in BenchmaRQ®



We decompose the Volatility in Surplus into **marginal risk source**.

Total volatility is less than the sum of individual risk sources due to **diversification and tax effects**.

The risk profile is the **company's identity**.

Risk Profile Benchmarking

Simulated Performance: Income Statement

What is the primary driver of the losses to surplus in the tail scenarios?

Is the trade-off between upside and downside acceptable?

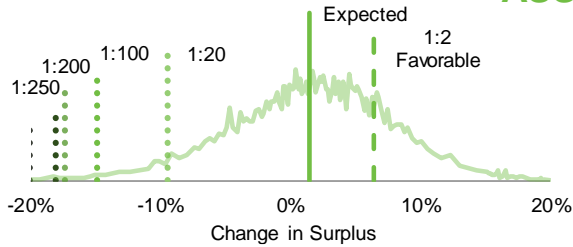
How does the downside compare to risk tolerance?

	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
Net Incurred Loss	61.0	55.3	70.1	72.8	78.8	81.7
Net Underwriting Expenses	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)
Investment Income	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)
Other Income	(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
Income Tax	0.3	1.7	(2.0)	(2.8)	(3.2)	(3.2)
Net Income	1.6	5.9	(5.2)	(7.4)	(13.2)	(16.2)
Change in Unrealized Capital Gains	(0.1)	0.3	(0.8)	(0.9)	(1.0)	(1.2)
Deferred Taxes & Other Changes	(0.0)	0.1	(0.2)	(0.2)	(0.2)	(0.2)
Change In Surplus	1.5	6.1	(5.8)	(8.1)	(14.0)	(17.2)
Combined Ratio						
Co A	98.9%	92.5%	109.3%	112.4%	119.2%	122.6%
Co B	94.0%	91.0%	98.5%	100.4%	102.1%	103.6%
Co C	102.6%	99.3%	107.4%	110.2%	120.9%	152.6%
Co D	98.7%	94.8%	104.8%	106.7%	110.7%	115.9%
Co E	99.6%	94.9%	107.3%	109.7%	114.5%	117.7%
Return on Surplus						
Co A	2.3%	9.1%	(8.6%)	(12.0%)	(20.9%)	(25.6%)
Co B	8.6%	14.9%	(1.5%)	(4.6%)	(10.8%)	(14.3%)
Co C	2.1%	10.4%	(10.5%)	(15.1%)	(29.1%)	(45.5%)
Co D	4.2%	8.8%	(2.9%)	(5.2%)	(10.2%)	(14.7%)
Co E	4.5%	8.6%	(2.2%)	(4.2%)	(8.4%)	(10.9%)

Risk Profile Benchmarking

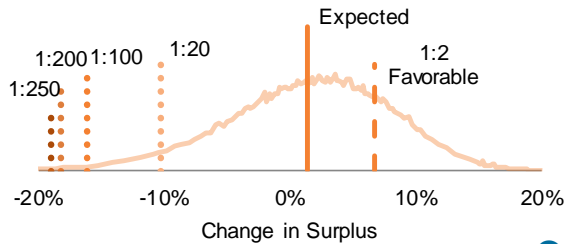
Summary Risk Appraisal

ASSET RISK



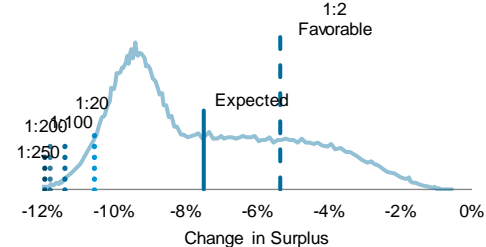
Risk Measure	Definition	Co A	Co B	Co C	Co D	Co E
Leverage	Inv Assets / PHS	2.27	1.97	1.68	1.72	1.71
1:20 Event	Asset Loss / PHS	9%	11%	13%	7%	5%
1:100 Event	Asset Loss / PHS	15%	18%	22%	12%	8%
1:250 Event	Asset Loss / PHS	18%	22%	25%	15%	11%

PRICING RISK (EX-CAT)



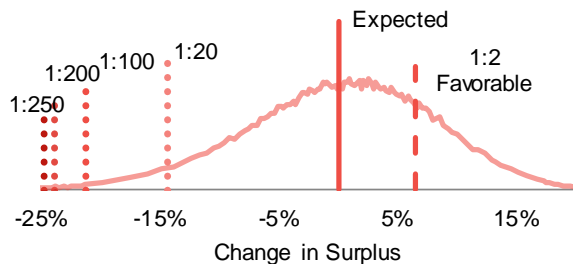
Risk Measure	Definition	Co A	Co B	Co C	Co D	Co E
Leverage	NWP / PHS	1.31	0.85	0.87	1.17	1.02
1:20 Event	UW Loss / PHS	10%	2%	9%	9%	11%
1:100 Event	UW Loss / PHS	16%	4%	12%	13%	15%
1:250 Event	UW Loss / PHS	19%	5%	13%	15%	18%

CAT RISK



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%

RESERVE RISK



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%

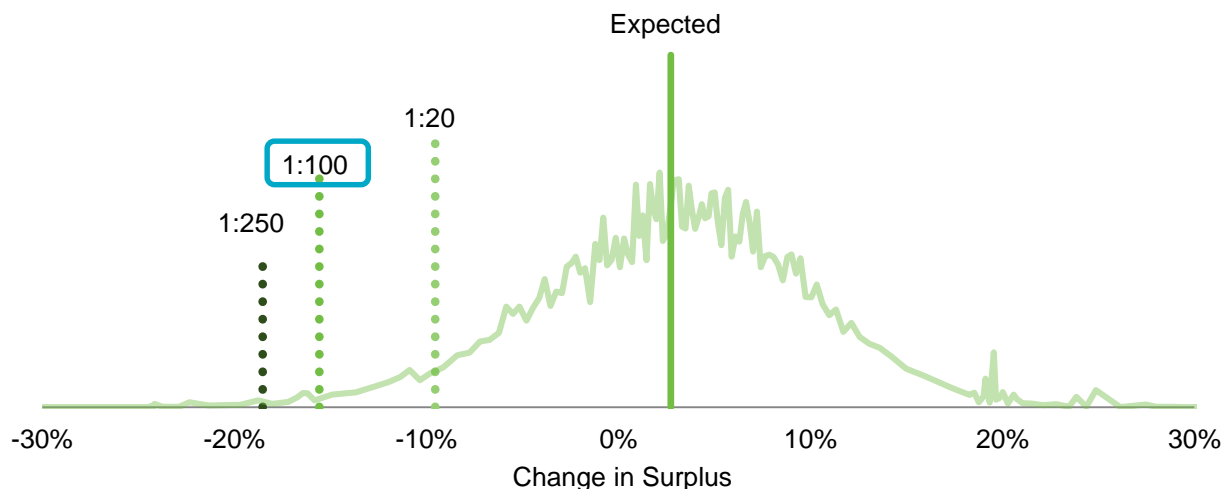
Risk Profile Benchmarking

Risk Tolerance Statements

ASSET RISK

Risk Measure	Definition	Company A	Company B	Company C	Company D
Leverage	Inv Assets / PHS	1.58	1.68	1.91	1.71
1:20 Event	Asset Loss / PHS	9%	6%	9%	7%
1:100 Event	Asset Loss / PHS	15%	11%	16%	13%
1:250 Event	Asset Loss / PHS	18%	13%	19%	15%

- There is a 1 in 100 chance that Company A will have an asset loss greater than **15%** of surplus
- **Sample risk tolerance:** We do not want to lose more than XX% of surplus from an asset loss in a 100 year event.



How much surplus will Company A lose in a stressed year due to asset risk?

Guy Carpenter Disclaimer

GC Analytics® Disclaimer(s)

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

This presentation (report, letter) is not intended to be a complete actuarial communication. Upon request, we can prepare one. We are available to respond to questions regarding our analysis.

There are many limitations on actuarial analyses, including uncertainty in the estimates and reliance on data. We will provide additional information regarding these limitations upon request.

As with any actuarial analysis, the results presented herein are subject to significant variability. While these estimates represent our best professional judgment, it is probable that the actual results will differ from those projected. The degree of such variability could be substantial and could be in either direction from our estimates.

The estimated cash flows may vary significantly from amounts actually collected, particularly in the event that a reinsurer is unwilling or unable to perform in accordance with the terms of the reinsurance contract.



GETTING THE MOST OUT OF YOUR CAPITAL MODEL

2019 ERM Symposium



May 3, 2019

Orlando, Florida

INTRODUCTION



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David is a Director in the Actuarial & Risk Analytics team at RSM and provides a diverse range of property & casualty actuarial, insurance management, and enterprise risk management consulting services for large financial institutions and clients in various other industries.

