

Agenda

Section 1 The Present

Section 2 A Bridge

Section 3 The Future?



Section 1: The Present

The Tension: Multi-year Economic Capital Model – For or Against?

Reasons For

Desire is for company to be viable for more than a single year

String of multiple bad years could be as detrimental as a single poor year

Corporate planning horizon is often 3-5 years

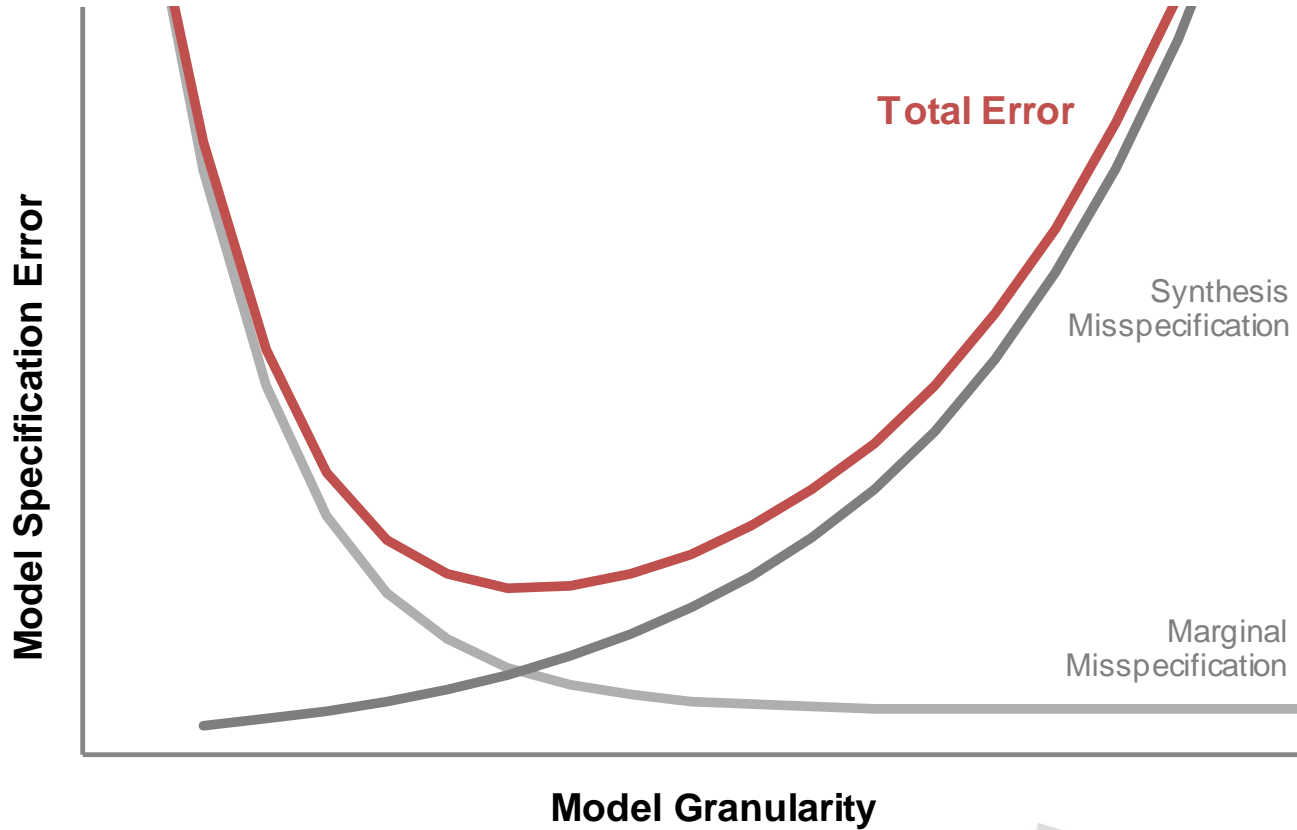
Reasons Against

Difficult to parameterize model over multi-year timeframe

The model results are only as good as the accuracy of the inputs

Easier to build a deterministic business plan over multi-years than a stochastic ECM

