LPTs and ADCs for Risk Management

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Prepared by Aon's Reinsurance Solutions
Presentation to 2019 Midwest Actuarial Forum Spring Meeting

Empower Results®

Agenda

Section 1	State of Casualty Catastrophe / Latent Liability Modeling
Section 2	Stochastic Reserving Methods
Section 3	The Point

Section 1: State of Casualty Catastrophe / Latent Liability Modeling

What is a Casualty Catastrophe / Latent Liability?

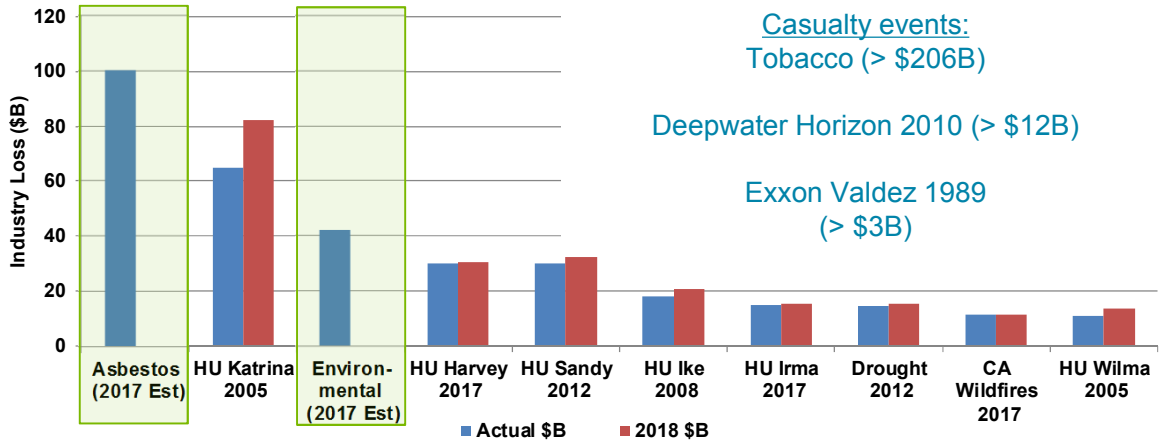
A.M. Best defines a casualty catastrophe as "an event, activity, or product that results in a large number of lawsuits from multiple plaintiffs alleging damages that impact multiple insureds, coverages, and/or time periods." (A.M. Best SRQ)

Question	Property	Casualty
What?	Event (not man-made)	Event, activity, or product (man-made)
Who?	Multiple claimants (first party)	Multiple plaintiffs (third party)
How?	Multiple insureds and coverages	Multiple insureds, coverages and/or time periods Potential for cascading losses across industries
Also:	Fortuitous Loss	Fortuitous Loss ? ? ? ?

Fortuitous: happening or produced by chance

Why Focus on Casualty Catastrophe?

Significant Insurance Industry Loss Events



Casualty events:
Tobacco (> $206B)

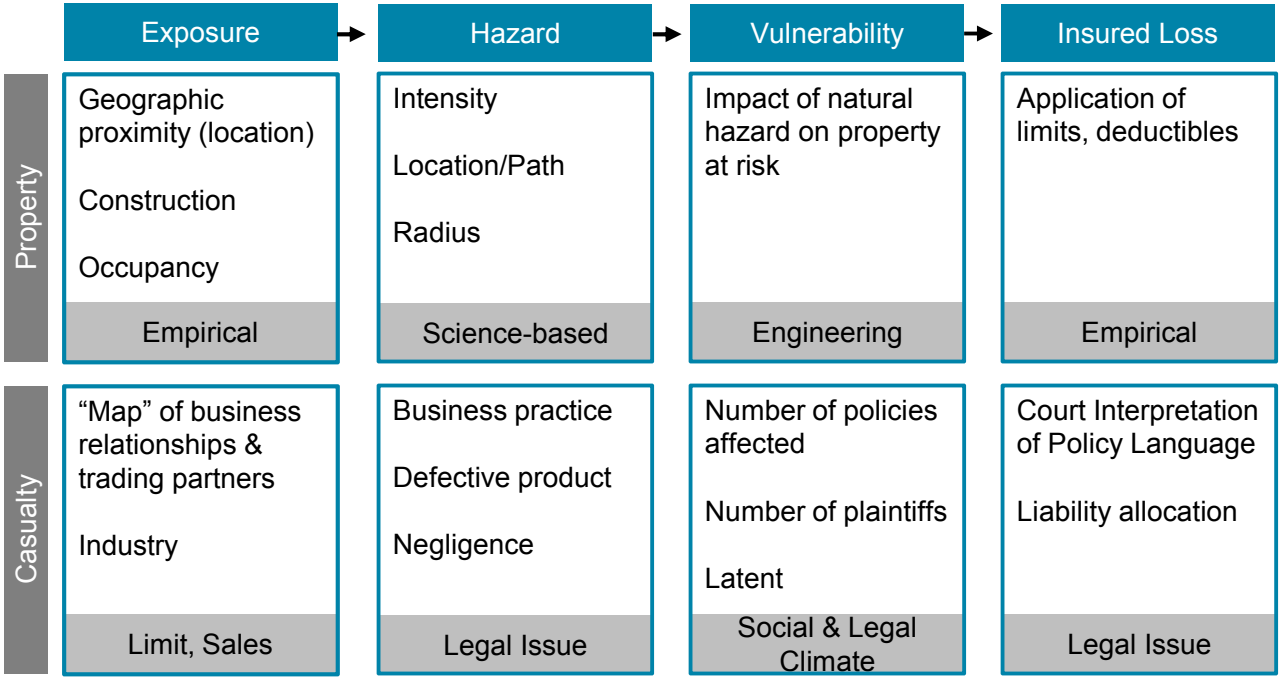
Deepwater Horizon 2010 (> $12B)

Exxon Valdez 1989
(> $3B)

- Although few, casualty catastrophes are large
  - Two of the three largest insured catastrophe events in the US have been casualty catastrophes!!
- Inadequate reserves have been a significant contributor of insolvencies
- Exposure to casualty catastrophes of growing importance from a capital perspective
  - Explicit casualty clash risk charges for IAIS and Solvency II
  - AM Best adding more casualty clash disclosures (five scenario impacts) to SRQs

Source: Estimates of casualty catastrophe from AM Best (2017), property catastrophes from PCS, only property catastrophes from the last 20 years considered.

Conceptual Similarities



- Casualty accumulation risk involves complex interactions among socio-economic, environmental, health and legal environments

Contrasts Between Property & Casualty Catastrophes

Characteristic	Property	Casualty
Emergence	Sudden	Gradual
Duration	Short (days)	Lengthy (Years/Decades)
Financial Recognition of Losses	Immediate	Deferred