David leads several complex model development initiatives in the area of economic capital and stochastic risk modeling, model validation and model risk management engagements for Canadian, US, and international clients, with a key focus on the applications of capital models within the strategic decision-making process.

David has held senior roles in the Corporate Actuarial and Risk Management departments of a large insurance company where he led the company's ORSA and stress testing programs, strategic planning process, model validation team, and various other ERM programs and initiatives. He also has experience as a consultant for a large reinsurance broker where he worked in pricing, reserving, reinsurance and capital modeling (including Solvency II) for long-tailed liability risks for global insurance companies and captives.

CAPITAL MODELS AND THE ERM PROCESS



Risk Identification and Measurement

- Scenario analysis, sensitivity testing, and reverse stress testing
- Stochastic modeling, risk aggregation and diversification
- Capital adequacy assessment

Risk Monitoring and Reporting:

- Own Risk and Solvency Assessment (“ORSA”) reporting
- Risk appetite statements and metrics, key risk indicators

Risk Response and Mitigation:

- Reactive or passive mitigation strategies (e.g. reinsurance programs, and setting aside capital)
- **Active business strategies that transform the inherent risk profile**
- **Embedding ORSA into strategic-decision making (i.e. use test)**

ALLOCATING CAPITAL FOR RISK-BASED PRICING

ALLOCATING CAPITAL FOR RISK-BASED PRICING

- Benefits:

- Rates will better reflect the underlying risk of each line of business.
- Financial performance (e.g. ROE) becomes more meaningful to management and allows them to more informed decisions.
- Capital is attributed in a holistic way, considering interactions between all lines of business.

- Challenges:

- Confidence level of the risk measure
- Many sound capital allocation methods exist
- Wide range of possible allocations

CAPITAL MODEL

- Basic Assumptions:

Line	Premiums	Loss Ratio	Expense Ratio	Correlation	Auto	Home	CGL
Auto	2,000	Mean = 70%, SD = 10%	25%	Auto	100%	50%	0%
Home	1,000	Mean = 60%, SD = 30%	30%	Home	50%	100%	25%
CGL	1,000	Mean = 65%, SD = 20%	30%	CGL	0%	25%	100%

- Model Overview:

- Claims are simulated using correlated Lognormal distributions.
- Profit (Loss) = Premiums – Claims – Expenses
- Capital is only needed in scenarios where Profit (Loss) < 0

SAMPLE SCENARIOS

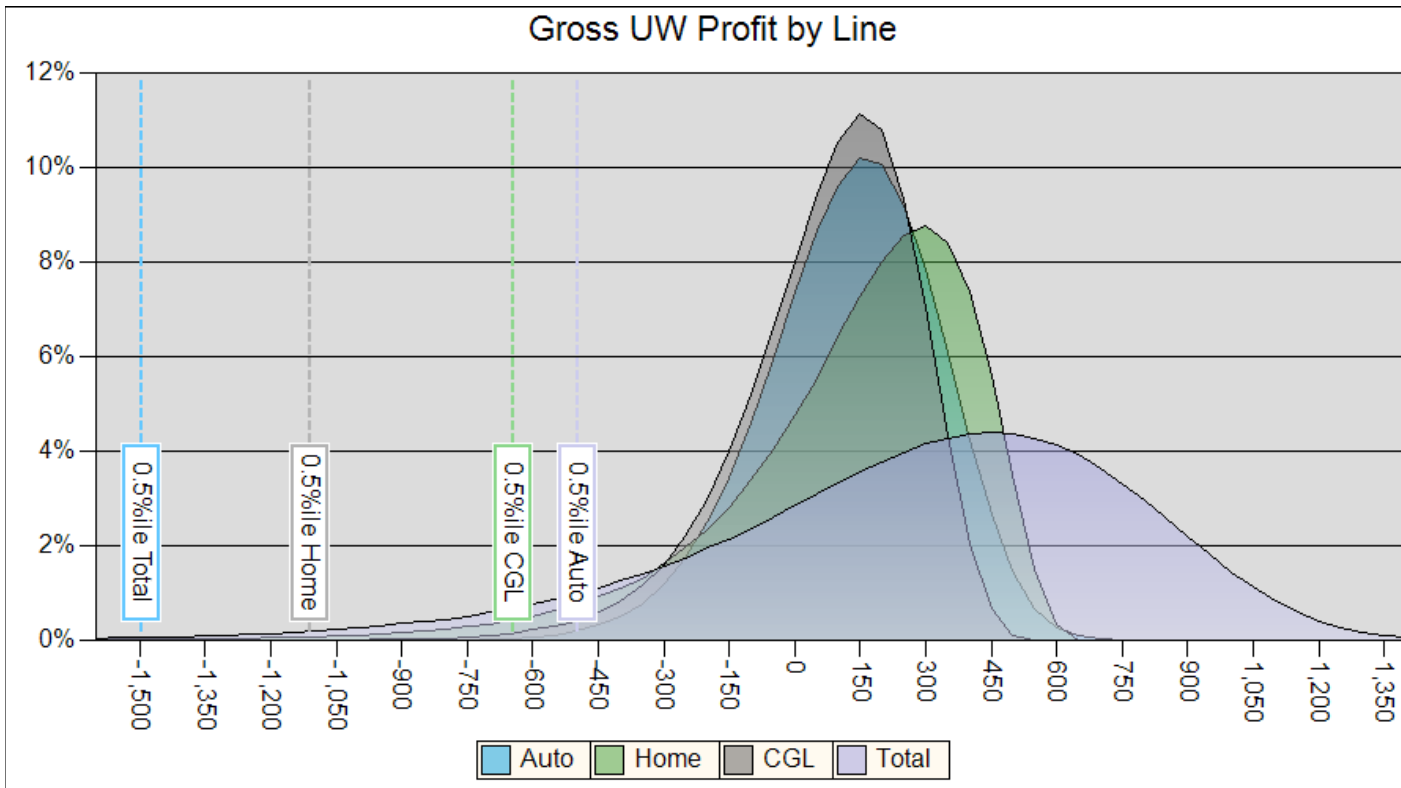
= 80.3% x 2,000

Scenario	1	2	3	4	5	6	7	8	9	10
Premiums_Auto	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Premiums_Home	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Premiums_CGL	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Premiums_Total	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Claims_Auto	1,605	1,096	1,345	1,565	1,089	1,256	1,340	1,242	1,357	1,259
Claims_Home	709	1,006	393	254	516	293	917	474	473	472
Claims_CGL	705	539	811	814	494	561	692	629	720	678
Claims_Total	3,018	2,642	2,549	2,633	2,099	2,109	2,949	2,345	2,550	2,409
Expenses_Auto	500	500	500	500	500	500	500	500	500	500
Expenses_Home	300	300	300	300	300	300	300	300	300	300
Expenses_CGL	300	300	300	300	300	300	300	300	300	300
Expenses_Total	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
P&L_Auto	(105)	404	155	(65)	411	244	160	258	143	241
P&L_Home	(9)	(306)	307	446	184	407	(217)	226	227	228
P&L_CGL	(5)	161	(111)	(114)	206	139	8	71	(20)	22
P&L_Total	(118)	258	351	267	801	791	(49)	555	350	491

= 25% x 2,000 = 2,000 - 1,605 - 500

90% VaR

SIMULATION RESULTS



Capital	Auto	Home	CGL	Total
90% VaR (1-in-10)	163	283	212	407
95% VaR (1-in-20)	251	468	317	666
99% VaR (1-in-100)	428	908	548	1,244
99.5% VaR (1-in-200)	498	1,109	644	1,497
99.9% VaR (1-in-1000)	653	1,610	876	2,100

Expected	Auto	Home	CGL	Total	
(1) Premiums	2,000	1,000	1,000	4,000	<i>Assumption</i>
(2) Claims	1,400	600	650	2,650	= (1) x (3)
(3) Loss Ratio	70%	60%	65%	66%	<i>Assumption</i>
(4) Expenses	500	300	300	1,100	= (1) x (5)
(5) Expense Ratio	25%	30%	30%	28%	<i>Assumption</i>
(6) Profit (Loss)	100	100	50	250	= (1) - (2) - (4)
(7) Combined Ratio	95%	90%	95%	94%	= (3) + (5)
(8) Capital (99.5% VaR)	498	1,109	644	1,497	<i>Modeled</i>
(9) P/S Ratio	402%	90%	155%	267%	= (1) / (8)
(10) ROE	20%	9%	8%	17%	= (6) / (8)

498 + 1,109 + 644 = 2,251 > 1,497

CAPITAL ALLOCATION METHODS

- **Pro Rata:** allocated proportionately to a risk measure (e.g. 99.5% VaR)
- **Last-In:** allocated proportionately to the decrease in capital required when a line of business is removed **entirely**
- **Incremental:** allocated proportionately to the decrease in capital required when a line of business is removed **partially**
- Many more complex methods, published in actuarial and risk modeling literature, could be implemented as well.