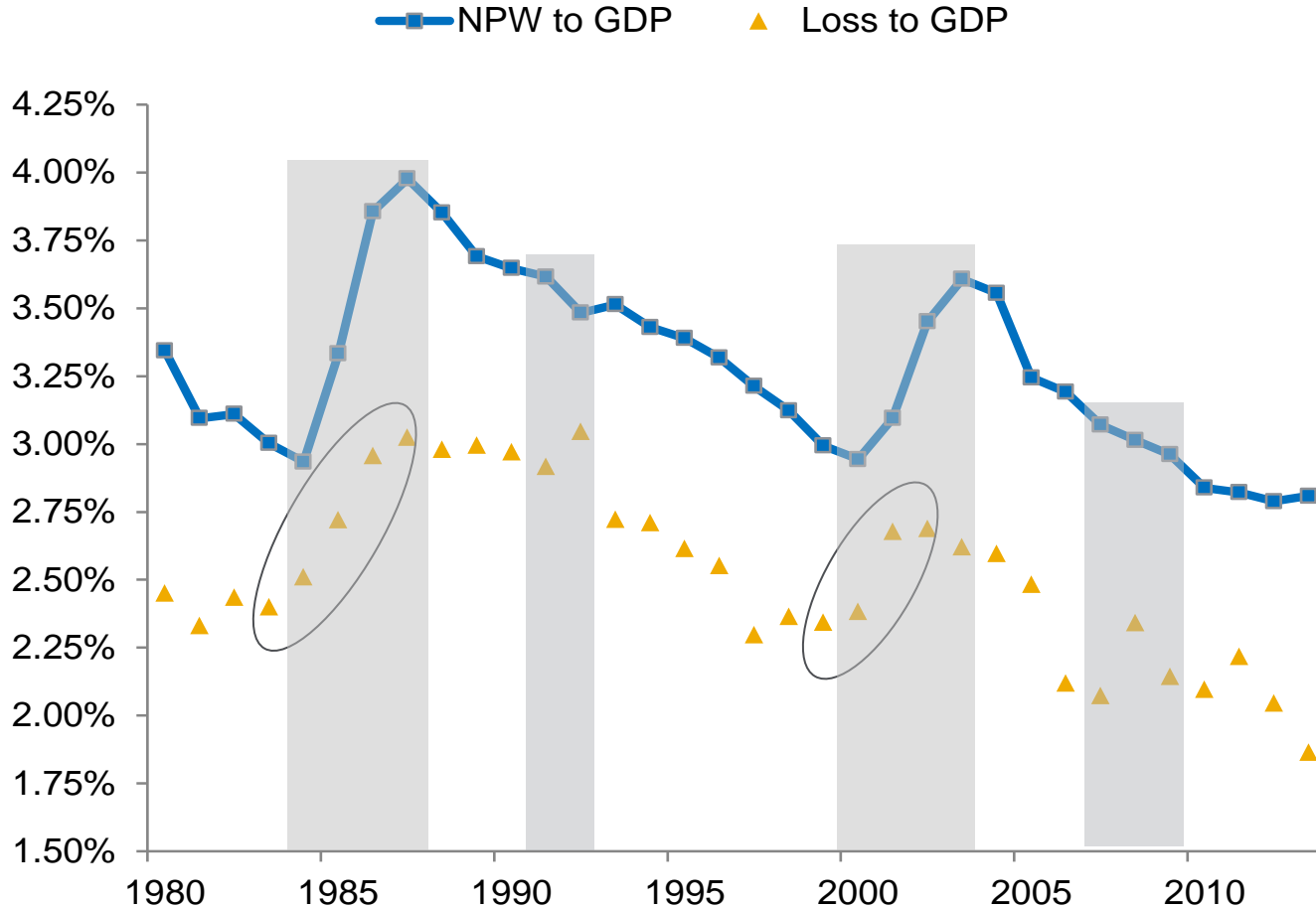
Balance Complexity And Accuracy



Business Desire for Greater Granularity

Multi-Year Underwriting Cycle

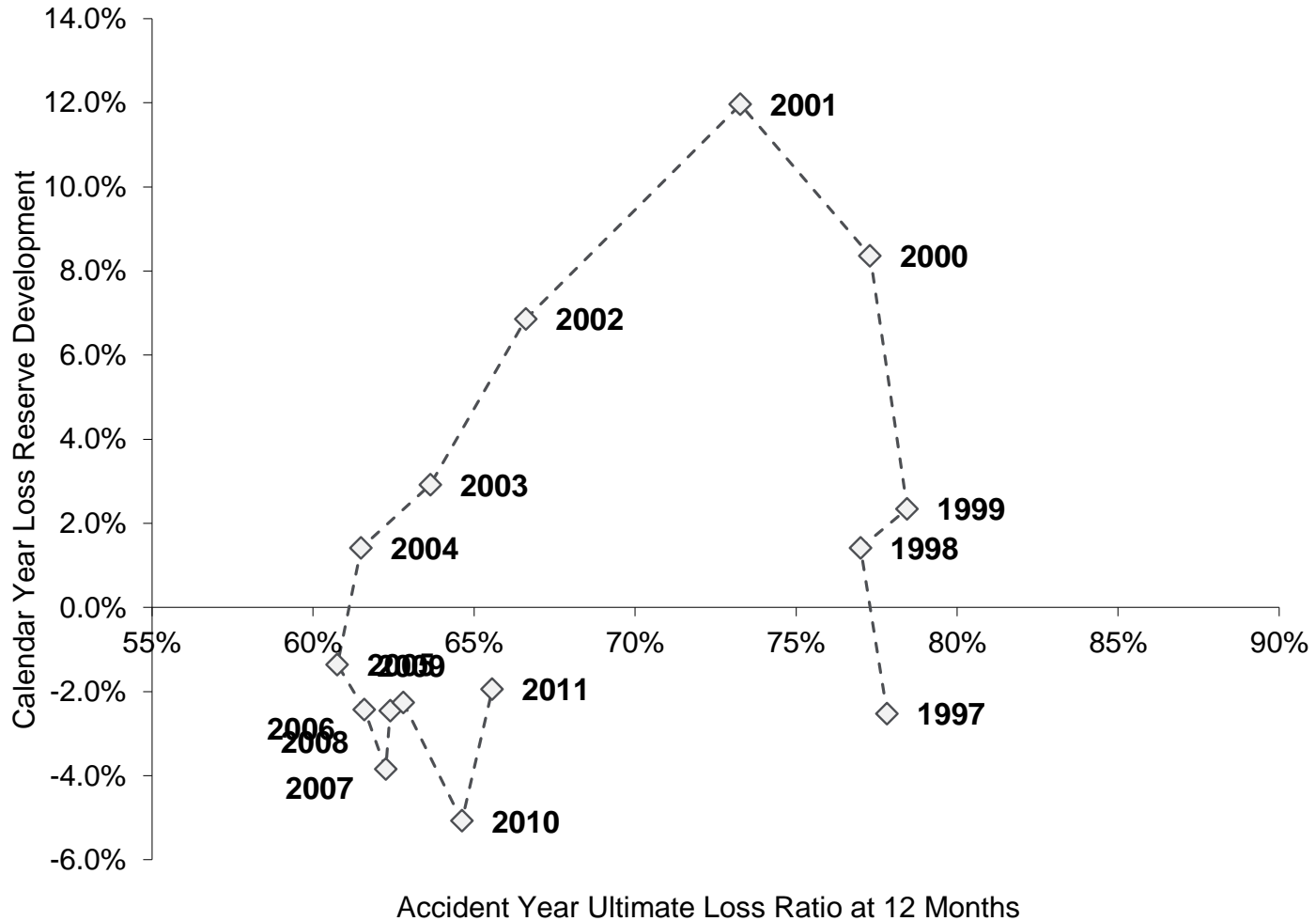
Loss and Premium Linked: But How?



