

Risks of the Future

Stephen Mildenhall Global CEO of Analytics for Aon



A story of successful industry and academic collaboration



A long time ago in a galaxy far away... A long time ago in a galaxy far away...

An actuary struggles...

with loss development

The problem...

E	Evaluated After	(Months)							
U/W Year	12	24	36	48	60	72	84	96	108
1995	4,030	21,892	52,243	85,181	120,872	142,936	164,162	178,008	193,776
1996	2,994	18,311	51,346	83,248	135,015	187,369	216,122	237,076	
1997	2,283	16,450	59,934	114,194	180,824	240,627	311,140		
1998	3,231	21,536	71,076	124,930	196,480	260,883			
1999	6,133	35,513	89,621	147,993	216,893				
2000	9,480	39,393	84,313	120,651				99	
2001	7,996	46,883	86,260						
2002	7,293	32,736							
2003	3,031								

■ Estimate for green box: 3,031 x (average increase of prior years)

Link Ratios

AY	24 / 12	36 / 24	48 / 36	60 / 48	72 / 60	84 / 72	96 / 84	108 / 96
1995	5.433	2.386	1.630	1.419	1.183	1.149	1.084	1.089
1996	6.117	2.804	1.621	1.622	1.388	1.153	1.097	
1997	7.205	3.643	1.905	1.583	1.331	1.293		
1998	6.665	3.300	1.758	1.573	1.328			
1999	5.790	2.524	1.651	1.466				
2000	4.156	2.140	1.431					
2001	5.863	1.840						
2002	4.489 =	32736 / 7293						



...the Question

- Which should we use?
 - E[current year loss / prior year loss]
 - E[current year loss] / E[prior year loss]
 - i.e. straight or weighted average of the factors?

As of 1992 no accepted answer!

Hundreds of billions of dollars of reserves at stake!



Answer

Distribution-free Calculation of the Standard Error of Chain Ladder Reserve Estimates

Thomas Mack

ASTIN Bulletin / Volume 23 / Issue 02 / November 1993, pp 213 - 225 DOI: 10.2143/AST.23.2.2005092, Published online: 29 August 2014

Link to this article: http://journals.cambridge.org/abstract S0515036100011764

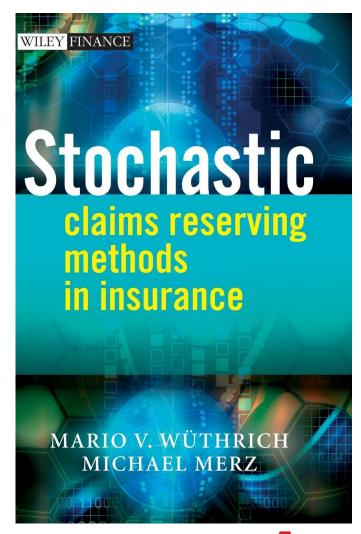
How to cite this article:

Thomas Mack (1993). Distribution-free Calculation of the Standard Error of Chain Ladder Reserve Estimates . ASTIN Bulletin, 23, pp 213-225 doi:10.2143/AST.23.2.2005092

- And related paper "Which stochastic model is underlying the chain ladder method?"
- Awarded Charles A. Hachemeister Prize by Casualty Actuarial Society,
 November 1994

Answer

- If it matters then the assumptions underlying the chain ladder are not valid!
- Mack's paper part of a huge body of literature today that has established the statistical foundation for loss reserving





...so, what was the answer?