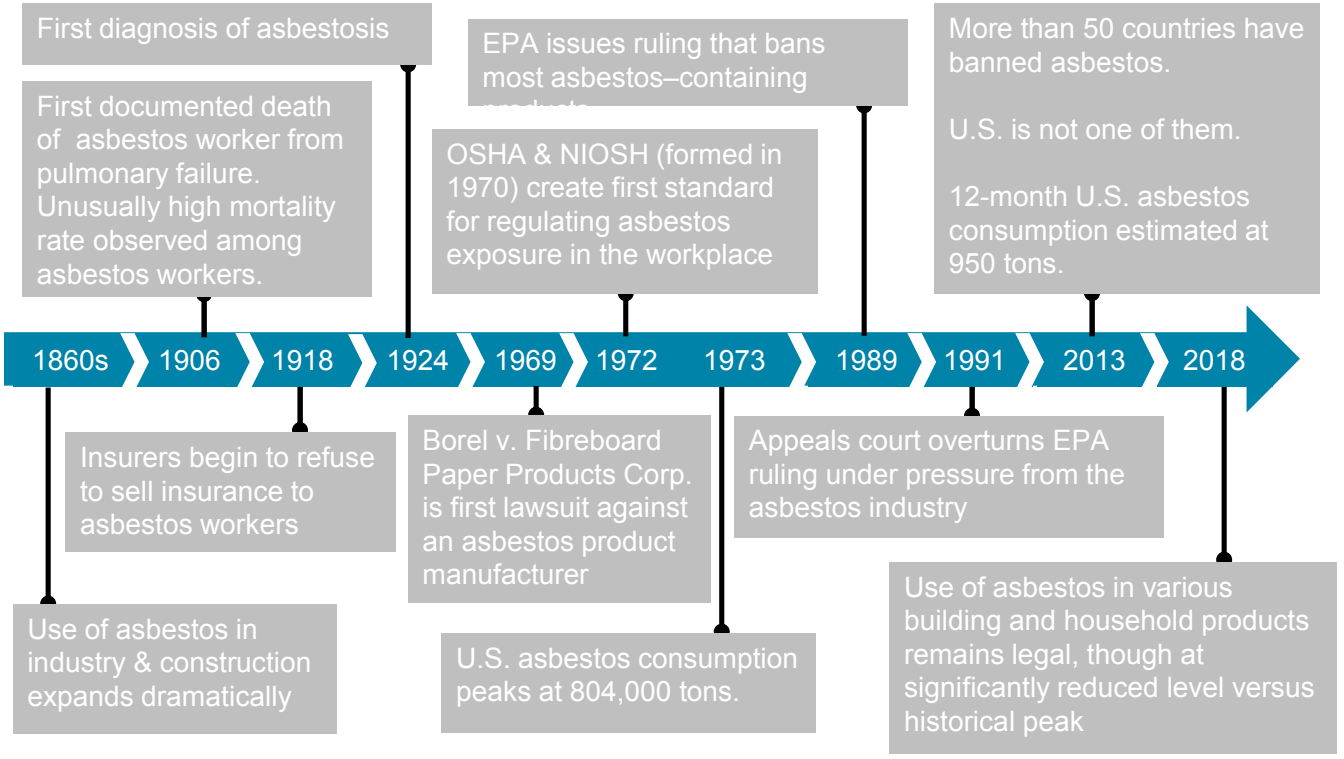
Challenging Aspects of Casualty Catastrophes

- Infrequency of events
- Singular nature of past events relative to possible future events
  - No two are the same
- Complexity of modeling legal dynamics and social trends
- Diversity of causes
- Inaccessible data
- Lack of mechanism for systematic identification and aggregation of casualty catastrophe insured loss across insurers
- Uncertainty as to the location of the casualty event
- Historical casualty events tend to get ‘excluded’ from insurance coverage once able to ‘parametrize’

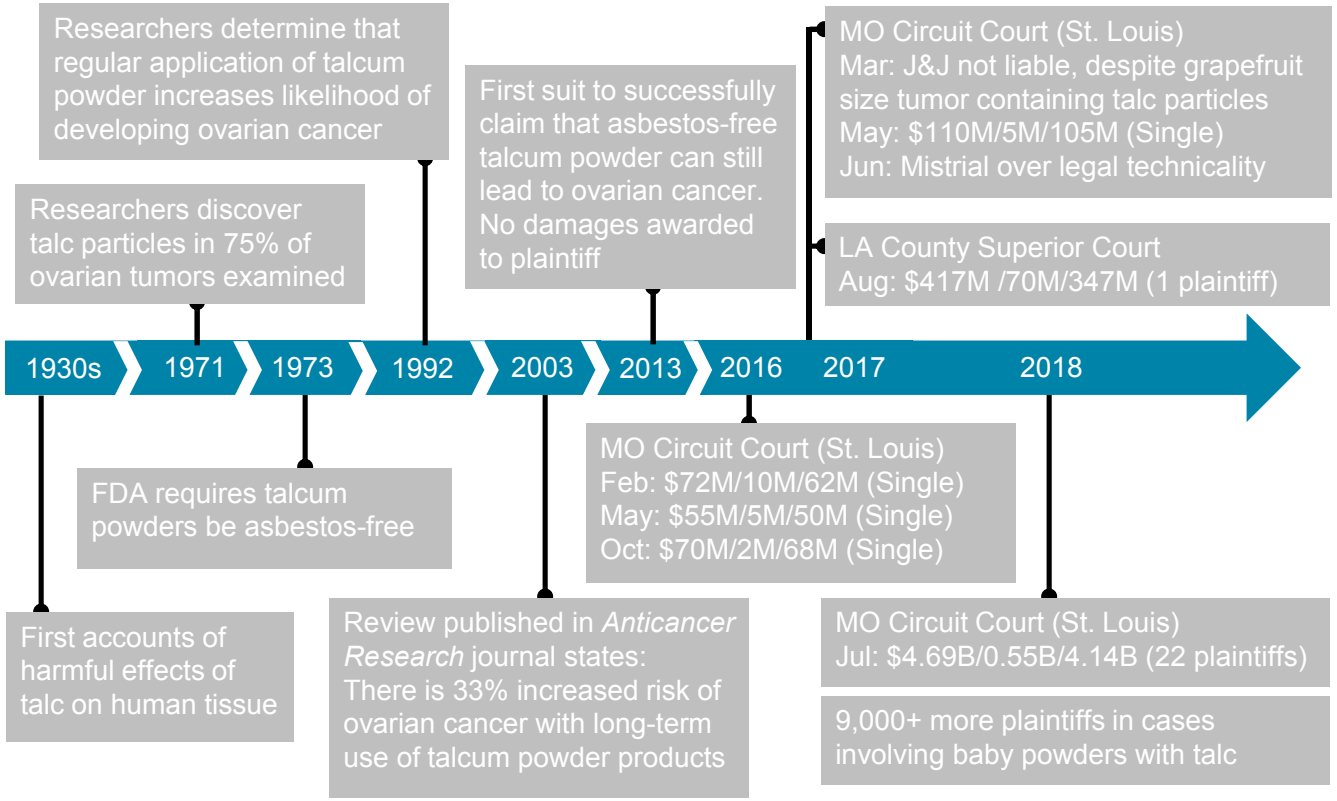
› Greater uncertainty in parameterization of casualty versus property modeling

Source: D’Arcy, Stephen P., Casualty Catastrophe Analytics: Where we are now and where we should be on this critical risk, March 2016.

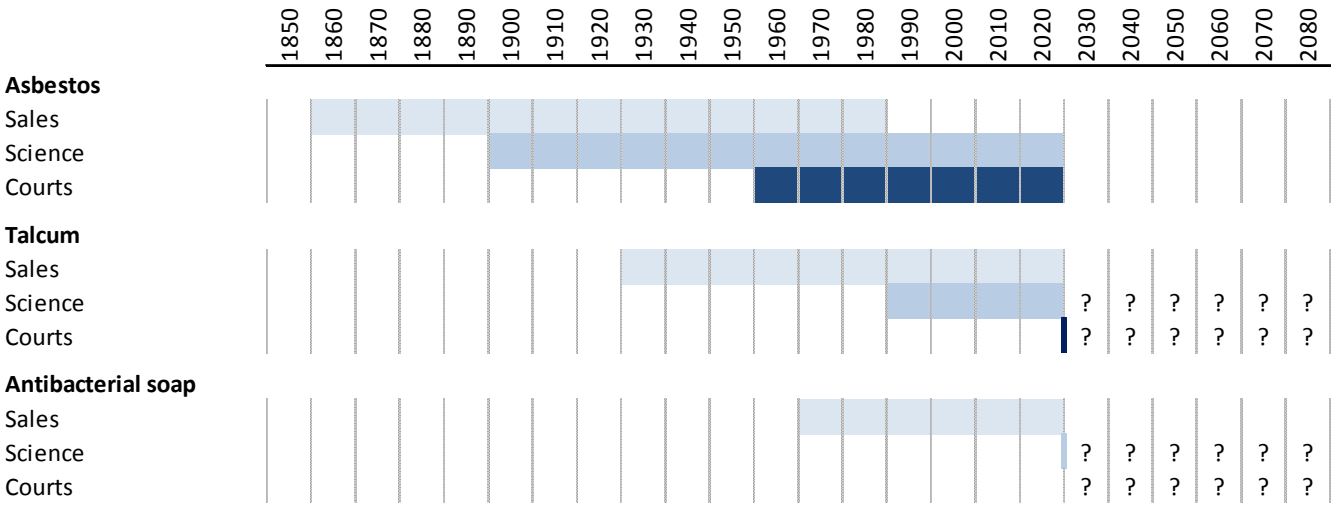
Asbestos Timeline



Talcum Powder Timeline



Emergence of Casualty Accumulation Risk



- There are many other emerging risks in casualty
  - Sugar
  - Cell phones
  - Neonicotinoids
  - Opioids
  - Concussions: Did anyone read the ESPN.com story on concussions in sports that quoted two CAS Actuaries?
- Are the exposures to these risks increasing in today's rapidly evolving world?