PRO RATA METHOD

Expected	Auto	Home	CGL	Total	
(1) Premiums	2,000	1,000	1,000	4,000	<i>Assumption</i>
(2) Claims	1,400	600	650	2,650	= (1) x (3)
(3) Loss Ratio	70%	60%	65%	66%	<i>Assumption</i>
(4) Expenses	500	300	300	1,100	= (1) x (5)
(5) Expense Ratio	25%	30%	30%	28%	<i>Assumption</i>
(6) Profit (Loss)	100	100	50	250	= (1) - (2) - (4)
(7) Combined Ratio	95%	90%	95%	94%	= (3) + (5)
(8) Capital (99.5% VaR)	498	1,109	644	1,497	<i>Modeled</i>
(9) P/S Ratio	402%	90%	155%	267%	= (1) / (8)
(10) ROE	20%	9%	8%	17%	= (6) / (8)
Pro Rata Method	Auto	Home	CGL	Total	
(11) Allocation %	22%	49%	29%	100%	= (8) / SUM(8)
(12) Allocated Capital	331	738	428	1,497	= (11) x (8) Total
(13) P/S Ratio	604%	136%	233%	267%	= (1) / (12)
(14) ROE	30%	14%	12%	17%	= (6) / (12)

LAST-IN METHOD

Expected	Auto	Home	CGL	Total	
(1) Premiums	2,000	1,000	1,000	4,000	Assumption
(2) Claims	1,400	600	650	2,650	= (1) x (3)
(3) Loss Ratio	70%	60%	65%	66%	Assumption
(4) Expenses	500	300	300	1,100	= (1) x (5)
(5) Expense Ratio	25%	30%	30%	28%	Assumption
(6) Profit (Loss)	100	100	50	250	= (1) - (2) - (4)
(7) Combined Ratio	95%	90%	95%	94%	= (3) + (5)
(8) Capital (99.5% VaR)	498	1,109	644	1,497	Modeled
(9) P/S Ratio	402%	90%	155%	267%	= (1) / (8)
(10) ROE	20%	9%	8%	17%	= (6) / (8)

Last-In Method	Auto	Home	CGL	Total	
(15) Decrease in Capital	194	783	149	1,126	See Arrows
(16) Allocation %	17%	70%	13%	100%	= (15) / (15) Total
(17) Allocated Capital	258	1,041	198	1,497	= (16) x (8) Total
(18) P/S Ratio	775%	96%	505%	267%	= (1) / (17)
(19) ROE	39%	10%	25%	17%	= (6) / (17)

Expected	Auto	Home	CGL	Total
Premiums	-	1,000	1,000	2,000
Claims	-	600	650	1,250
Loss Ratio	0%	60%	65%	63%
Expenses	-	300	300	600
Expense Ratio	0%	30%	30%	30%
Profit (Loss)	-	100	50	150
Combined Ratio	0%	90%	95%	93%
Capital (99.5% VaR)	-	1,109	644	1,303
P/S Ratio	0%	90%	155%	153%
ROE	0%	9%	8%	12%

Expected	Auto	Home	CGL	Total
Premiums	2,000	-	1,000	3,000
Claims	1,400	-	650	2,050
Loss Ratio	70%	0%	65%	68%
Expenses	500	-	300	800
Expense Ratio	25%	0%	30%	27%
Profit (Loss)	100	-	50	150
Combined Ratio	95%	0%	95%	95%
Capital (99.5% VaR)	498	-	644	714
P/S Ratio	402%	0%	155%	420%
ROE	20%	0%	8%	21%

Expected	Auto	Home	CGL	Total
Premiums	2,000	1,000	-	3,000
Claims	1,400	600	-	2,000
Loss Ratio	70%	60%	0%	67%
Expenses	500	300	-	800
Expense Ratio	25%	30%	0%	27%
Profit (Loss)	100	100	-	200
Combined Ratio	95%	90%	0%	93%
Capital (99.5% VaR)	498	1,109	-	1,348
P/S Ratio	402%	90%	0%	223%
ROE	20%	9%	0%	15%

INCREMENTAL METHOD

Expected	Auto	Home	CGL	Total	
(1) Premiums	2,000	1,000	1,000	4,000	Assumption
(2) Claims	1,400	600	650	2,650	= (1) x (3)
(3) Loss Ratio	70%	60%	65%	66%	Assumption
(4) Expenses	500	300	300	1,100	= (1) x (5)
(5) Expense Ratio	25%	30%	30%	28%	Assumption
(6) Profit (Loss)	100	100	50	250	= (1) - (2) - (4)
(7) Combined Ratio	95%	90%	95%	94%	= (3) + (5)
(8) Capital (99.5% VaR)	498	1,109	644	1,497	Modeled
(9) P/S Ratio	402%	90%	155%	267%	= (1) / (8)
(10) ROE	20%	9%	8%	17%	= (6) / (8)

Incremental Method	Auto	Home	CGL	Total	
(20) Decrease in Capital	12	99	25	136	See Arrows
(21) Allocation %	9%	73%	18%	100%	= (20) / (20) Total
(22) Allocated Capital	132	1,090	275	1,497	= (21) x (8) Total
(23) P/S Ratio	1514%	92%	363%	267%	= (1) / (22)
(24) ROE	76%	9%	18%	17%	= (6) / (22)

Expected	Auto	Home	CGL	Total
Premiums	1,900	1,000	1,000	3,900
Claims	1,330	600	650	2,580
Loss Ratio	70%	60%	65%	66%
Expenses	475	300	300	1,075
Expense Ratio	25%	30%	30%	28%
Profit (Loss)	95	100	50	245
Combined Ratio	95%	90%	95%	94%
Capital (99.5% VaR)	473	1,109	644	1,485
P/S Ratio	402%	90%	155%	263%
ROE	20%	9%	8%	16%

Expected	Auto	Home	CGL	Total
Premiums	2,000	900	1,000	3,900
Claims	1,400	540	650	2,590
Loss Ratio	70%	60%	65%	66%
Expenses	500	270	300	1,070
Expense Ratio	25%	30%	30%	27%
Profit (Loss)	100	90	50	240
Combined Ratio	95%	90%	95%	94%
Capital (99.5% VaR)	498	998	644	1,398
P/S Ratio	402%	90%	155%	279%
ROE	20%	9%	8%	17%

Expected	Auto	Home	CGL	Total
Premiums	2,000	1,000	900	3,900
Claims	1,400	600	585	2,585
Loss Ratio	70%	60%	65%	66%
Expenses	500	300	270	1,070
Expense Ratio	25%	30%	30%	27%
Profit (Loss)	100	100	45	245
Combined Ratio	95%	90%	95%	94%
Capital (99.5% VaR)	498	1,109	580	1,472
P/S Ratio	402%	90%	155%	265%
ROE	20%	9%	8%	17%

STRATEGIC INSIGHTS

Capital	Auto	Home	CGL	Total
90% VaR (1-in-10)	163	283	212	407
95% VaR (1-in-20)	251	468	317	666
99% VaR (1-in-100)	428	908	548	1,244
99.5% VaR (1-in-200)	498	1,109	644	1,497
99.9% VaR (1-in-1000)	653	1,610	876	2,100

ROE Summary	Auto	Home	CGL	Total
Standalone	20%	9%	8%	17%
Pro Rata Method	30%	14%	12%	17%
Last-In Method	39%	10%	25%	17%
Incremental Method	76%	9%	18%	17%

Insights

- On a standalone basis, all lines of business appear to be less profitable than they actually are
- **Diversification across lines of business is a key consideration in sound decision-making for pricing.**

Opportunities

- Auto has the highest marginal return on capital.
- CGL is much more profitable than it appears on a standalone basis.
- **Focused-marketing initiatives and strategic rate actions could drive growth in these lines.**

Threats

- Home has subpar returns compared to other lines and has large loss volatility.
- **Profitability can be addressed through base rate increases, reinsurance, or better risk selection.**

Best Practices

- Capital allocation should be updated regularly to provide management with feedback as strategies are implemented.
- Consideration should be given to lines of business that are often sold together (Auto and Home).