Sources: A.M. Best's Aggregates and Averages, IMF World Economic Outlook Database (www.imf.org), SNL Financial, Aon Benfield Analytics

Multi-Year Underwriting Cycle

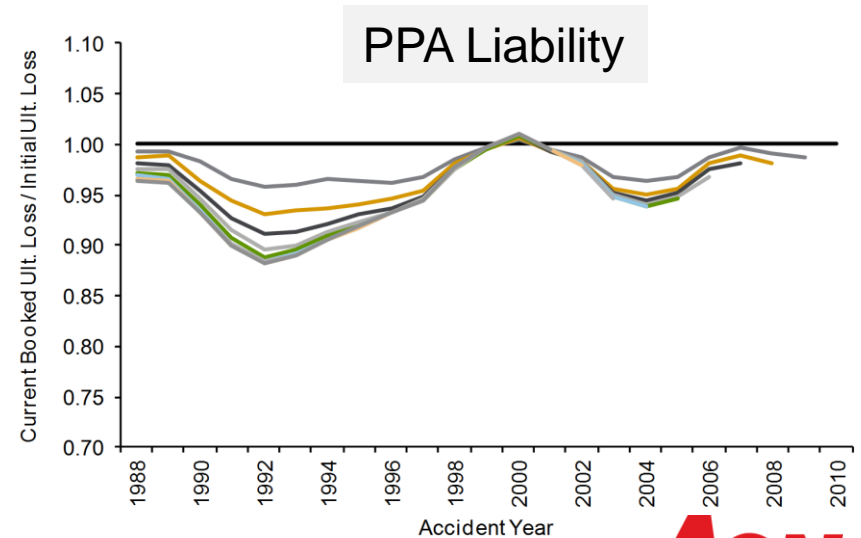
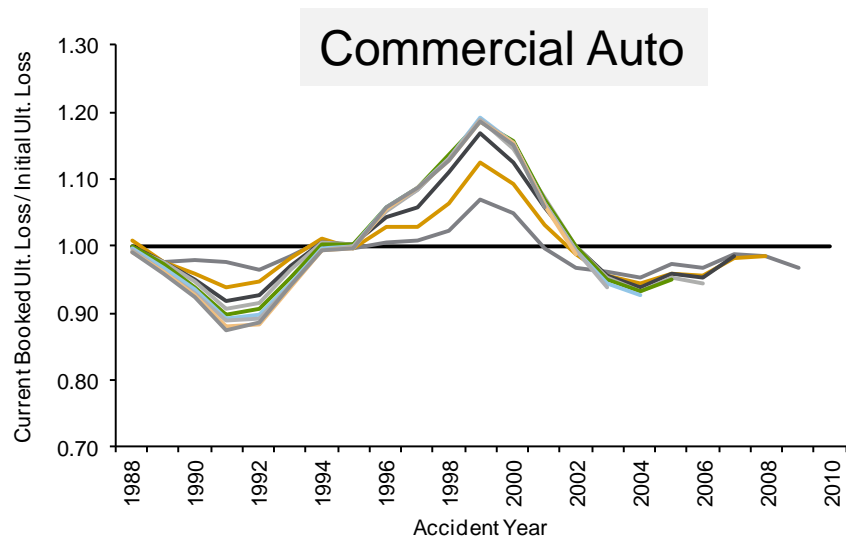
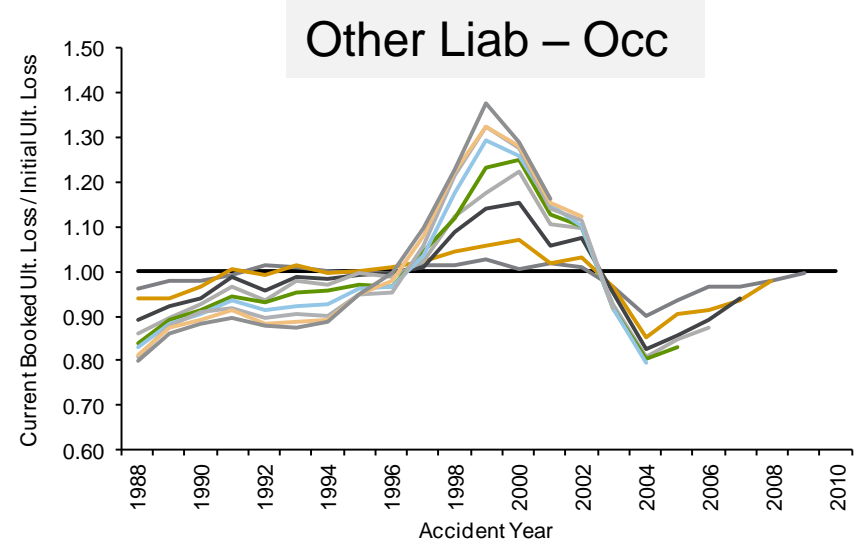
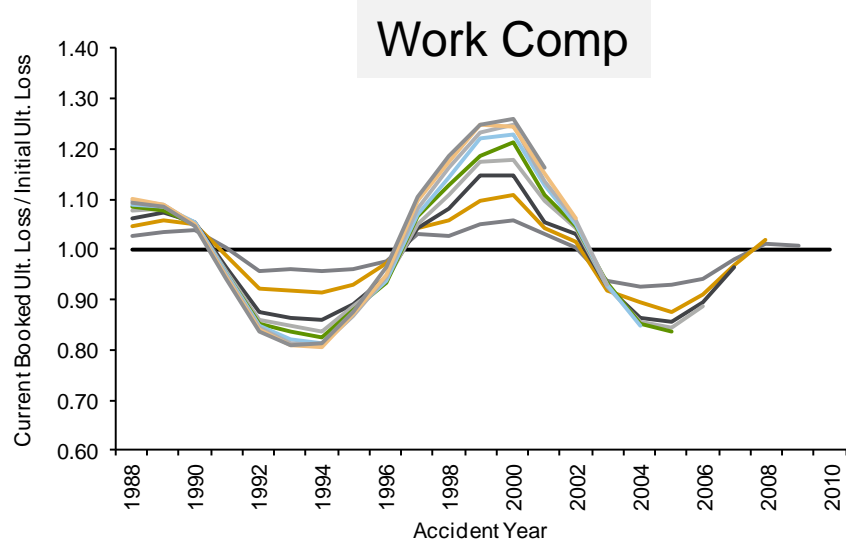
Current AY Loss Ratio and Prior Year Loss Development Linked: But How?