Proprietary Models

- Several insurers, consultants, and InsurTech companies have produced proprietary casualty catastrophe models
  - Models vary in their approach, data source(s), complexity, reliance on historical experience

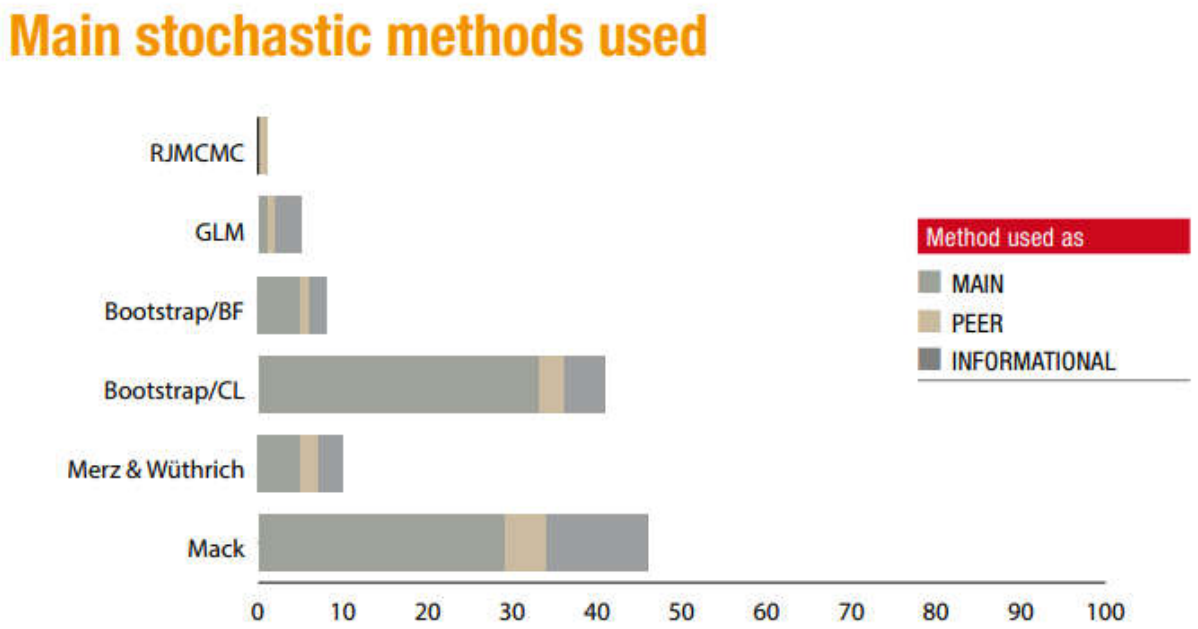
Company	Affiliations	Model	Data	Source of data
Willis Re	Towers Watson	eNTAIL	30 years of historical losses 300 casualty catastrophes	Willis Re Towers Watson
Guy Carpenter	n/a	GC ForCas	300,000 historical losses	Advisen
Aon Benfield	n/a	ReMetrica	60 scenarios evaluated across 1,000+ industry classes (NAIC / SIC)	Aon Benfield
Lloyd's / Arium	AIR	Arium	300,000 historical losses	Advisen
Praedicat	RMS	Oortfolio	Text mining of 10,000 journals	Praedicat

- Several models use historical losses to develop industry loss parameters which then can be modeled across an insurance portfolio

Source: D'Arcy, Stephen P., Casualty Catastrophe Analytics: Where we are now and where we should be on this critical risk, March 2016.

Section 2: Stochastic Reserving Methods

Most popular stochastic reserving methods today…



Mack-derived analytical methods are slightly behind the algorithmic Bootstrap methods, the other methods following far behind. On average a little more than one out of two insurers on two use a stochastic method (either being Bootstrap or Mack-derived).

Source: 2016 ASTIN Non-life Reserving Practices Report

…first introduced in the 1990s

Mack Method

DISTRIBUTION-FREE CALCULATION OF THE STANDARD ERROR OF CHAIN LADDER RESERVE ESTIMATES

BY THOMAS MACK

Munich Re, Munich

ABSTRACT

A distribution-free formula for the standard error of chain ladder reserve estimates is derived and compared to the results of some parametric methods using a numerical example.

KEYWORDS

Claims reserving; chain ladder; standard error.

1993

ODP Bootstrap

ELSEVIER

Insurance: Mathematics and Economics

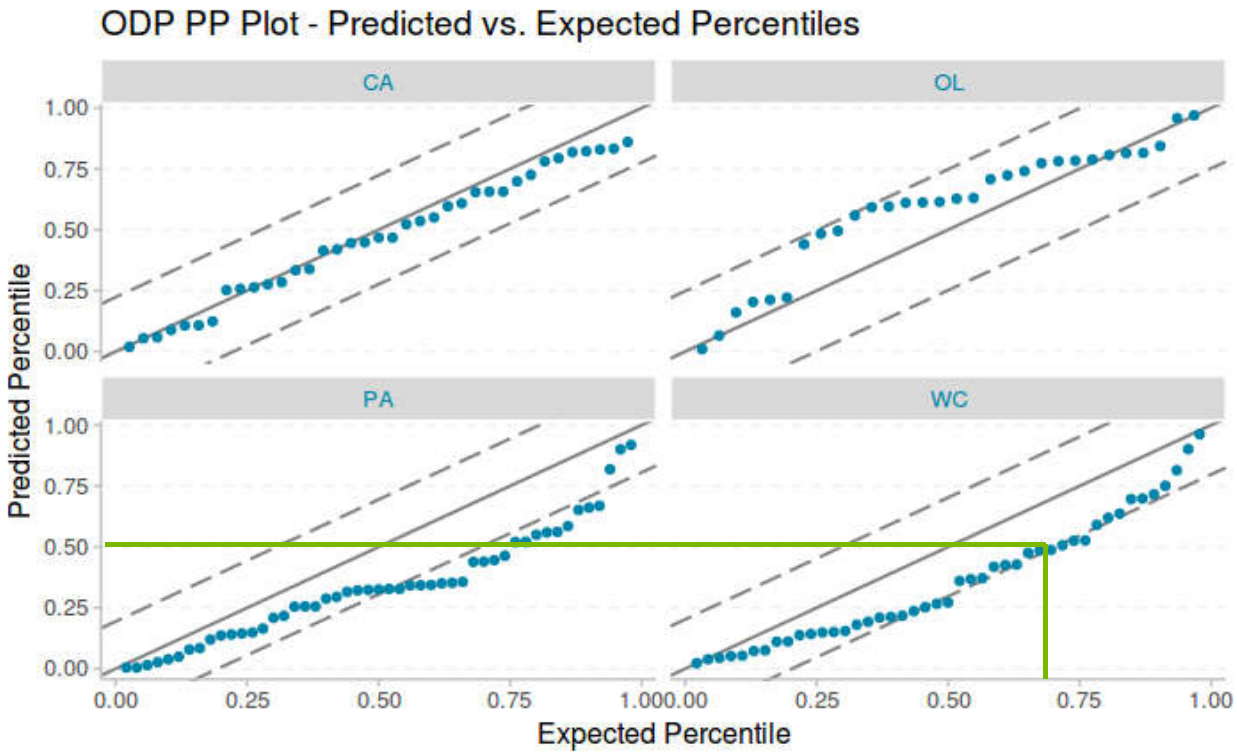
Volume 25, Issue 3, 10 December 1999, Pages 281-293

Analytic and bootstrap estimates of prediction errors in claims reserving ☆

Peter England [a], Richard Verrall [b]