	Evaluated After	(Months)	В	old = Actual	N	lormal = Projec	tion				
U/W Year		` 24	36	48	60	72	84	96	108		
1995	4,030	21,892	52,243	85,181	120,872	142,936	164,162	178,008	193,776		•
1996	2,994	18,311	51,346	83,248	135,015	187,369	216,122	237,076	258,076		
1997	2,283	16,450	59,934	114,194	180,824	240,627	311,140	339,613	369,694		
1998	3,231	21,536	71,076	124,930	196,480	260,883	315,941	344,853	375,399		
1999	6,133	35,513	89,621	147,993	216,893	284,930	345,063	376,641	410,002		
2000	9,480	39,393	84,313	120,651	184,618	242,530	293,715	320,593	348,990		
2001	7,996	46,883	86,260	142,776	218,473	287,005	347,576	379,383	412,987		
2002	7,293	32,736	80,996	134,064	205,142	269,492	326,367	356,233	387,787		
2003	3,031	16,240	40,180	66,506	101,766	133,689	161,903	176,719	192,372		
	,		.,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	,	,,,,,,	,,,,,,,	-, -	- ,-		
U/W Year	Evaluated After 12	(Months) 24	36	48	60	72	84	96	108		
1995	4,030	21,892	52,243	85,181	120,872	142,936	164,162	178,008	193,776		•
1996	2,994	18,311	51,346	83,248	135,015	187,369	216,122	237,076	253,777		
1997	2,283	16,450	59,934	114,194	180,824	240,627	311,140	352,769	379,373		
1998	3,231	21,536	71,076	124,930	196,480	260,883	337,071	397,793	429,092		
1999	6,133	35,513	89,621	147,993	216,893	288,697	355,745	391,793 391,986	429,092		
2000	9,480	39,393	84,313	120,651	171,736	247,629	315,418	355,375	382,222		
2000		•	86,260	147,122	205,031	247,629 262,190	•	•	302,222 404,298		
	7,996	46,883	•	•	•	•	319,641	370,578	,		
2002	7,293	32,736	75,340	130,203	185,565	228,495	283,498	311,802	345,719		
2003	3,031	25,285	86,068	135,814	205,384	259,120	286,424	310,996	330,661		
	Evaluated After	(Months)									
U/W Year	12	24	36	48	60	72	84	96	108	Mack SE	Err/SE
1995									4.200	205	14 570
1996								10 157	4,299	295	14.578
1997							24 420	-13,157	-9,679	3,178	-3.045
1998						2 767	-21,130	-52,940	-53,693	27,588	-1.946
1999					40.004	-3,767	-10,682	-15,346	-20,239	37,954	-0.533
2000				4.046	12,881	-5,099	-21,703	-34,782	-33,232	39,422	-0.843
2001			5.050	-4,346	13,442	24,815	27,935	8,806	8,689	58,870	0.148
2002			5,656	3,861	19,577	40,997	42,869	44,432	42,068	111,047	0.379
2003	ĺ	-9,046	-45,887	-69,308	-103,618	-125,431	-124,521	-134,277	-138,288	89,744	-1.541
								Total:	-200,076	197,986	-1.011
									$\overline{}$		4

...so, what was the answer?

U/W Year	Error	Mack SE	Err/SE
1995			
1996	4,299	295	14.578
1997	-9,679	3,178	-3.045
1998	-53,693	27,588	-1.946
1999	-20,239	37,954	-0.533
2000	-33,232	39,422	-0.843
2001	8,689	58,870	0.148
2002	42,068	111,047	0.379
2003	-138,288	89,744	-1.541
Total	-200,076	197,986	-1.011



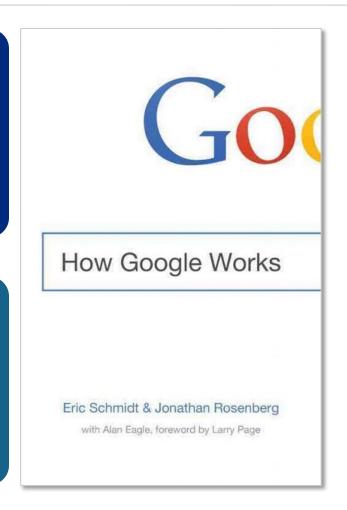
Technology, big data, & analytics are changing everything

Features of the new world

- Cheap/free data, free distribution and free duplication
- Mobil connectivity, location aware
- Cheap and scalable cloud computing

Product excellence is paramount, not

- Control of information
- Stranglehold on distribution
- Overwhelming market power
- Vested interest



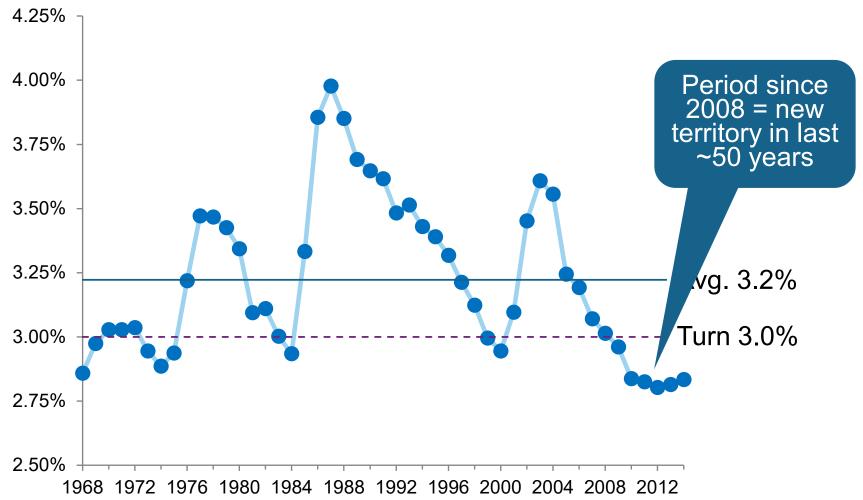
Success = "10X" a product...not 10% growth