DERIVING RESERVE RISK MARGINS

DERIVING RESERVE RISK MARGINS

- Benefits:

- Increased transparency with regards to the confidence level of the booked reserves.
- Established models and methodologies can be leveraged in financial statement disclosures (e.g. IFRS 17).
- Margins are determined in a holistic way, considering interactions between all lines of business (vs. traditional factor-based approaches).

- Challenges:

- Selecting the confidence level and the risk measure
- Allocating the risk margin by line of business

RESERVE MODEL

- Basic Assumptions:

Line	Best Estimate Reserve	Standard Deviation	Payment Pattern
Auto	1,000	100	60 / 25 / 10 / 5
Home	225	42	70 / 20 / 10 / 0
CGL	475	97	50 / 30 / 10 / 10

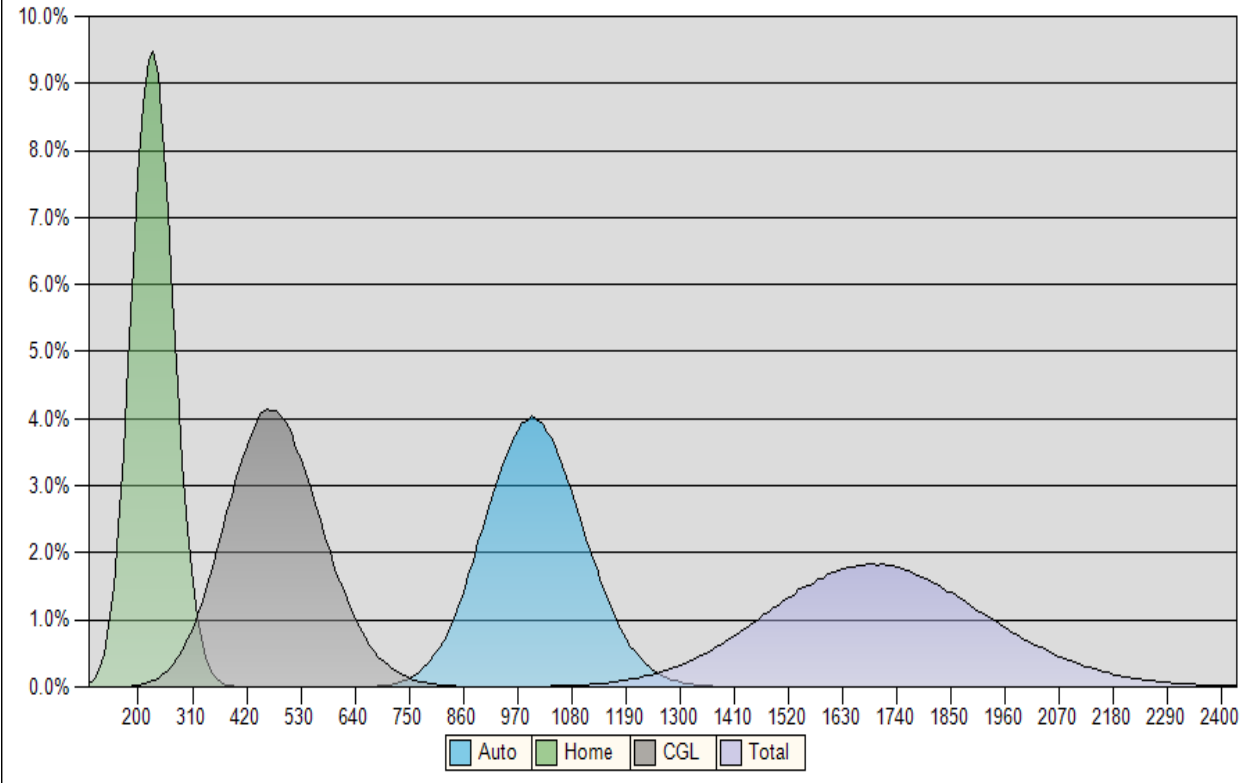
Correlation	Auto	Home	CGL
Auto	100%	75%	75%
Home	75%	100%	75%
CGL	75%	75%	100%

- Model Overview:

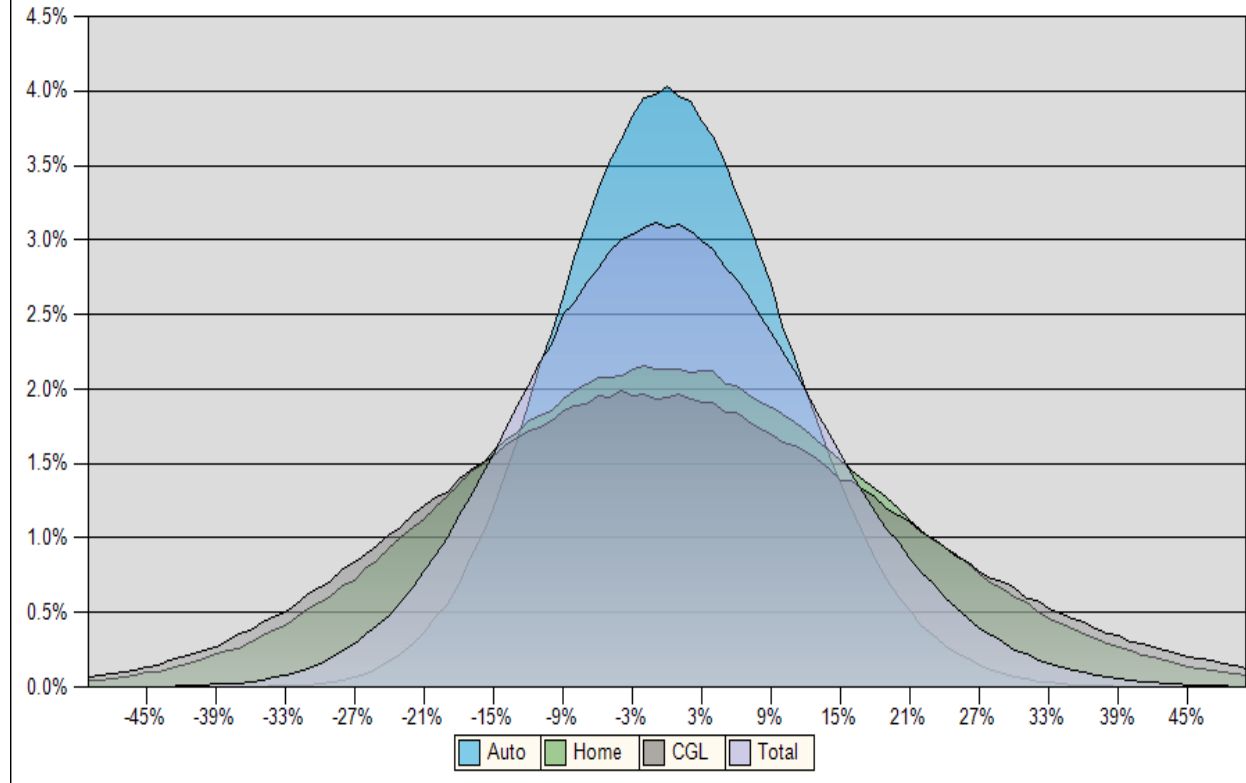
- Reserves are simulated using correlated Lognormal distributions.
- Reserve Development = Simulated Reserve - Best Estimate Reserve
- Reserve Risk Margin = Simulated Reserve / Best Estimate Reserve - 1