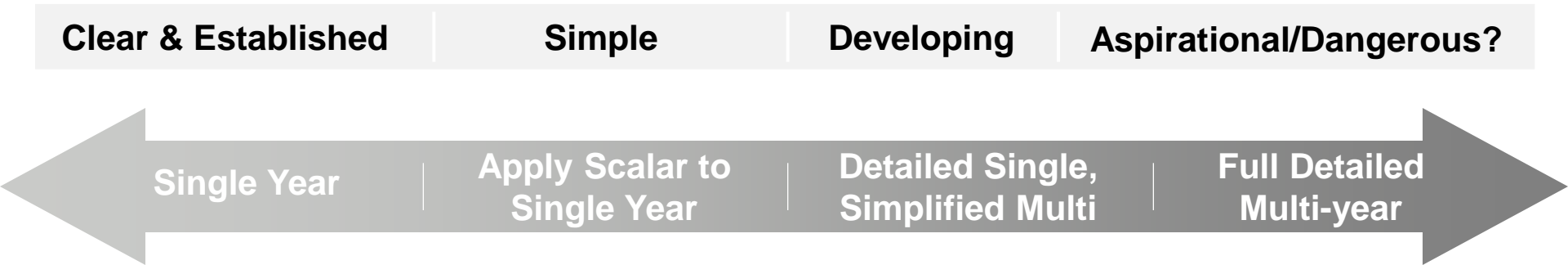
Source: SNL US Industry Aggregate Schedule P, Aon Benfield Analytics

Multi-Year Underwriting Cycle

AY Reserve Development Linked Across Time: But How?

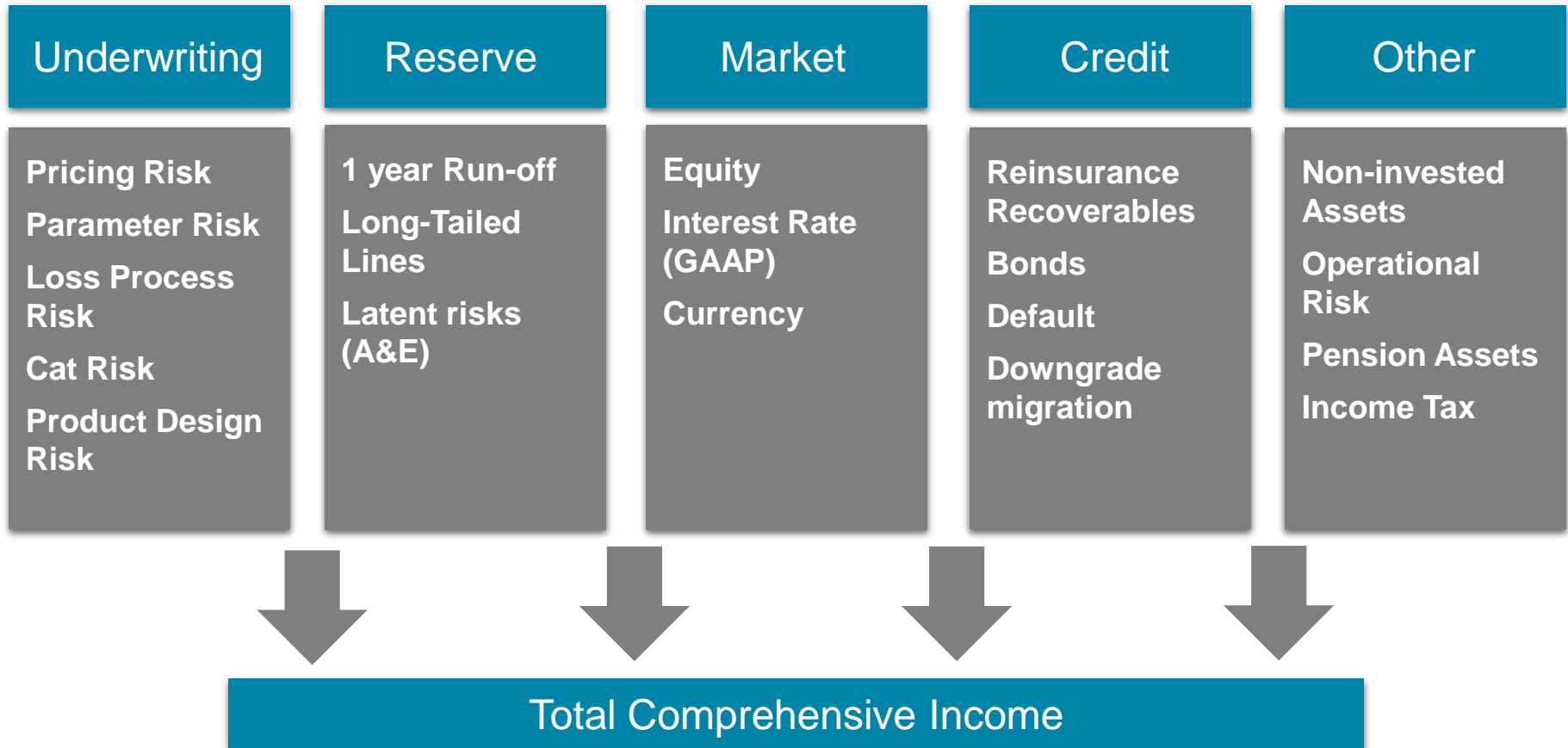


Spectrum of Economic Capital Modeling – Single to Multi-Year



- Alternative ways to develop multi-year capital requirements
 - Rating agency models
 - Stress test multi-year financials

Modeled Components of Total Comprehensive Income



Example Company – One Year Inputs

Underwriting Inputs (\$M)

LOB	Net Earned Premium	Non-Cat Loss Ratio	Non-Cat Expense Ratio	Allocated Cat Loss Ratio	Total Combined Ratio	Net UW Profit	Non-Cat Loss Ratio CV
Homeowners	100.0	40.0%	30.0%	21.1%	91.1%	8.9	25.0%
Private Auto Liab	100.0	65.0%	35.0%	0.0%	100.0%	0.0	20.0%
Auto Phys Dam	100.0	60.0%	35.0%	0.0%	95.0%	5.0	15.0%
Comm Auto Liab	100.0	70.0%	30.0%	0.0%	100.0%	0.0	25.0%
Comm Prop	100.0	45.0%	30.0%	14.1%	89.1%	10.9	30.0%
Total	500.0	56.0%	32.0%	7.0%	95.0%	24.9	14.6%

Example Company – One Year Output

Capital Adequacy Univariate Stats (\$M)