Product excellence is paramount



US P&C insurance premium to GDP ratio enters uncharted territory

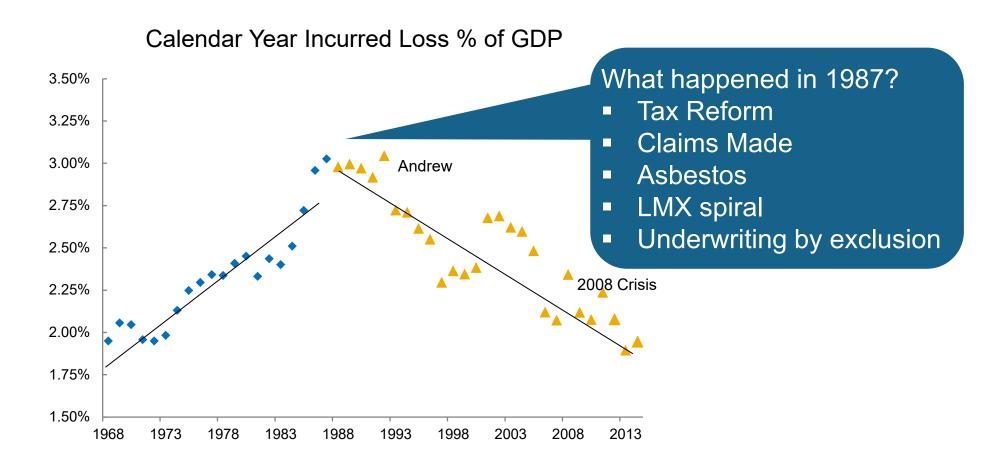


Sources: A.M. Best's Aggregates and Averages, IMF World Economic Outlook Database (www.imf.org), SNL Financial, Aon Benfield Analytics, World Bank Databank (www.worldbank.org)

US GDP based on revised July 31, 2014 methodology by US Bureau of Economic Analysis



Declining premium reflects declining loss to GDP Ratio

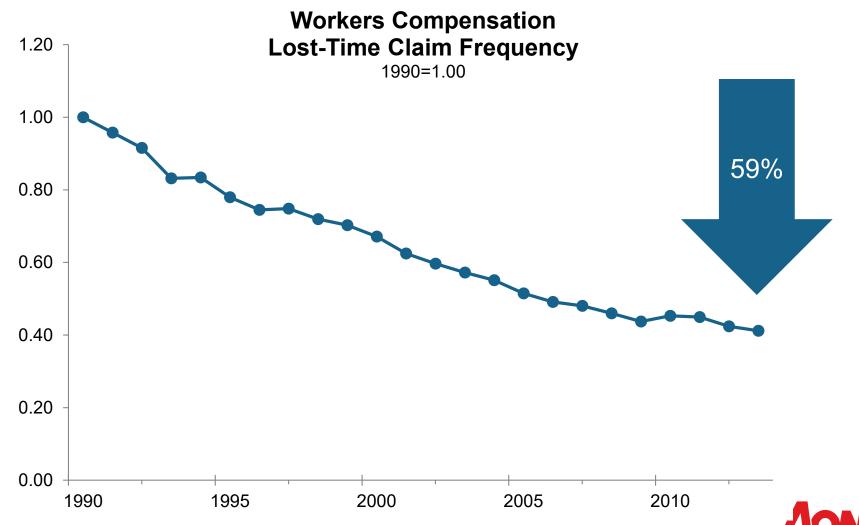


Sources: A.M. Best's Aggregates and Averages, IMF World Economic Outlook Database (www.imf.org), SNL Financial, Aon Benfield Analytics, World Bank Databank (www.worldbank.org)