1999

Back-testing results of ODP



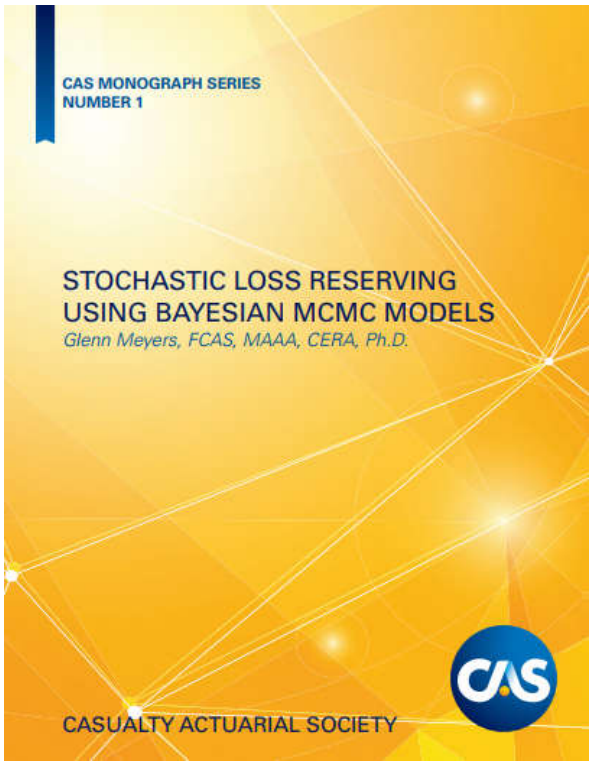
Bayesian MCMC Changing Settlement Rate (CSR) Method

As described in the literature

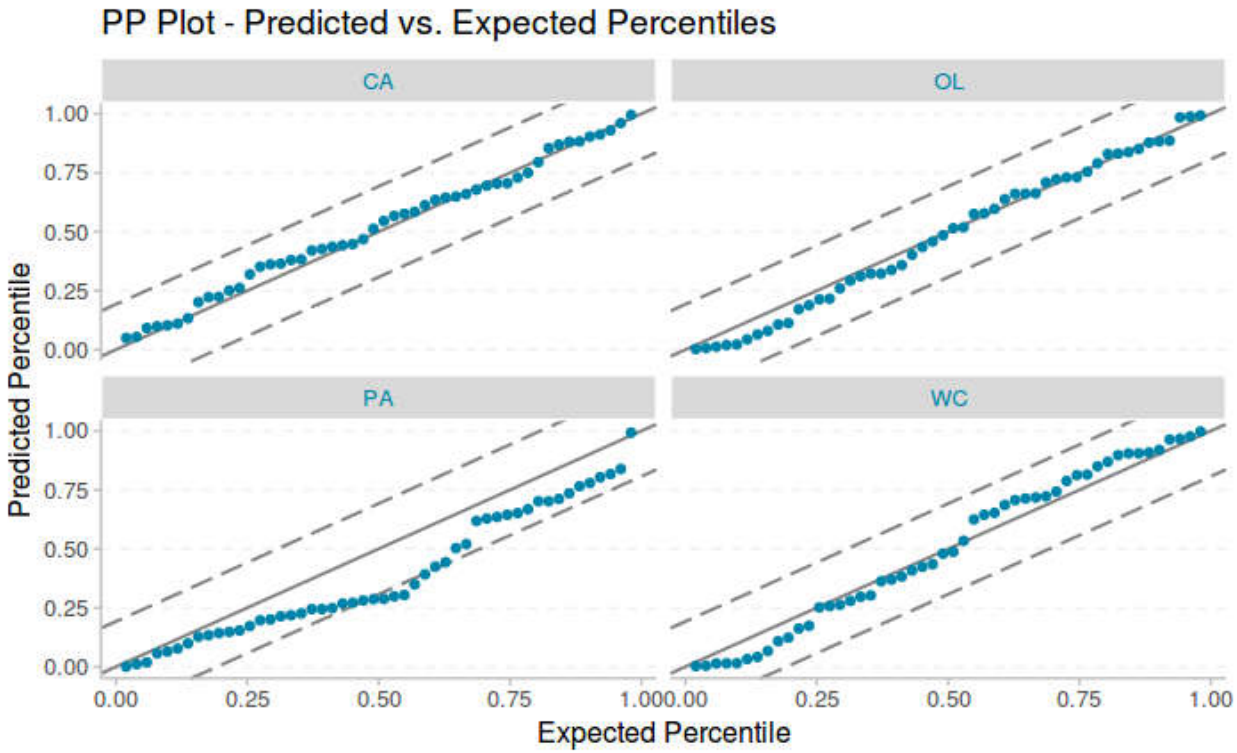
- Dependencies in Stochastic Loss Reserve Models. http://www.casact.org/pubs/forum/16wforum/Meyers.pdf
- STOCHASTIC LOSS RESERVING USING BAYESIAN MCMC MODELS. http://www.casact.org/pubs/monographs/papers/01-Meyers.PDF
- http://ar.casact.org/actuarialreview/july_august_2017/MobilePagedArticle.action?articleId=1130425#articleId1130425

Benefits of method

- Removes independence assumptions across accident years and development years
- Bayesian method also reflects uncertainty in parameter estimates (esp. for small samples)
- Allows for full distribution of posterior simulations
- Back tests well against Casualty Actuarial Society Loss Triangle database (http://www.casact.org/research/index.cfm?fa=loss_reserves_data)



Back-testing results for CSR method



Compare results of ODP and CSR

Using CAS Triangle database, CSR method produces CVs 1.6x – 2.2x higher than ODP Bootstrap

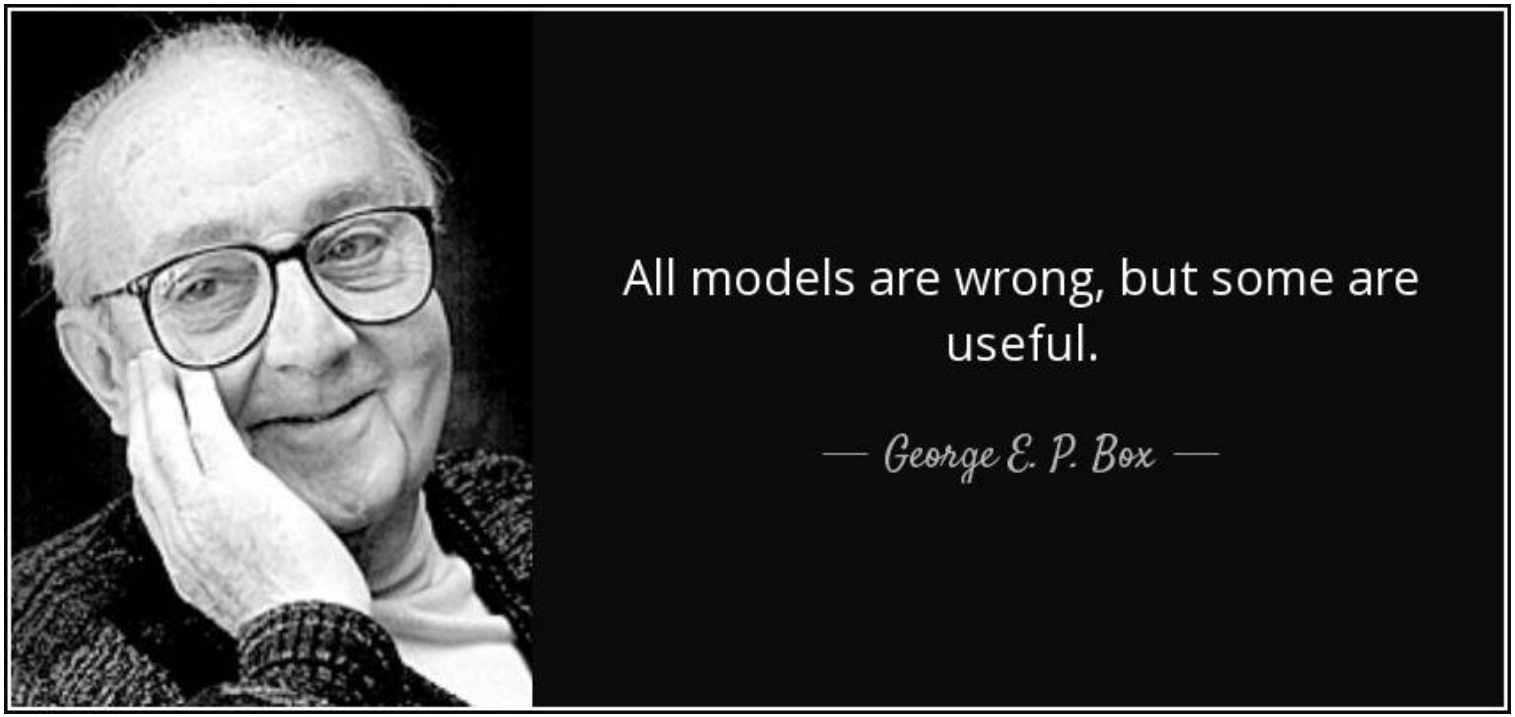
Summary of CSR and ODP CoVs on CAS Triangle Database

	# of	ODP Bootstrap CoV		CSR CoV		Ratio of CSR to ODP	
Line	triangles	Median	Wtd Avg	Median	Wtd Avg	Median	Wtd Avg
CA	37	22%	11%	48%	25%	2.1	2.1
OL	30	33%	14%	56%	38%	1.8	2.7
PA	49	11%	5%	22%	8%	2.2	1.6
WC	45	12%	10%	24%	18%	1.9	1.9

- Using Other Liability as an example, a the 99th percentile of a LogNormal distribution using a 14% CV would be the **85th** percentile of a LogNormal distribution based on a 38% CV

Section 3: The Point

It all comes back to this!