SIMULATION RESULTS

Simulated Reserves

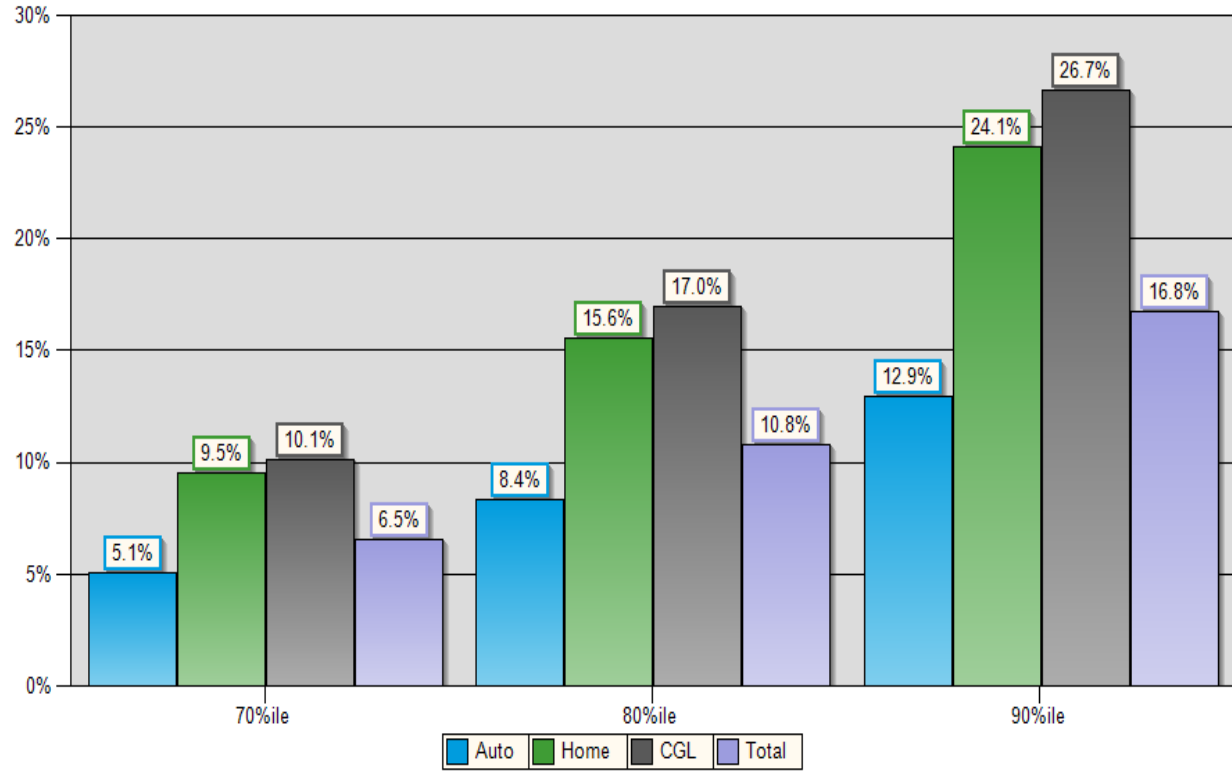


Reserve Risk Margin

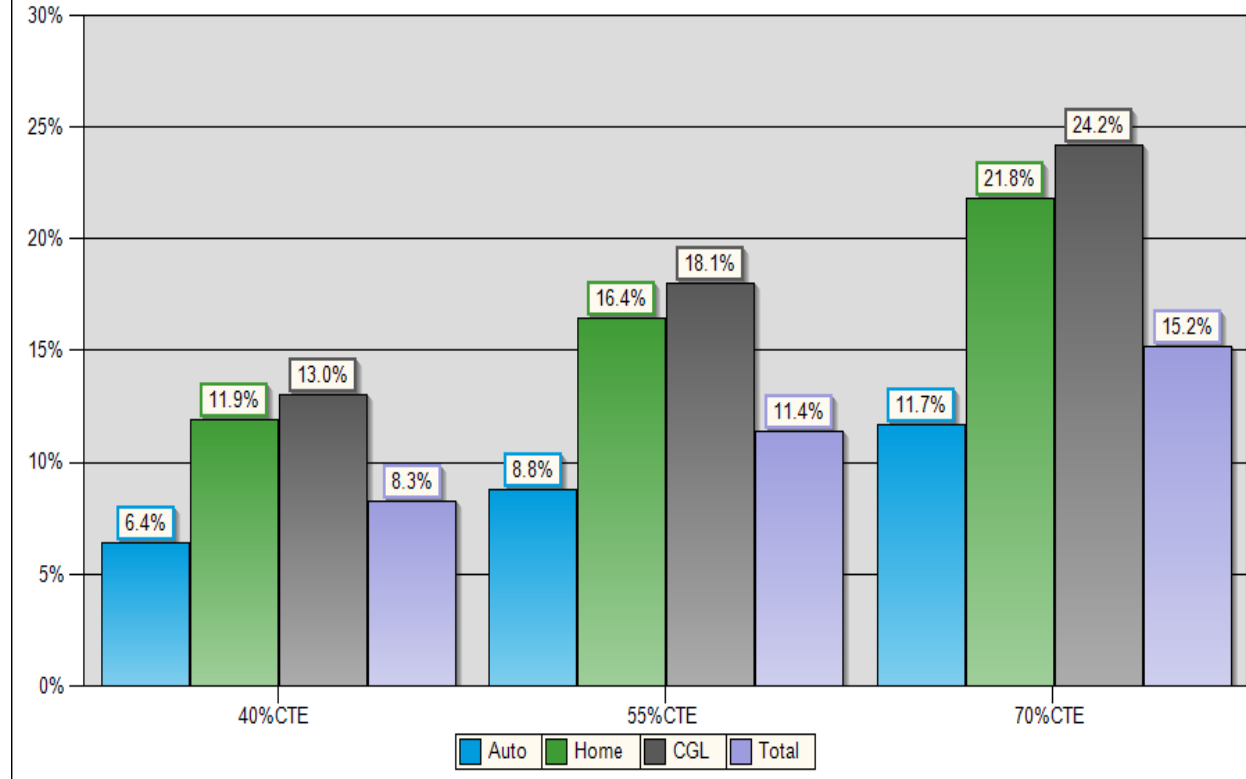


RESERVE RISK MARGINS

Reserve Risk Margin - VaR



Reserve Risk Margin - CTE



RESERVE RISK MARGIN ALLOCATION

Reserve Development	Auto	Home	CGL	Total
(1) 70% VaR	51	21	48	111
(2) 80% VaR	84	35	81	183
(3) 90% VaR	129	54	127	285
(4) 40% CTE	117	49	115	258
(5) 55% CTE	142	60	140	314
(6) 70% CTE	180	76	179	398

Reserve Margin	Auto	Home	CGL	Total
(14) 70% VaR	5.1%	9.5%	10.1%	6.5%
(15) 80% VaR	8.4%	15.6%	17.0%	10.8%
(16) 90% VaR	12.9%	24.1%	26.7%	16.8%
(17) 40% CTE	11.7%	21.8%	24.2%	15.2%
(18) 55% CTE	14.2%	26.5%	29.5%	18.4%
(19) 70% CTE	18.0%	33.6%	37.7%	23.4%

Pro-rata Allocation	Auto	Home	CGL	
(7) 70% VaR	42.5%	17.5%	40.0%	= (1) x SUM(1)
(8) 80% VaR	42.0%	17.5%	40.5%	= (2) x SUM(2)
(9) 90% VaR	41.6%	17.4%	41.0%	= (3) x SUM(3)
(10) 40% CTE	41.6%	17.4%	40.9%	= (4) x SUM(4)
(11) 55% CTE	41.5%	17.5%	40.9%	= (5) x SUM(5)
(12) 70% CTE	41.4%	17.5%	41.1%	= (6) x SUM(6)
(13) Selected	41.5%	17.5%	41.0%	

Allocated Margin	Auto	Home	CGL	
(20) 70% VaR	4.6%	8.8%	9.6%	= (13) x (1) Total x (14) / (1)
(21) 80% VaR	7.6%	14.3%	15.7%	= (13) x (2) Total x (15) / (2)
(22) 90% VaR	11.8%	22.3%	24.6%	= (13) x (3) Total x (16) / (3)
(23) 40% CTE	10.7%	20.1%	22.3%	= (13) x (4) Total x (17) / (4)
(24) 55% CTE	13.0%	24.3%	27.1%	= (13) x (5) Total x (18) / (5)
(25) 70% CTE	16.5%	30.8%	34.4%	= (13) x (6) Total x (19) / (6)

SETTING INVESTMENT STRATEGIES

SETTING INVESTMENT STRATEGIES

- Benefits:

- Optimize the risk-adjusted portfolio returns based on your view of risk.
- Assess asset liability matching holistically in cases where reserves are discounted (e.g. IFRS 17).
- Provide additional support and insights to external investment managers.