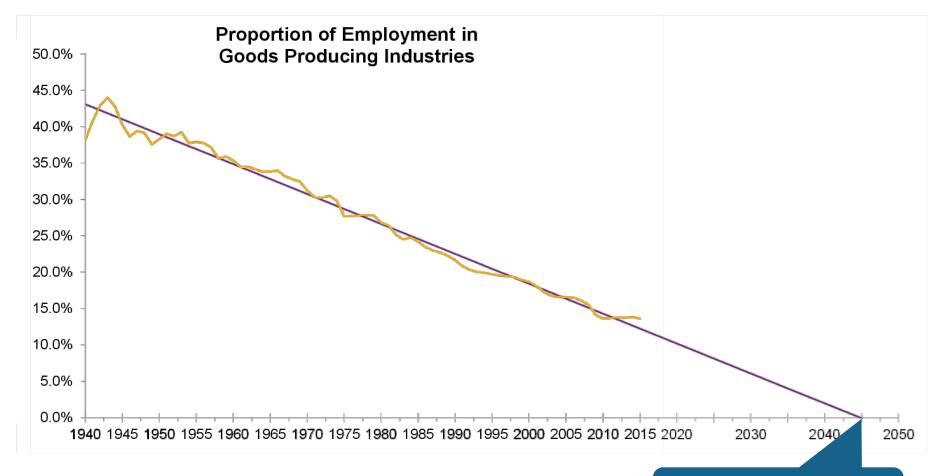
US GDP based on revised July 31, 2014 methodology by US Bureau of Economic Analysis



Workers Compensation lost time frequency down 59% since 1990



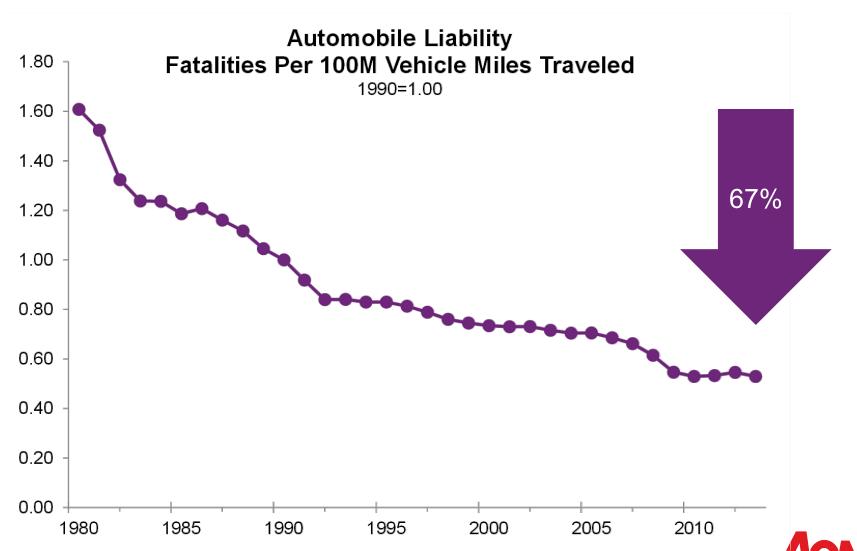
Partial driver of lower frequency: "lighter" nature of commerce...offset by growth in healthcare services



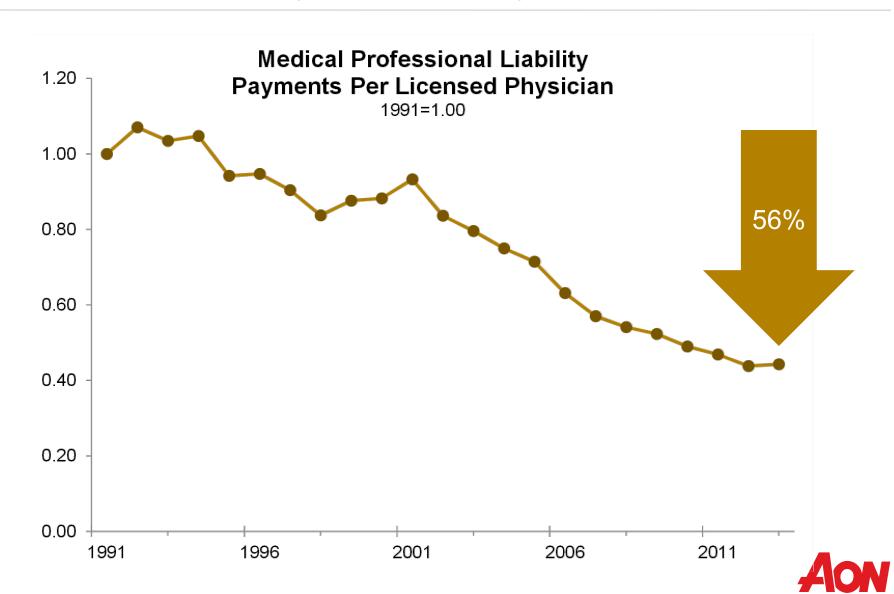
Last US manufacturing job disappears: 2045