Quick Overview of LPT/ADC's

Retroactive covers are fairly straightforward

- Insurer seek to cap off the risk of adverse development on all or a sub-segment of their unpaid liabilities.
- Ceding companies can either pay a pure premium for coverage attaching either at current carried or above some additional retained buffer.
- Alternatively the coverage can attach below the carried which results in an immediate cession of both premium (assets associated with loss reserves) and losses. Coverage above current carried is still provided and can be "paid" for by the interest income the reinsurer can earn on the ceded reserves.

LPT

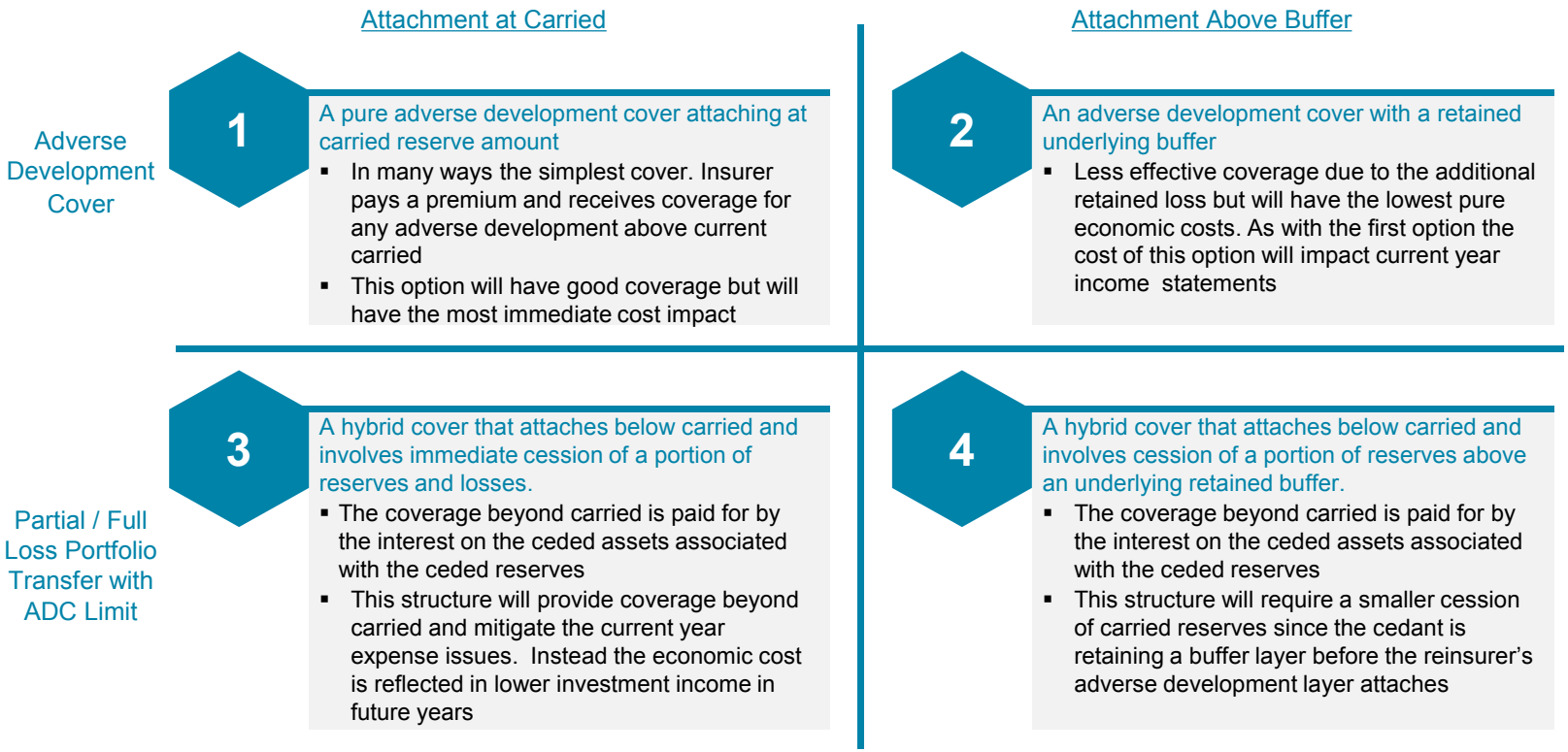
Loss Portfolio Transfer ("LPT") :
A cession of all or part of a company's reserves to a Reinsurer who assumes financial responsibility for ceded reserves.

ADC

Adverse Development Cover ("ADC"):
Provides reinsurance above net carried reserve level (existing reserves are not transferred)

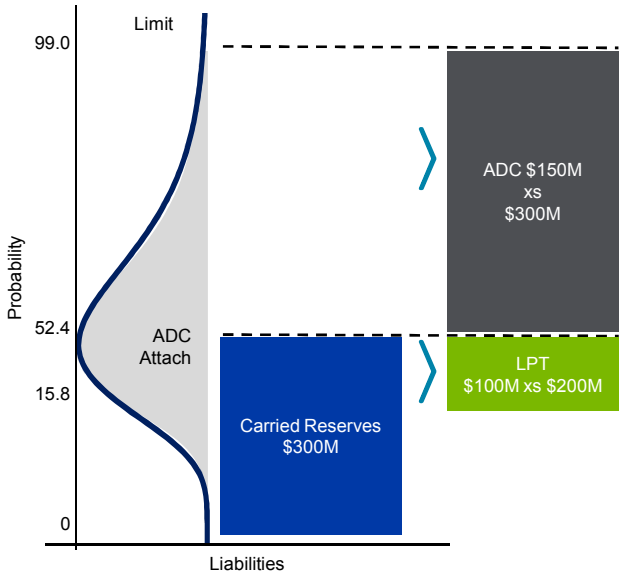
An LPT is frequently done in combination with an ADC so that the time value of money embedded in the ceded carried reserves funds the ADC layer

Structure Options Summary



Partial Loss Portfolio Transfer with Adverse Development Cover

Protection is provided by a partial LPT of $100M of carried reserves plus $2.5M above carried as an additional risk premium for AY's 2017 and prior, combined with an ADC with $150M of limit attaching at carried reserves



Pros

- Embedded discount in the held reserves may fully fund the ADC
- Use of held reserves for funding reduces or eliminates income hit at inception
- Draws strong interest from Reinsurers which value cash flow (float)

Cons

- Reinsurers will generally price transactions using the duration matched risk free rate, which is lower than most companye's investment yield
- May require liquidation of material amount of assets to fund the premium
- Large LPT cession introduces additional reinsurer credit risk
- Funds held structure can mitigate the above three cons
- Execution is challenging, if market view of reserves is materially higher than carried

Execution

- At inception would require a transfer of assets equal to $100M + $2.5M additional risk premium
- Reinsurer would be responsible for $100M of in-the-money loss and ALAE plus $150M of adverse development above carried reserves, which protects to 99th percentile

Partial LPT with ADC Attaching at Carried Reserves BCAR Impact

ABC Insurance Group

A.M. Best - Baseline BCAR ($ thousands)