- Challenges:

- Assessing friction costs, trading costs, and liquidity in tail events.
- Modeling correlations between the insurance liabilities and market factors

INVESTMENT MODEL

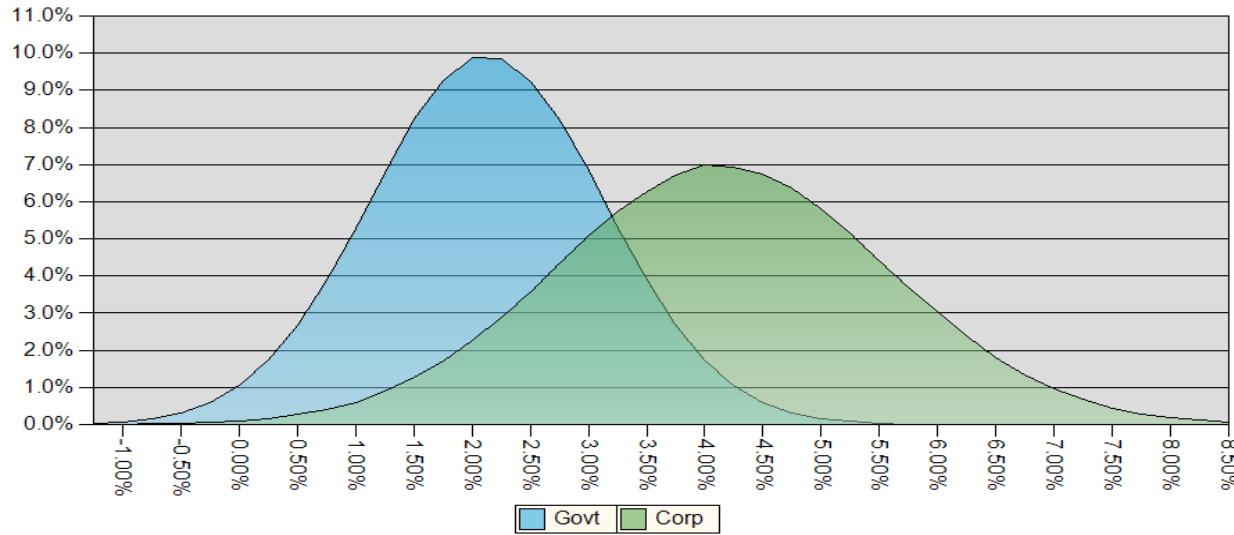
Correlation	Risk-Free	Credit Spread	Equity
Risk-Free	100%	0%	0%
Credit Spread	0%	100%	-75%
Equity	0%	-75%	100%

Index	Expected Return	Standard Deviation	Distribution
Risk-Free	2%	1%	Normal
Credit Spread	4%	2%	Lognormal
Equity	6%	15%	Lognormal

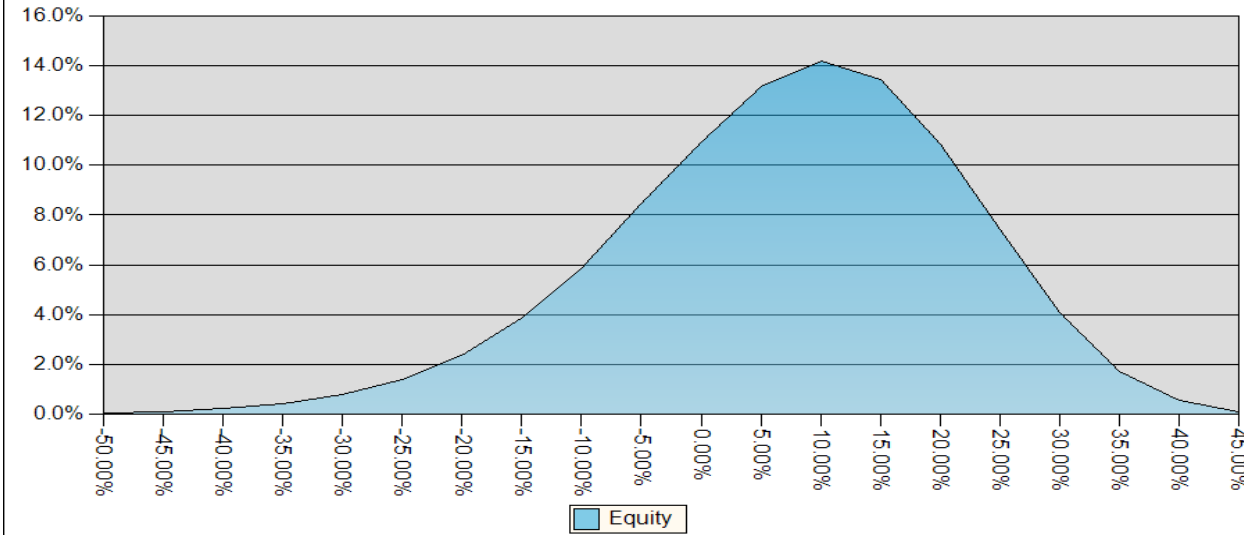
Class	Market Value	Allocation
Government Bond	600	10%
Corporate Bond	2,100	20%
Common Equity	300	70%

SIMULATION RESULTS

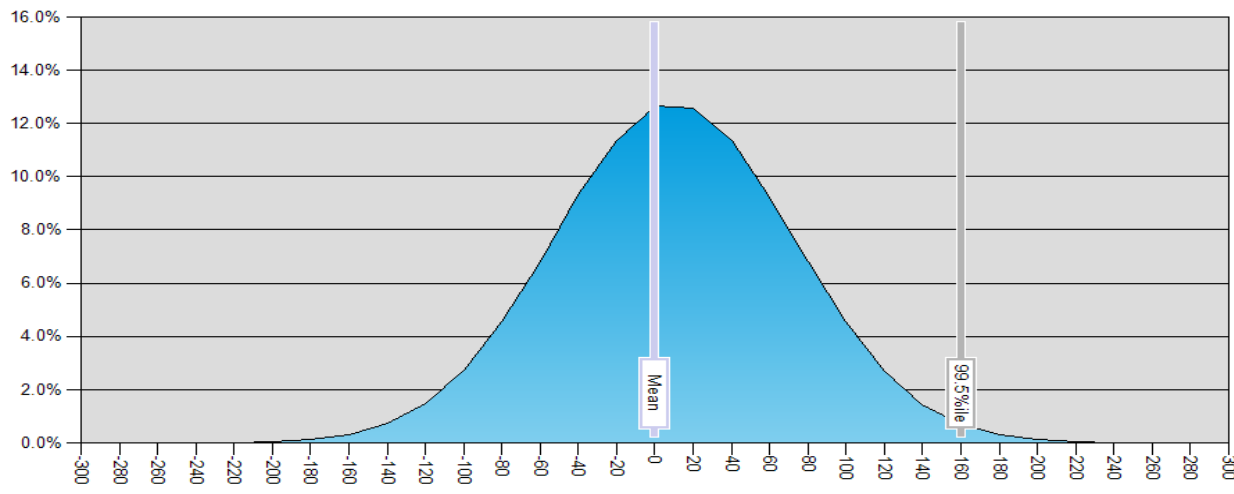
Fixed Income Returns



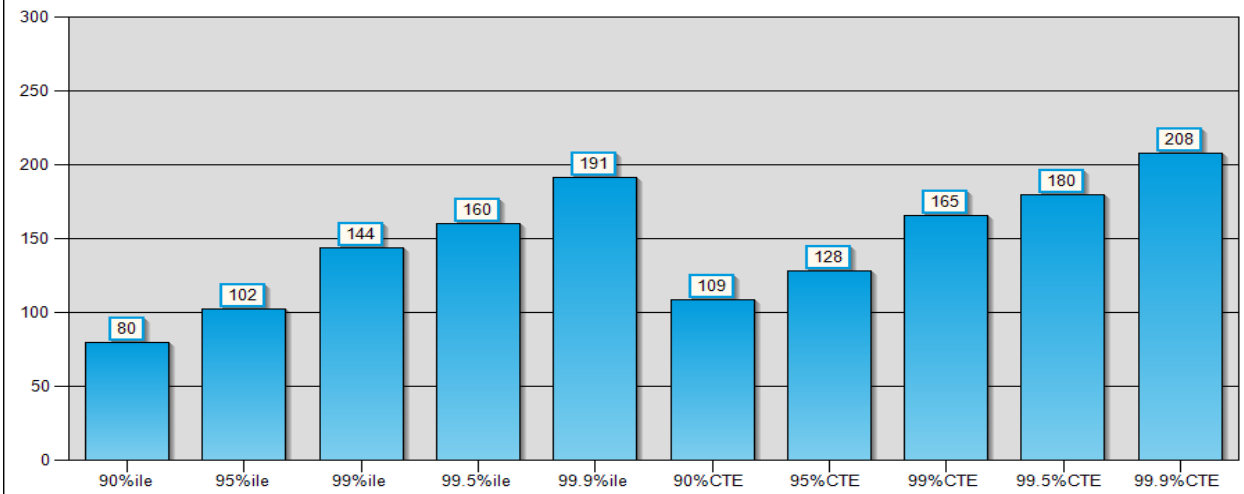
Equity Return



ALM Risk
Discount Rate: Portfolio Yield
Asset Allocation: 20% Govt, 70% Corp, 10% Equity