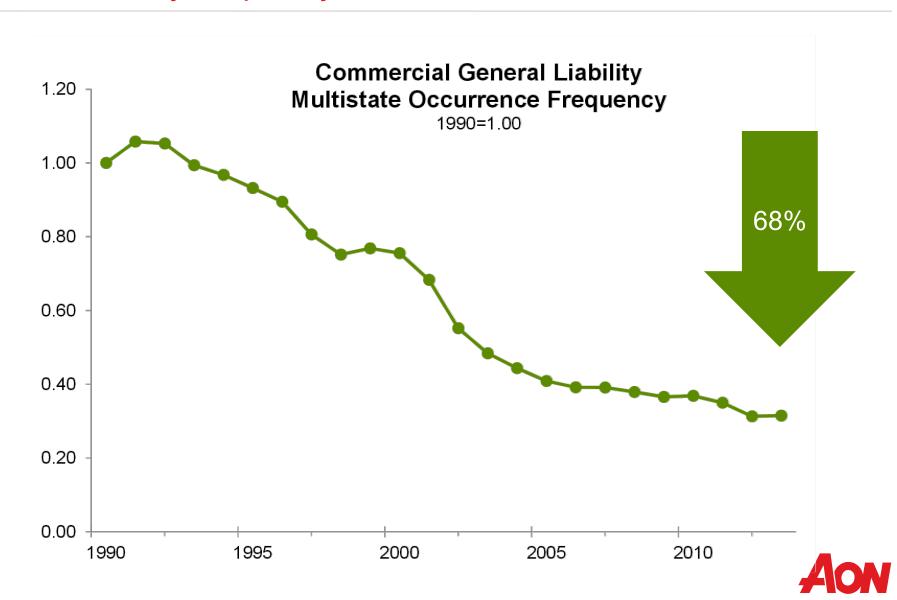
Auto severe accident frequency down 47% since 1990 and 67% since 1980



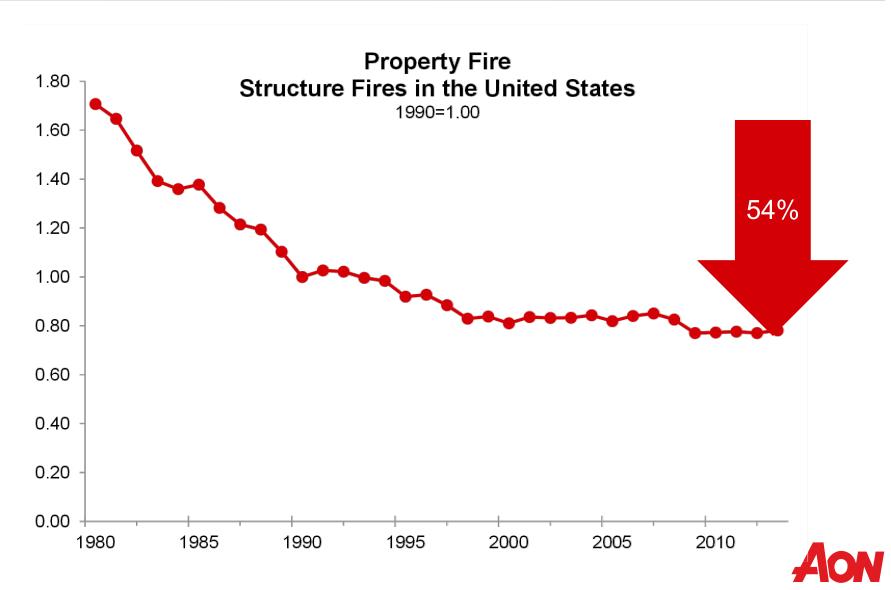
Medical Professional payment frequency down 56% since 1991