	Net Acc Yr Underwriting	1 Year Reserve Risk	Investment Income Risk	Interest Rate Risk	Market Risk Equity
Mean Result	25.0	(0.1)	45.9	0.1	21.1
Volume	500.0	675.0	1,312.5	1,312.5	375.0
Volume Metric	Net Premium	Net Loss Reserves	Bonds	Bonds	Equities
Std. Dev.	113.8	33.8	4.6	52.5	100.8
Scaled Std. Dev.	22.8%	5.0%	0.4%	4.0%	26.9%
Percentiles					
0.10%	(1,512.2)	(97.7)	33.5	(177.2)	(198.3)
0.20%	(662.0)	(91.4)	34.3	(162.0)	(188.5)
0.40%	(236.8)	(84.7)	35.1	(144.7)	(177.4)
0.50%	(211.4)	(81.7)	35.4	(142.1)	(172.3)
1.00%	(131.2)	(75.0)	36.2	(128.1)	(160.6)
2.00%	(101.3)	(66.5)	37.3	(109.6)	(145.1)
5.00%	(66.5)	(54.5)	38.7	(87.2)	(121.5)
10.00%	(37.8)	(42.9)	40.2	(66.9)	(96.8)
20.00%	(9.5)	(28.5)	42.0	(44.1)	(63.6)

Example Company – One Year Required Capital

Required Capital - Range of TVaR Indications (\$M)

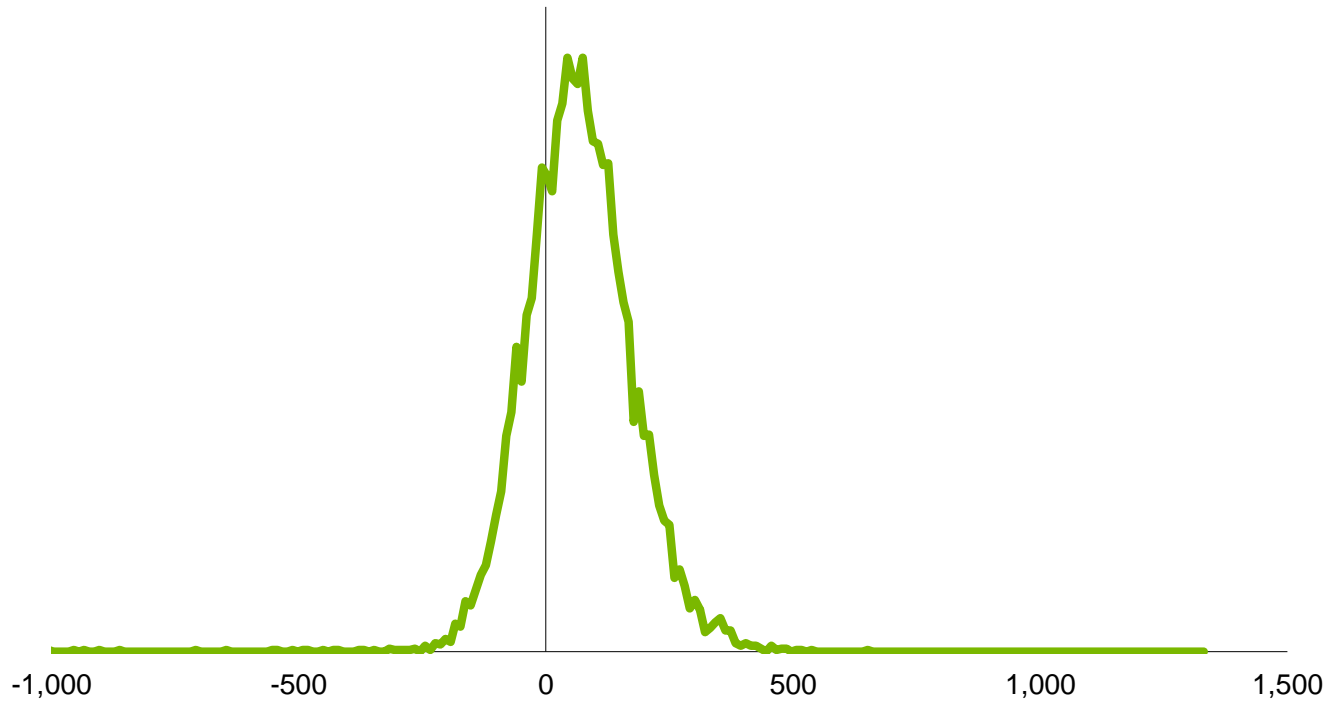
P:S Ratio

		Correlation					
		Low	Base	High	Low	Base	High
0.10%	(1000 yr)	-1,757.4	-1,807.0	-1,886.3	0.28	0.28	0.27
0.20%	(500 yr)	-1,239.2	-1,288.4	-1,369.3	0.40	0.39	0.37
0.40%	(250 yr)	-768.8	-813.6	-885.3	0.65	0.61	0.56
0.50%	(200 yr)	-653.6	-696.3	-766.2	0.76	0.72	0.65
1.00%	(100 yr)	-405.7	-443.6	-505.9	1.23	1.13	0.99
2.00%	(50 yr)	-268.7	-301.7	-352.8	1.86	1.66	1.42
Actual Surplus		750.0					
Pr[Lose 50% Surplus]		0.250%	0.260%	0.310%			

Multi-Year Required Economic Capital

Year 1

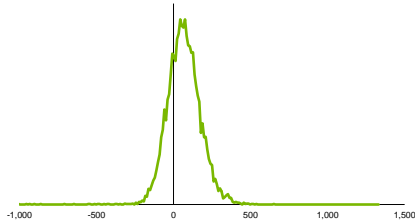
One Year Distribution
of Total Comprehensive Income (\$M)