		VaR 99.6	
		YE 2017	ADC - LPT Impact
B1	Fixed Income Securities	40,000	**39,275**
B2	Equity Securities	244,000	244,000
B3	Interest Rate	27,000	27,000
B4	Credit	98,000	**111,000**
B5	Loss and LAE Reserves	445,000	**340,000**
B6	Net Premiums Written	269,000	269,000
B7	Business Risk	5,000	5,000
B8	Catastrophe Risk	20,000	20,000
	Unadjusted Required Capital	1,148,000	1,055,275
	Covariance Adjustment	525,697	507,994
	Net Required Capital	622,303	547,281
	Reported Surplus	1,000,000	**998,025**
	UPR Equity	50,000	50,000
	Loss Reserve Equity	10,000	**19,000**
	Fixed Income Equity	24,000	24,000
	Schedule F Provision	8,000	8,000
	Adjusted Policyholder Surplus	1,092,000	1,099,025
	New Capital Adequacy Ratio (APHS - NRC) / APHS	**43%**	**50%**

LPT ADC Components

ADC Attachment	ADC Limit	Rate on Line	Reserves Transferred	Buffer Layer
$300.0M	$150.0M	1.7%	$100M	N/A

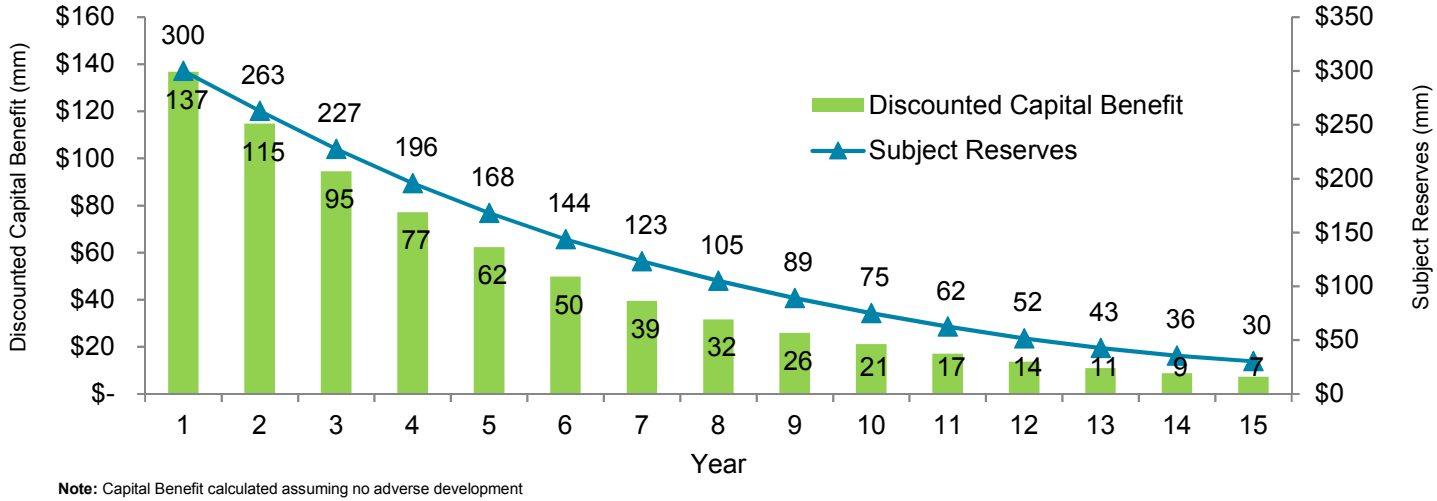
- Decrease in surplus is from the post-tax cost of the program
  - LPT significantly reduces ROL as most of ceded premium is for transferred reserves
  - Reduction in cash decreases Fixed Income Risk (B1) (not material)
- Increase in Credit Risk (B4):
  - All reserves associated LPT increases reinsurance recoverables
  - A.M. Best view of deficiency in reserves adds expected reinsurance recoverables from ADC into Credit Risk (B4)
- ADC increases Loss Reserve Equity but is offset from LPT as ceded reserves are no longer discounted; overall positive impact
- ADC/LPT with no buffer mitigates exposure to reserving errors, thus reducing Reserve Risk (B5)
  - Reduction in Reserve Risk has the greatest impact on BCAR
- Estimated BCAR score still eligible for highest “Balance Sheet Strength” assessment in rating methodology

Partial LPT with ADC Attaching at Carried Reserves Capital Benefit

Reinsurance Terms	
Subject Reserves	$300.0M
ADC Attachment	$300.0M
Buffer	$0
ADC Limit	$150.0M
ROL	1.7%
Assets Transferred	$ 102.5M

Additional Considerations	
Deficiency Factor	7.5%
Risk Free Rate	3%
Reserves Transferred	$100.0M
Reinsurer Margin	$102.5M
Tax Rate	21.0%
Commute Option	Year 15

Cost of Capital	
15 Year Cumulative Capital Benefit	$ 810,000
15 Year Discounted Capital Benefit	$ 715,000
Expected Cost of Reinsurance (Post-tax)	$ 25,000
Ceded Return On Equity	3.5%



Note: Capital Benefit calculated assuming no adverse development

Pricing and Placement

Given our market scope and leverage we feel that Aon Benfield is well positioned to deliver the best terms and conditions that are available. Here are what we see as some of the key issues we will encounter during the course of placement:

State of the market - A combination of new entrants and established markets looking to expand their writings, has made for a dynamic marketplace for retroactive reinsurance.

Class of business - Markets like liability lines due to the long pay-out pattern

Age of subject reserves – Depending on what accident years the cover protects, this could be a pro or a con. Older accident year's, e.g., 2015 and prior, are more mature and predictable and could result in better pricing. More recent accident year's have more IBNR and more volatility, thus including them could make the transaction larger for reinsurers, however, these years are very green and highly uncertain which will be reflected in the reinsurer's pricing.

Size of portfolio - A portfolio in excess of $50M to $100M is large enough to attract a lot of market interest, especially for a large, in-the-money last-to-pay loss portfolio transfer of at least $50M. The larger the asset transfer or up front premium, the stronger the competition

Market's opinion of adequacy – The market's opinion of the adequacy of the carried reserves will make or break the viability of the placement in the marketplace. Can additional long-tail reserves be used to help close a gap due to difference of opinion in adequacy?

National Indemnity Major Adverse Development and Loss Portfolio Transfer Transactions

Transaction	Date	Limit ($B)	Cost ($B)	ROL	Break Even Yield for Avg Payout Duration of: 6 Yrs	9 Yrs	12 Yrs	15 Yrs	Comment
ACE-Brandywine	Jul-99	2.5	1.3	50.0%	12.2%	8.0%	5.9%	4.7%	
One Beacon	Mar-01	2.5	1.3	52.8%	11.2%	7.4%	5.5%	4.3%	
Equitas	Oct-06	15.1	7.2	47.7%	13.1%	8.6%	6.4%	5.1%	Included Reinsurance Recoverable Credit Risk
CNA	Jul-10	4.0	2.2	55.0%	10.5%	6.9%	5.1%	4.1%	Included Reinsurance Recoverable Credit Risk
AIG	Apr-11	3.5	1.7	47.0%	13.4%	8.8%	6.5%	5.2%	Included Reinsurance Recoverable Credit Risk
Liberty Mutual	Jul-14	6.5	3.0	46.2%	13.8%	9.0%	6.7%	5.3%	A&E sublimited to 3.1B (2.4x transferred A&E reserve)
Hartford	Dec-16	1.5	0.7	46.7%	13.5%	8.8%	6.6%	5.2%	Reinsurance recoverables not covered, retained claims handling
AIG v2	Jan-17	20.0	10.2	51.0%	11.9%	7.8%	5.8%	4.6%	Retained claims handling
Average				49.5%	12.5%	8.1%	6.0%	4.8%	