General Liability frequency down 68% since 1990



Structure fire loss frequency down 22% since 1990, and 54% since 1980

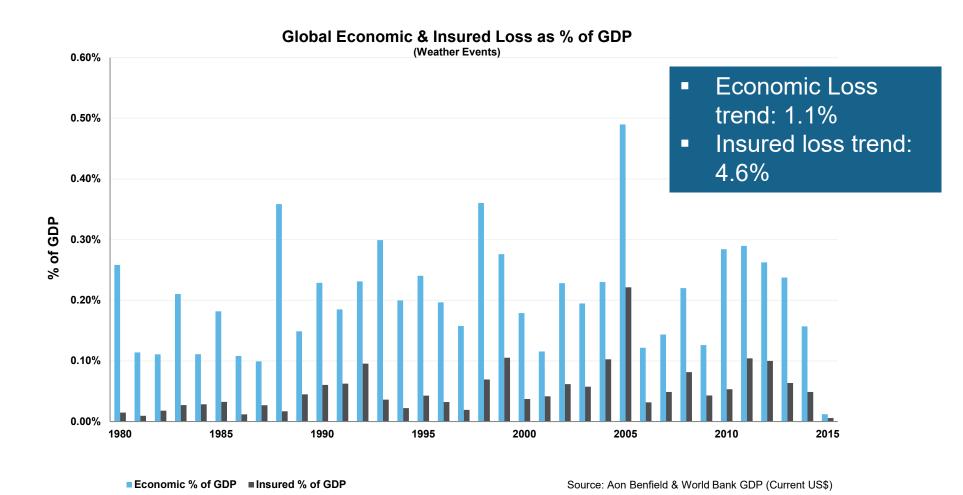




We are doing an outstanding job with loss control and risk engineering



Weather event losses relative to GDP



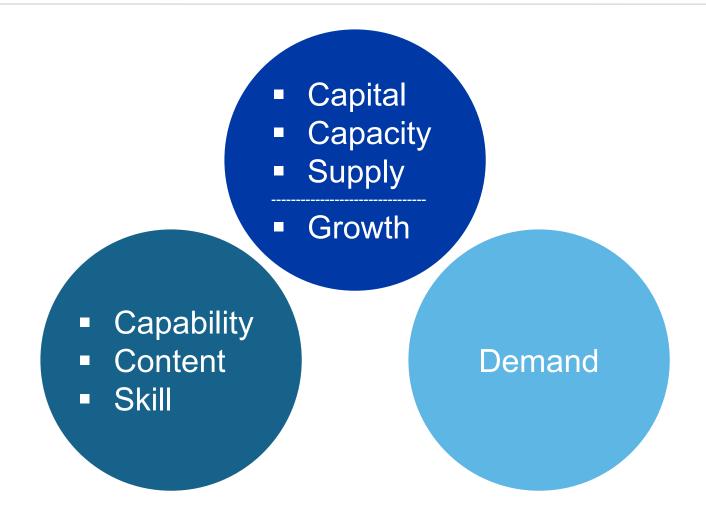




Beyond weather, what compelling new products & services should the risk management industry offer?