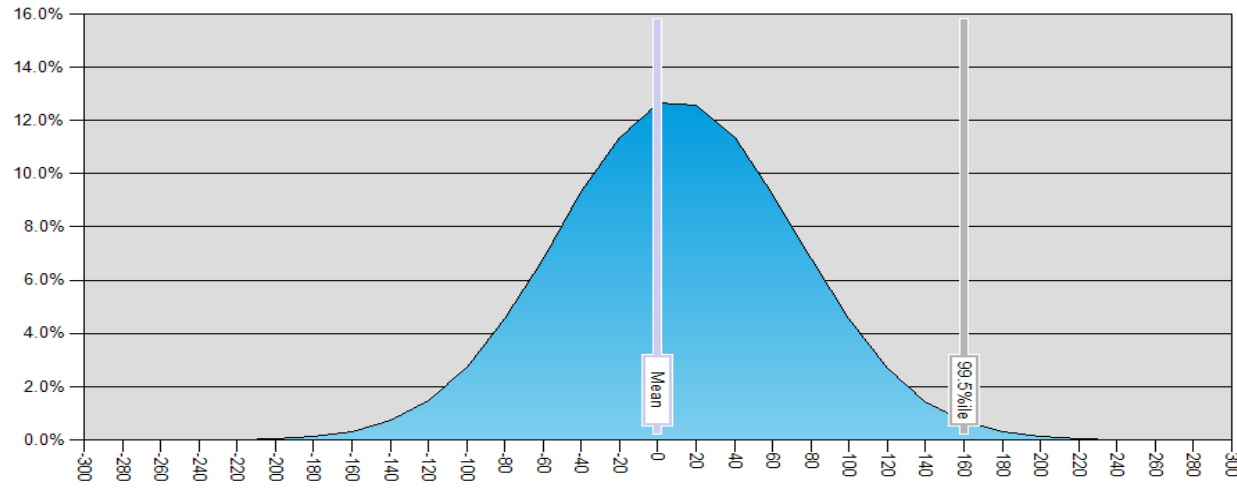


ALM Risk
Discount Rate: Portfolio Yield
Asset Allocation: 20% Govt, 70% Corp, 10% Equity

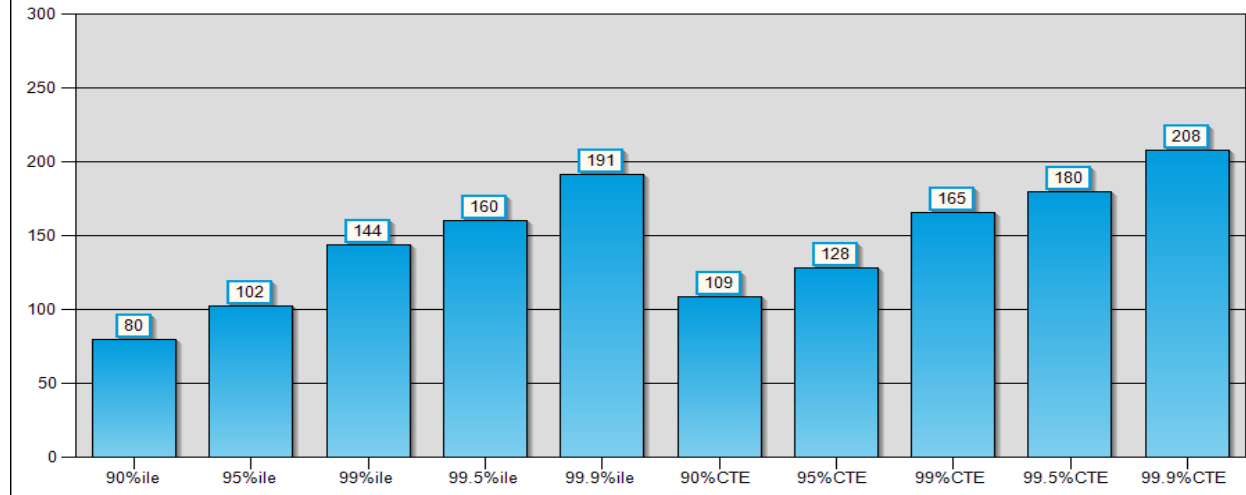


ALM RISK – IMPACT OF IFRS 17

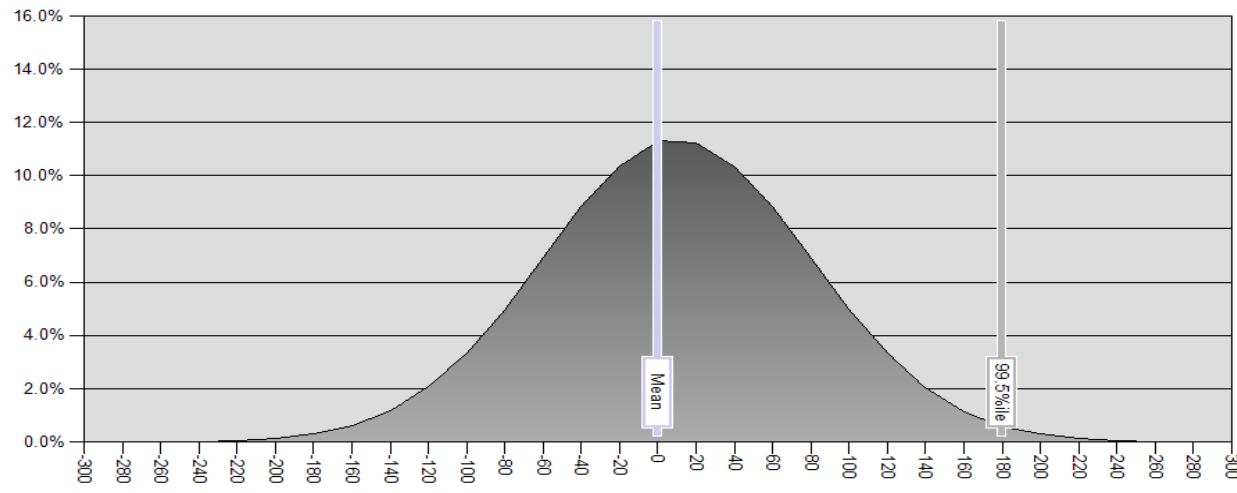
ALM Risk
Discount Rate: Portfolio Yield
Asset Allocation: 20% Govt, 70% Corp, 10% Equity



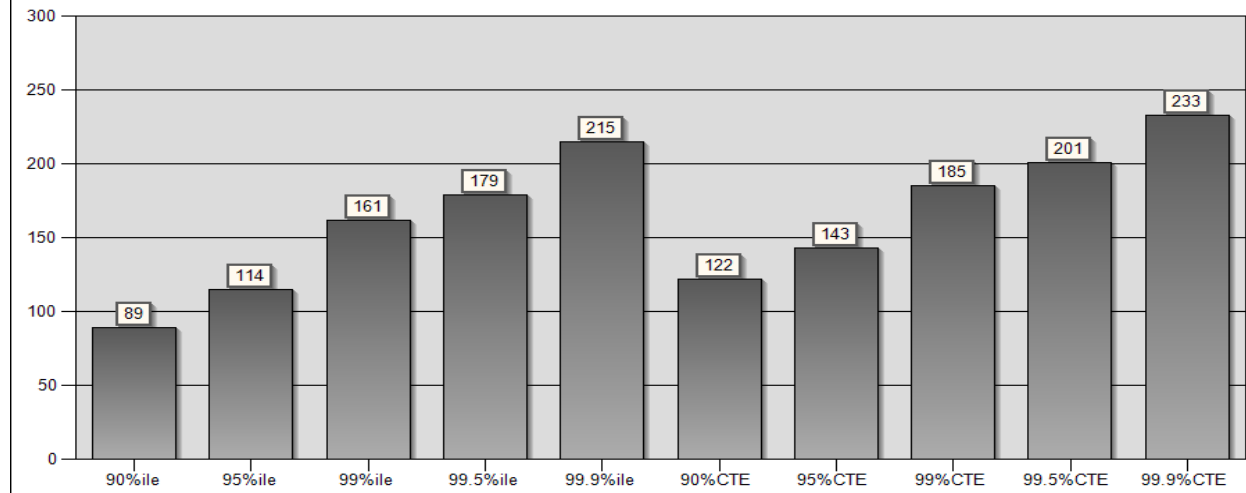
ALM Risk
Discount Rate: Portfolio Yield
Asset Allocation: 20% Govt, 70% Corp, 10% Equity



ALM Risk
Discount Rate: Risk - Free Rate
Asset Allocation: 20% Govt, 70% Corp, 10% Equity