Sources: SNL Financial, company financial disclosures, Aon Benfield research

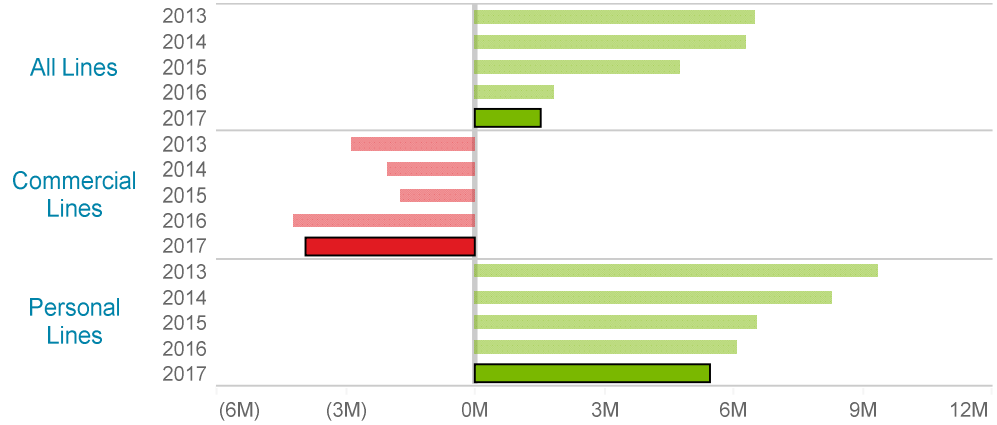
Assuming full limit loss, yield at which NICO return is >$0, by duration of the assumed liabilities

Other Deal of Note

In 2009, Swiss Re purchased a 5B Swiss Franc limit cover for 2B Swiss Francs, but there also was an agreement for Swiss Re to issue $2.5B preferred shares at a 12% coupon

Industry Reserve Study Highlights

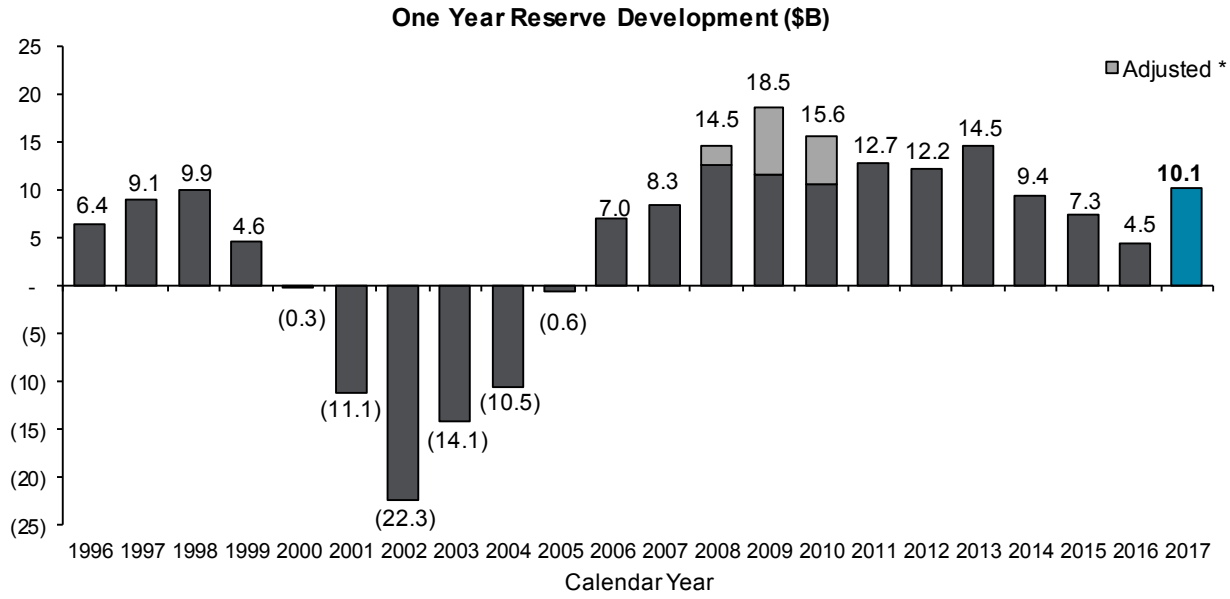
Historical Industry Reserve Redundancy/(Deficiency)



2016	2017
1.8 B	**1.5 B**
(4.2) B	**(3.9) B**
6.1 B	**5.4 B**

- Overall industry redundancy at year end 2017 of USD1.5 billion – equivalent to 0.2 percent of booked reserves
- Commercial lines improved marginally with an overall deficiency position of USD3.9 billion at year end 2017 compared to an estimated USD4.2 billion deficiency at year end 2016
- Personal lines continued to show a redundancy of USD5.4 billion at year end 2017, though not as strong as the redundancy of USD6.1 billion at year end 2016

US P&C Industry Reserve Development (1996 – 2017)



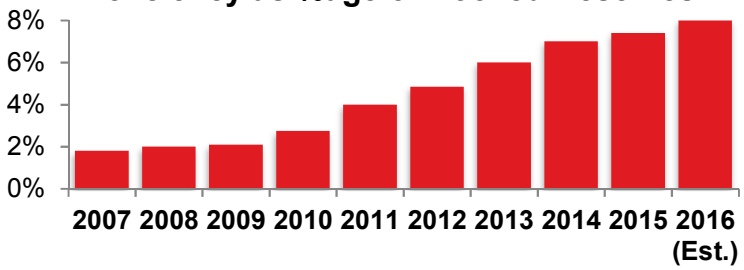
*Adjustments include Financial Lines development in 2008-2009, and AIG adverse development in 2010.

- 2017 development per P&C Industry data as compiled by SNL through July 31, 2018
- Total favorable development in 2017 of USD10.1 billion

Rating Agency Concern over Reserve Adequacy Trends

Since 2007, AM Best's estimate of industry deficiency has grown from ≈ 2% to 8%

AM Best Industry Loss & LAE Reserve Deficiency as %age of Booked Reserves



Increased Inflation What-If Scenarios				
	Based on CY Inflation Increase of:			
	+1%		+3%	
LOB	% Impact on Deficiency	% Impact on PHS	% Impact on Deficiency	% Impact on PHS
Property Lines	2%	-1%	6%	-2%
Other Liability (Occurrence)	5%	-7%	16%	-22%
Workers Compensation	6%	-10%	20%	-32%

Source: AM Best Review Preview conference materials 2017

A.M. Best cites ongoing concerns of:

- Loss development factors continuing to increase
- Uncertainty of inflation on loss costs increasing
- Premium/rates continue to soften in commercial lines
- Increasing number of companies reporting overall adverse development
- Significant amount of companies strengthening commercial casualty reserves in 2016

*Note: Includes statutory discount as a deficiency
*Source: AM Best 2017 Review Preview conference materials

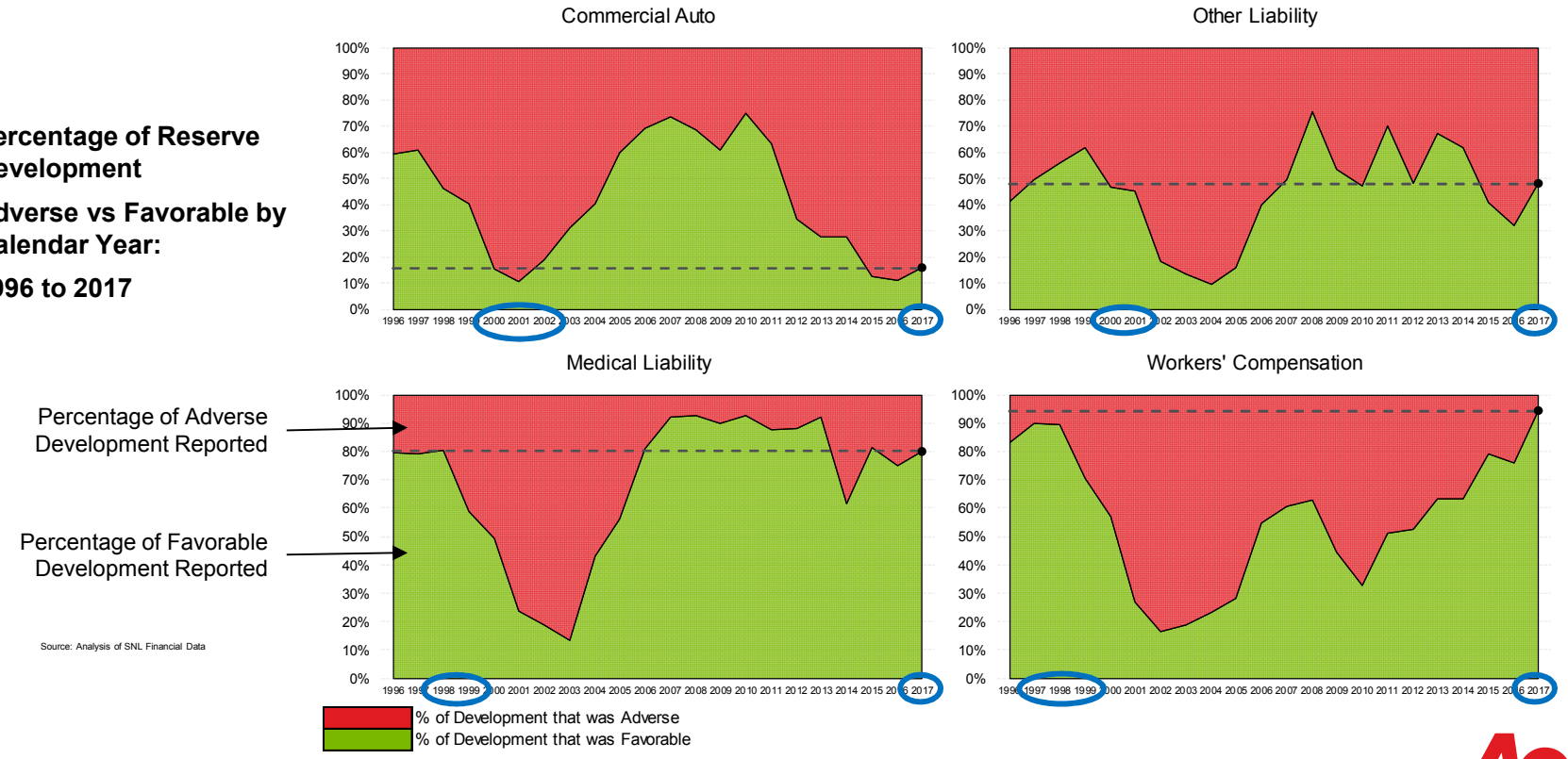
The Reserve Cycle by Line – Will History Repeat Itself?