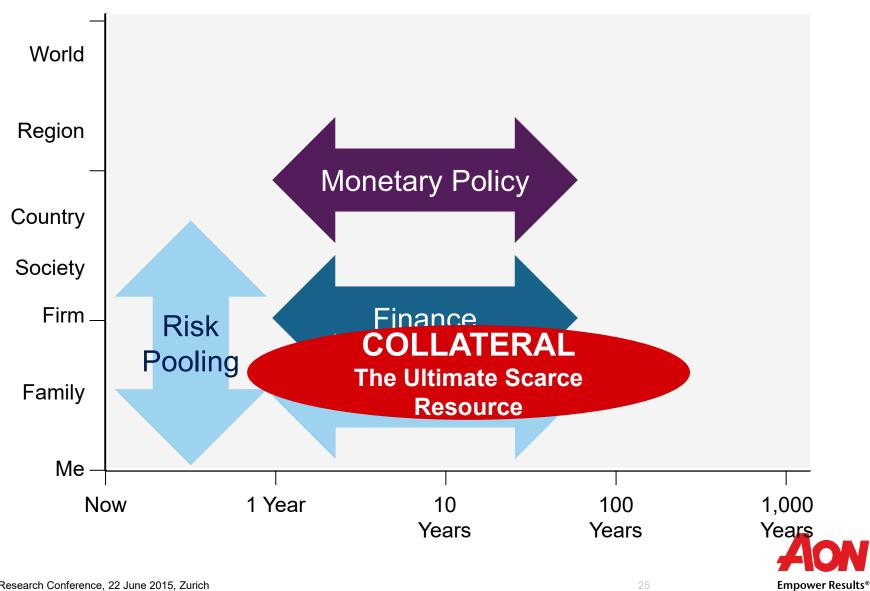


Three favorable dynamics create opportunity today

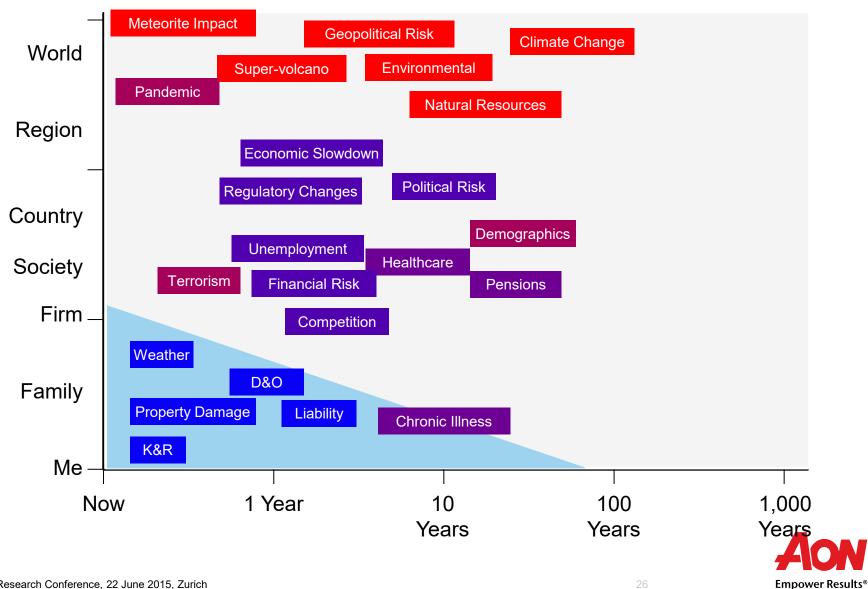




Demand: The world of risk



Demand: The world of risk



Demand: ARS 2015 global risk manager's top 53 risks

Damage to reputation/ brand	Economic slowdown/ slow recovery	Regulatory/ legislative changes	Increasing competition	Failure to attract or retain top talent	Failure to innovate/ meet customer needs	Business interruption	Third-party liability	Computer crime/ hacking/ viruses
Weather/ natural disasters	Exchange rate fluctuation	Corporate governance/ compliance burden	Political risk/ uncertainties	Distribution or supply chain failure	Technology failure/ system failure	Cash flow/ liquidity risk	Commodity price risk	Property damage
Capital availability/ credit risk	Directors & Officers personal liability	Failure of disaster recovery plan	Corporate social responsibility/ sustainability	Injury to workers	Crime/ theft/ fraud/ employee dishonesty	Loss of intellectual property/ data	Failure to implement or communicate strategy	Counter party credit risk
Globalization/ emerging markets	Aging workforce and related health issues	Acclerated change in market & geopolitics	Product recall	Workforce shortage	Lack of technology to support business needs	Inadequate succession planning	Environmental risk	Merger/ acquisition/ retructuring
Interest rate fluctuation	Outsorcing	Unethical behaviour	Natural resource scarcity	Terrorism/ sabotage	Asset value volatility	Understaffing	Pandemic risk/ health crises	Climate change
	Harassment/ discrimination	Kidnap and ransom/ extortion	Soverign debt	Pension scheme funding	Share price volatility	Joint venture failure	Absenteeism	Social media

Demand: Where are the new product opportunities?

		Insurable &	Insurable &	Unclear loss			
		Generally	Not Enough	amount or	Social or		
General Bu	ısiness Risk	Insured	Insured	loss trigger	Global Risk	Financ	ial Risk
Economic slowdown/ slow recovery	Inadequate succession planning	Third-party liability	Business interruption	Damage to reputation/ brand	Environmental risk	Commodity price risk	Pension scheme funding
Regulatory/ egislative changes	Lack of technology to support business needs	Property damage	Computer crime/ hacking/ viruses	railure of disaster ecovery plan	Acclerated change in market & geopolitics	Cash flow/ liquidity risk	Soverign debt
Increasing competition	Workforce shortage	Weather/ natural disasters	Tegnnology failure/ system failure	Corporate social responsibility/ sustainability	Aging workforce and related health issues	Exchange rate fluctuation	
Failure to attract or retain top talent	Outsorcing	Directors & Officers personal liability	Distribution or supply chain failure	Loss of intellectual property/ data	Globalization/ emerging markets	Capital availability/ credit risk	
Failure to innovate/ meet customer needs	Unethical behaviour	Injury to workers	Political risk/ uncertainties	Social media	Natural resource scarcity	Counter party credit risk	
Corporate gover- nance/ compli- ance burden	Understaffing	Crime/ theft/ fraud/ employee dishonesty	Product recall		Pandemic risk/ health crises	Interest rate fluctuation	
Failure to imp- lement or comm- unicate strategy	Joint venture failure	Kidnap and ransom/ extortion	Terrorism/ sabotage		Climate change	Asset value volatility	
Merger/ acquisition/ retructuring			Absenteeism			Share price volatility	
	-		Harassment/				

discrimination

Demand: comparative advantage rationale for business insurance

- Risk assessment and risk management
 - Lower loss cost
 - PML assessment, construction
 - Risk control: WC, auto, liability, med mal, ...
 - Building engineering
 - Monitoring: surety, credit, political risk
 - Insurance
- Non-market motivations
 - Rating agencies and regulation → Cat
 - Regulation → Mortgage credit