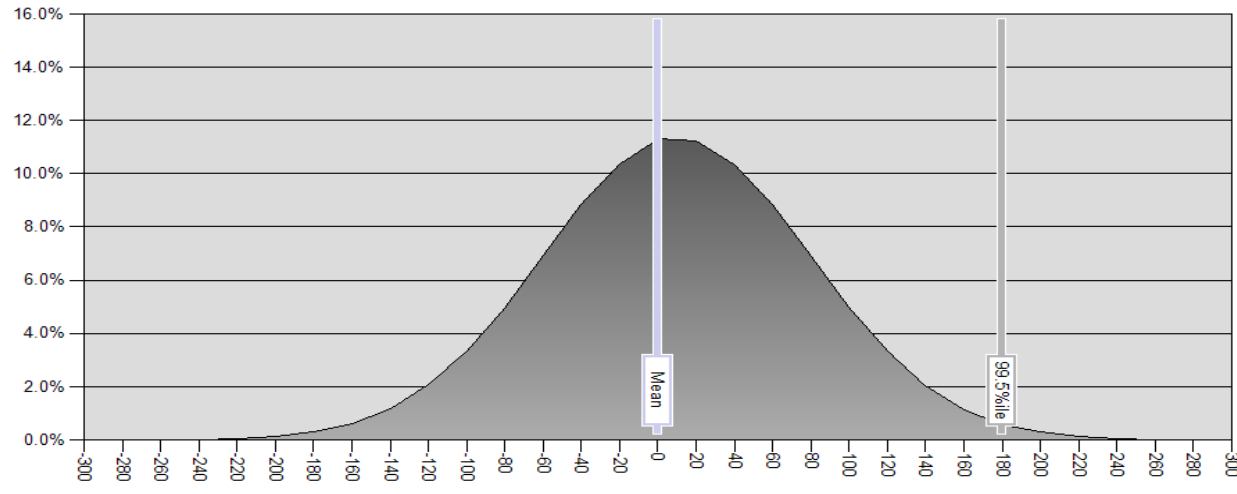


ALM Risk
Discount Rate: Risk - Free Rate
Asset Allocation: 20% Govt, 70% Corp, 10% Equity

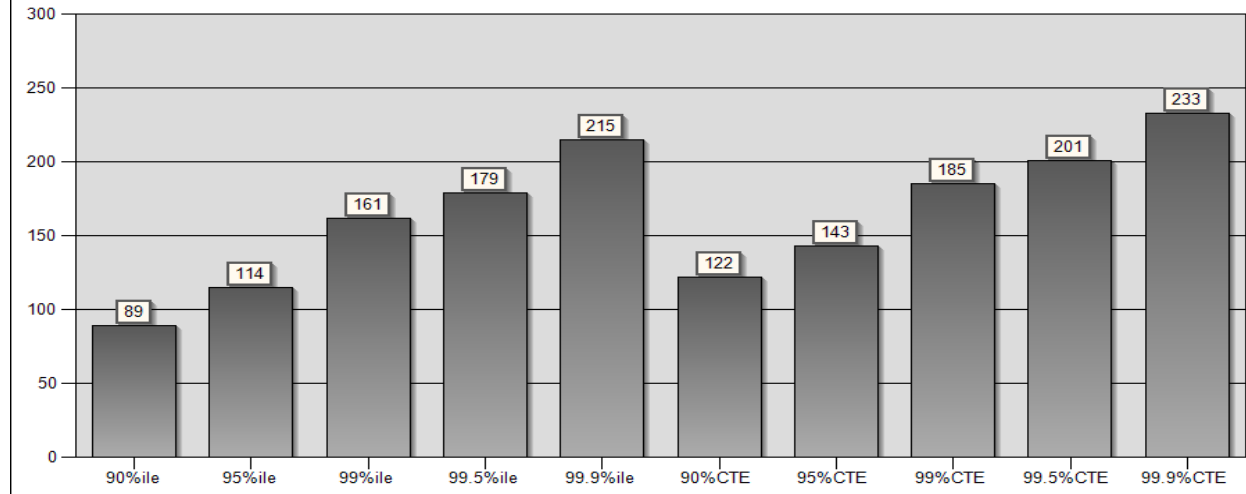


ALM RISK – ASSET ALLOCATION STRATEGY

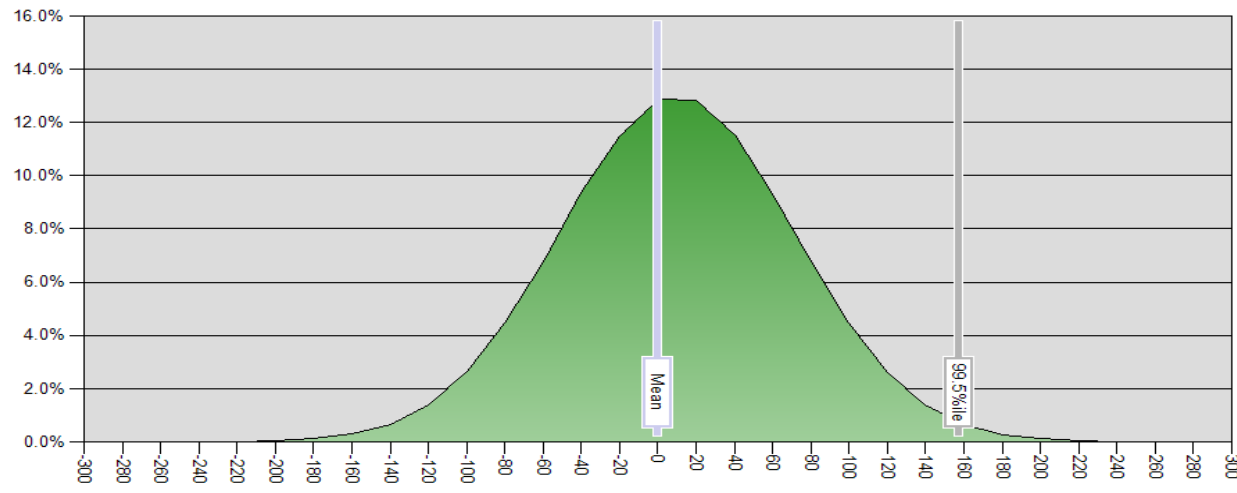
ALM Risk
Discount Rate: Risk - Free Rate
Asset Allocation: 20% Govt, 70% Corp, 10% Equity



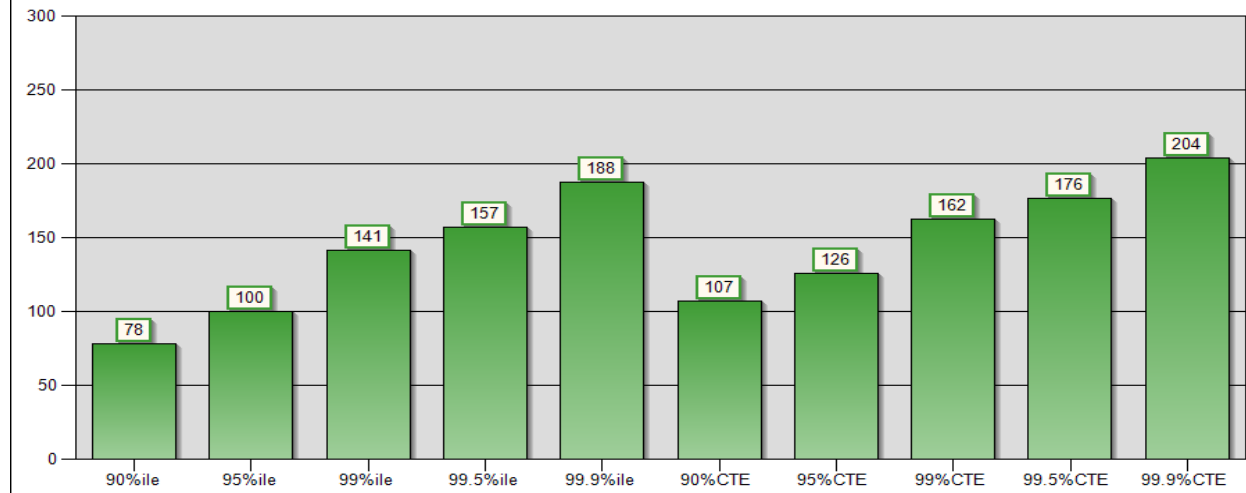
ALM Risk
Discount Rate: Risk - Free Rate
Asset Allocation: 20% Govt, 70% Corp, 10% Equity



ALM Risk
Discount Rate: Risk - Free Rate
Asset Allocation: 40% Govt, 50% Corp, 10% Equity



ALM Risk
Discount Rate: Risk - Free Rate
Asset Allocation: 40% Govt, 50% Corp, 10% Equity



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