Percentage of Industry Reserve Development by Year: Adverse vs. Favorable

Percentage of Reserve Development

Adverse vs Favorable by Calendar Year:

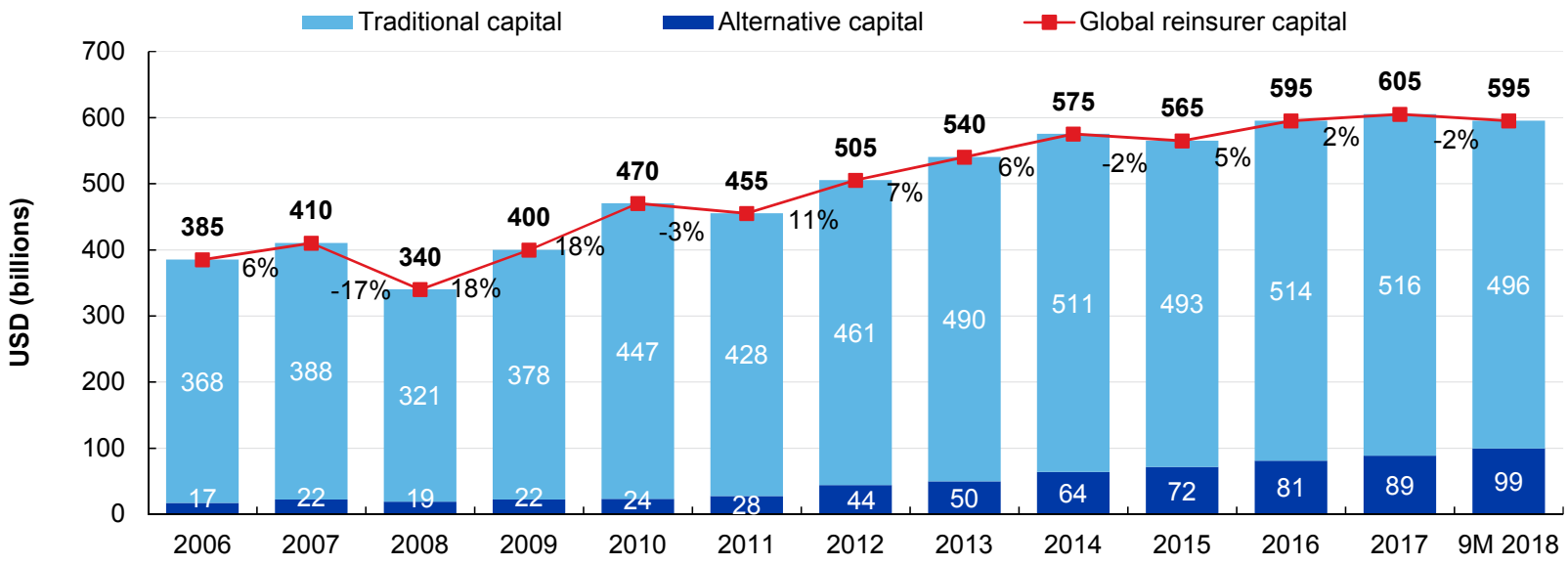
1996 to 2017



Source: Analysis of SNL Financial Data

But global reinsurer capital is still at all time highs

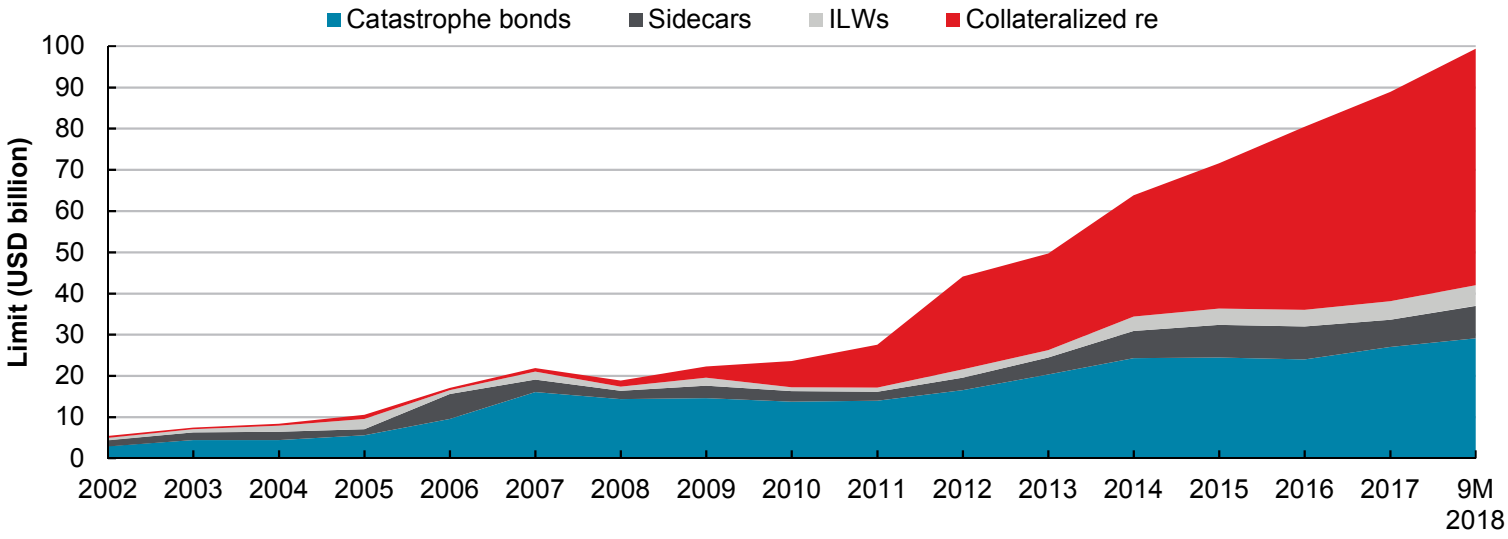
- Global reinsurance capital stood at $595 billion at September 30, 2018
- Traditional capital fell 4%, to $496 billion, while alternative capital rose 11%, to $99 billion



Source: Aon Benfield Analytics

Alternative Capital

- Growth in alternative capital is slowing, as the continuing entry of new funds is being offset by loss development on past events and redemption requests from a relatively small number of investors looking to exit.
- Many investors in the final quarter of 2018 have experienced some combination of lower than expected pricing, creep on 2017 events and further losses in 2018
- Significant amounts of collateral have become trapped and the ongoing commitment of newer participants is being tested
- Aon expects the previous rate of growth to resume once losses are digested as many long-term investors have made good returns over time and the diversification strategy remains valid.



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