Multi-Year Required Economic Capital

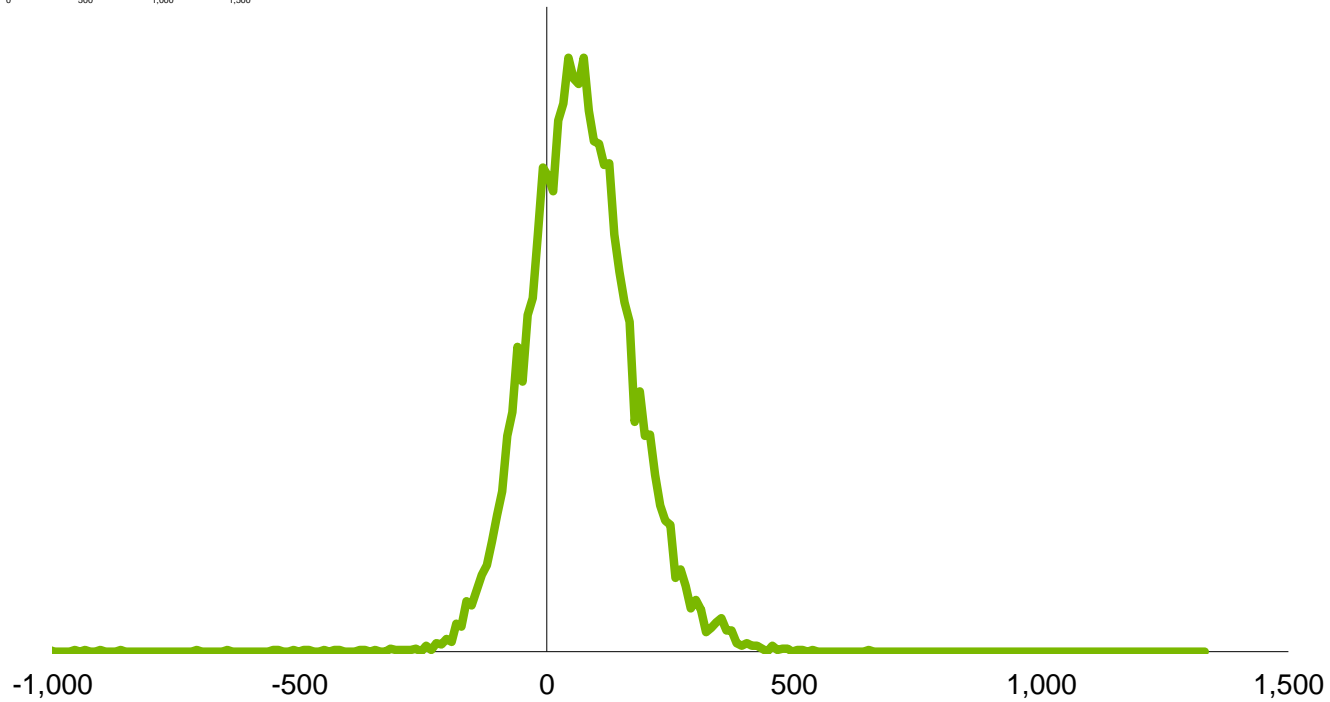
Year 1

One Year Distribution
of Total Comprehensive Income (\$M)



Year 2

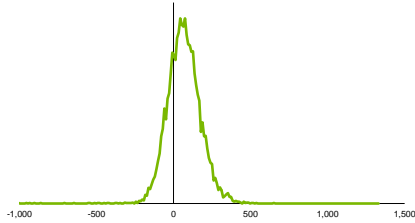
One Year Distribution
of Total Comprehensive Income (\$M)



Multi-Year Required Economic Capital

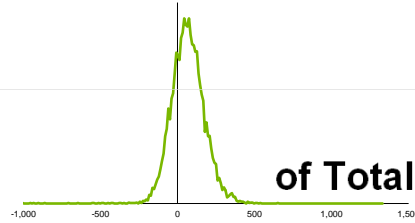
Year 1

One Year Distribution of Total Comprehensive Income (\$M)



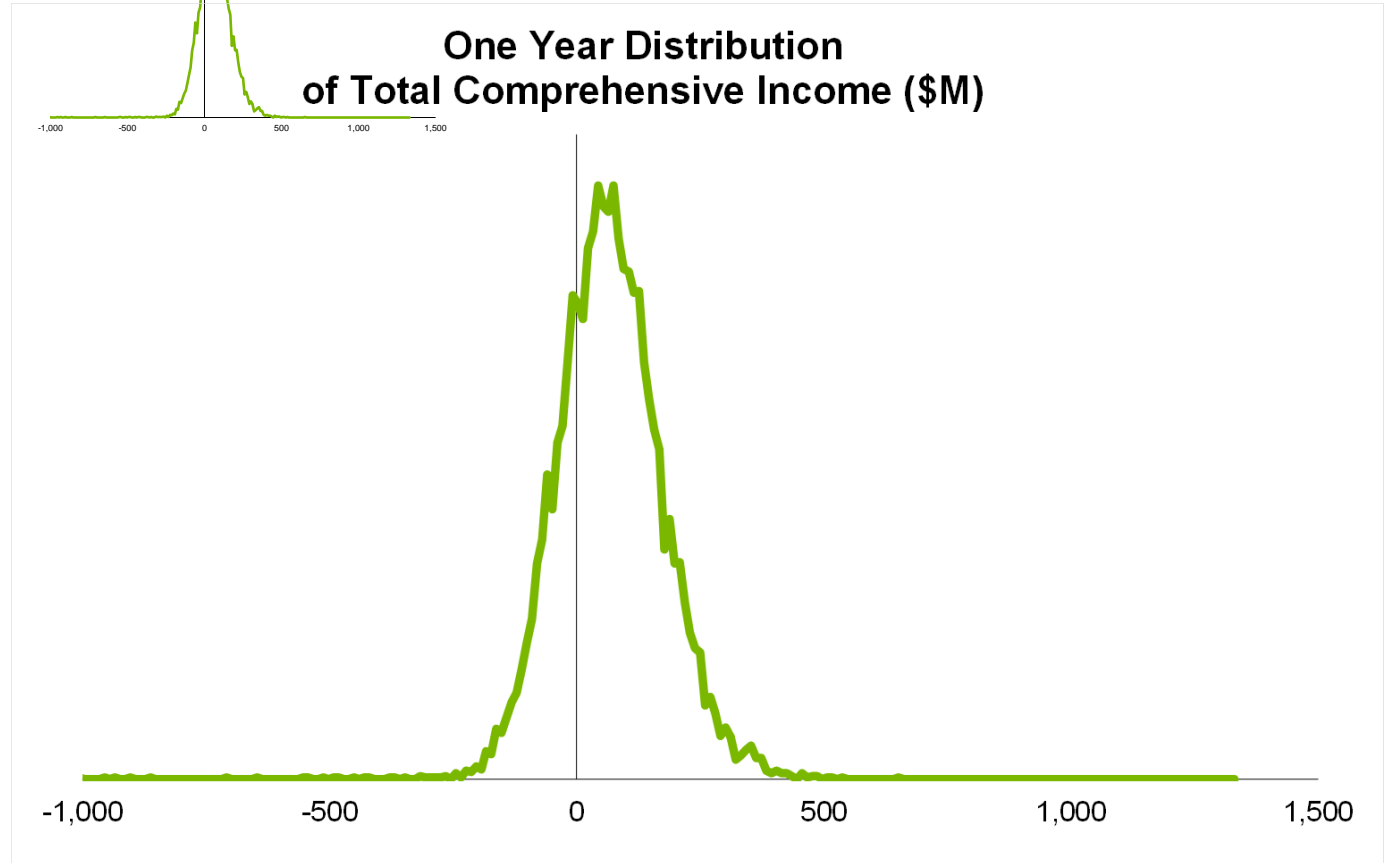
Year 2

One Year Distribution of Total Comprehensive Income (\$M)

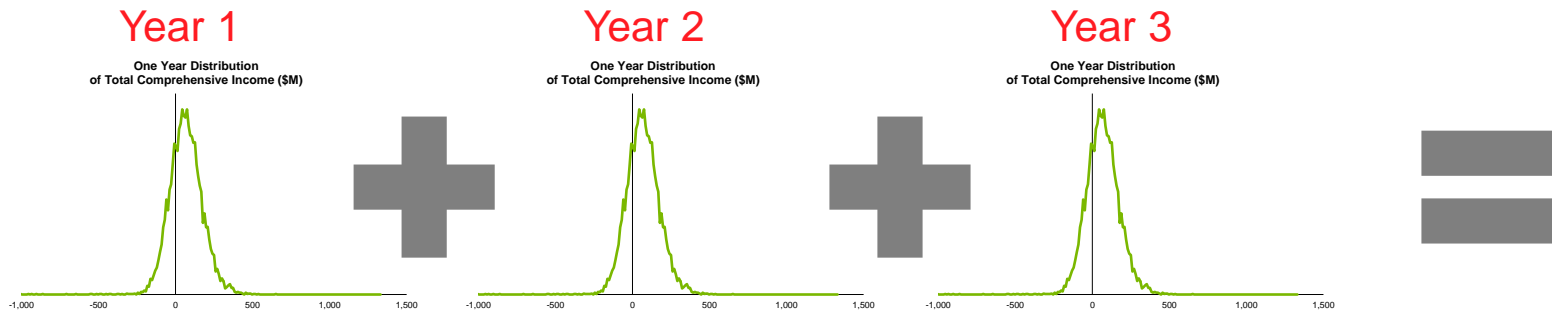


Year 3

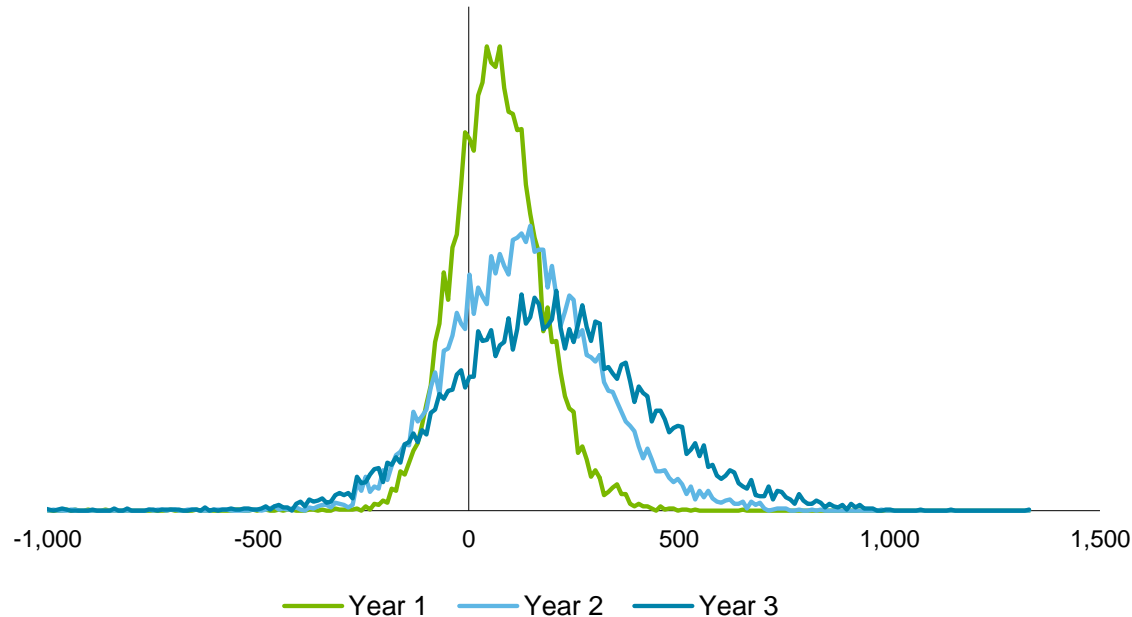
One Year Distribution of Total Comprehensive Income (\$M)



Multi-Year Required Economic Capital



Multi-Year Distribution of Cumulative Total Comprehensive Income (\$M)



Multi-Year Required Economic Capital

Required Capital - Range of TVaR Indications (\$M)

		Base Correlation		
		Year 1	Year 2	Year 3
0.10%	(1000 yr)	-1,807.0	-2,556.4	-3,054.9
0.20%	(500 yr)	-1,288.4	-1,955.4	-2,343.6
0.40%	(250 yr)	-813.6	-1,380.2	-1,749.5
0.50%	(200 yr)	-696.3	-1,199.8	-1,563.1
1.00%	(100 yr)	-443.6	-775.6	-1,037.5
2.00%	(50 yr)	-301.7	-516.1	-692.5

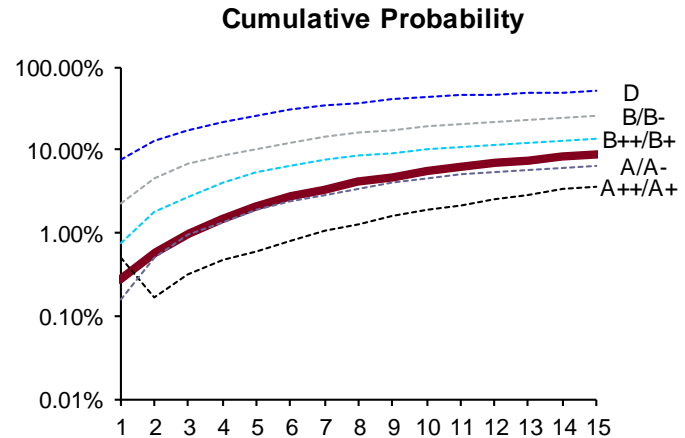
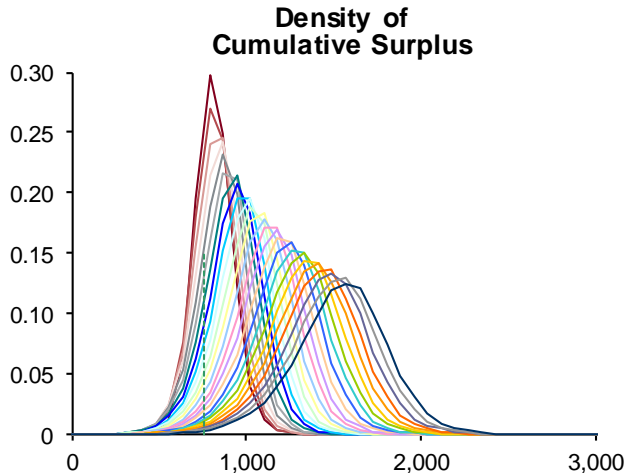
		Multiple of Year 1	
0.10%	(1000 yr)	1.41x	1.69x
0.20%	(500 yr)	1.52x	1.82x
0.40%	(250 yr)	1.70x	2.15x
0.50%	(200 yr)	1.72x	2.24x
1.00%	(100 yr)	1.75x	2.34x
2.00%	(50 yr)	1.71x	2.30x

Multi-Year Economic Capital Analysis – Franchise Value Estimation

Multi-Year Analysis (\$M)

Starting Surplus \$M	750.0	Enterprise Value \$M	1,177.7	P:B	1.57
Default Threshold	375.0	Dividend Valuation	701.6		
Dividend Barrier	750.0	Volatility to Surplus Ratio	16.7%		

Year	Conditional Average Surplus	Average Surplus	ROE	Average Dividend	Conditional Probability of Default	Cumulative Probability of Default
2014	812.9	809.9	8.0%	63.4	0.270%	0.270%
2015	813.8	810.5	8.6%	54.4	0.316%	0.585%
2016	826.0	822.1	8.7%	51.5	0.408%	0.990%
2017	843.0	838.6	8.8%	50.3	0.510%	1.495%
2018	864.1	859.1	9.0%	50.4	0.591%	2.077%
2023	993.3	986.7	9.0%	54.1	0.744%	5.491%
2028	1,150.2	1,142.4	8.7%	59.9	0.763%	9.013%
2033	1,333.4	1,324.4	8.5%	66.9	0.764%	12.433%



Compare Alternative Strategies

- Analyze alternative strategies by comparing cost of strategy to impact on estimated Franchise Value and Probability of Default

Impact of Alternative Strategies on Multi-year Metrics (\$M)

	Base	Lower Cat Retention	More Cat Limit	Lower Non-Cat Volatility	Lower Equity Volatility
Enterprise Value	1,177.7	1,185.5	1,184.8	1,178.8	1,179.5
\$ change from Base		7.8	7.1	1.1	1.8
Price:Book Ratio	1.57	1.58	1.58	1.57	1.57
Cumulative Probability of Default					
5 years	2.077%	2.022%	1.923%	1.944%	1.505%
10 years	5.491%	5.315%	5.187%	5.042%	3.366%
20 years	12.433%	12.027%	11.869%	11.391%	7.156%

Linking Loss and Premium

Modeling the Underwriting Cycle



Industry cyclical behavior can be replicated with a simple time series model that links changes to the Loss/GDP ratio and NWP/GDP

Loss/GDP becomes the signal, the Premium/GDP factors provide a feedback loop driving the cycle

	Parameter	Std. Error	p Value
Constant	0.0106	0.0018	9.69E-07
Prior Loss/GDP	0.4512	0.0858	5.49E-06
Prior Premium/GDP	1.0156	0.1177	1.38E-10
Second Prior Premium/GDP	-0.6706	0.0969	2.76E-08
Regression R²	89.9%		

Signal

Noise

Linking Losses to Common Drivers

- Simplify modeling issues by linking variables to common drivers
 - Reduces dimensionality if link by line, by year (future and prior years)
- Link to shared economic variables provides intuitive explanation of methodology
- Research ongoing

Most Predictive Economic Variables

Economic Variable	Pers Auto Liab		Auto Phys Damage		Home	
	% Included	Rank	% Included	Rank	% Included	Rank
GDP: Implicit Price Deflator	55%	1	69%	2	60%	2
CPI-U: Medical care commodities	45%	4	59%	6	62%	1
Vehicle Miles Traveled	35%	8	63%	4	57%	3
S&P Case-Shiller 10-City Home Price Index	49%	3	46%	7	49%	5
CPI-U: Motor vehicle maintenance and repair	41%	5	64%	3	42%	7
10-Year Treasury Constant Maturity Rate	35%	8	61%	5	43%	6
CPI-U: Motor vehicle parts and equipment	54%	2	27%	12	40%	9
S&P 500	38%	7	24%	14	55%	4
Producer Price Index: All Commodities	28%	11	73%	1	28%	15
Real Gross Domestic Product	28%	11	42%	8	40%	9

Conclusion

- Valid business reasons for desiring a multi-year view of Economic Capital
- We need to think about how to thoughtfully address this business desire
- Make small, measured steps towards a multi-year view by leveraging current single year model with simplified assumptions over multiple years
- Future research needed to improve confidence in multi-year modeling

Contact Information

Adam Troyer

Aon Benfield Analytics

+1.312.381.5622

adam.troyer@aonbenfield.com