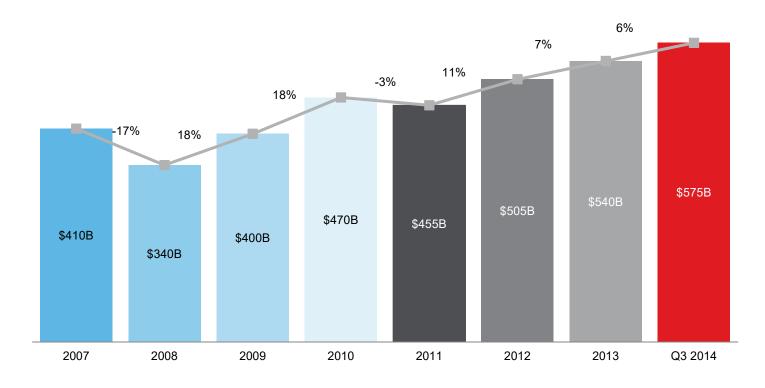
- Claims handling
 - Lower cost of LAE
 - Lower ultimate cost of indemnity
 - Insurance or reinsurance

- Risk financing
 - Lower cost of capital
 - Reinsurance





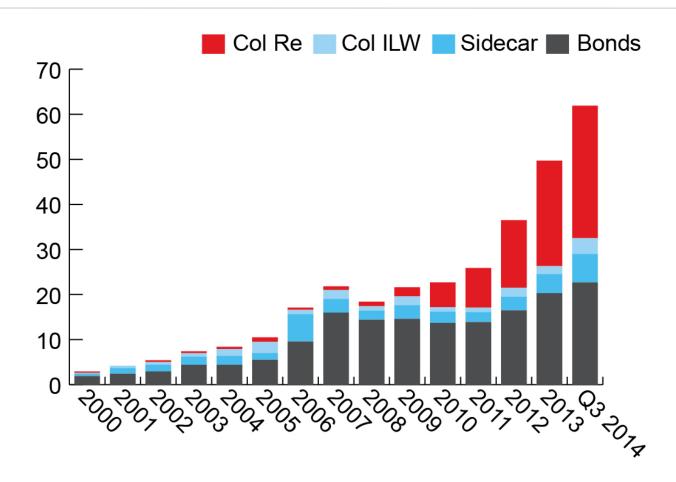
Capital: changes in global reinsurance capital



- Traditional capital growth rate: 6% p.a. in nominal terms vs. 5% GDP growth since 2007
- Capital stands at 0.74% of global GDP
- Global economic cat losses average 0.3% of GDP per year



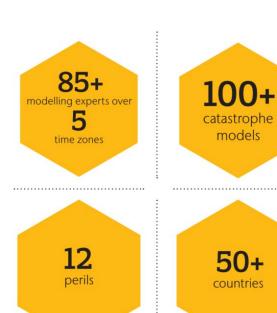
Capital: alternative capital – it's not stopping at cat



 Alternative capital growth rate: 25% p.a., on track for \$150B deployed by 2018



Cat Modeling: huge success story





models







Risk rating

information to enhance primary underwriting

Transparent

ELEMENTS

loss calculation platform

Breadth

of model coverage

Customisable

models

Catastrophe analysis

and

reporting

Natural Disaster USD900B Insured Losses*:

Natural Disaster Economic Losses*:

USD3.4T



Cyber risk is real and growing...and needs a model "currency"





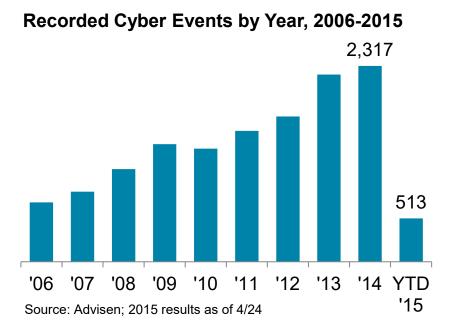








"There are two kinds of companies: those that have been hacked, and those that have been hacked but don't yet know it."



Sector	Top Cause		Second Cause		
Finance	Web app attack	27%	Denial of service	26%	
Retail	Denial of service	33%	POP intrusion	31%	
Public	Misc. error	34%	Insider misuse	24%	
Healthcare	Theft or loss	46%	Insider misuse	15%	
Education	Misc. error	20%	Web app attack	19%	

Where else to focus analytics lens?

Marketing & **Product Policy Claims** Risk development sales administration management management Customer Request/transaction Supplier Risk engineering Market research segmentation processing Management and loss prevention New product New customer **Payment** Claims investigation Behaviour monitordevelopment administration and settlement ing & risk feedback acquisition Risk assessment Anomaly detection Cross-selling Disbursements and pricing **Product** Insider threat Churn prevention Fraud detection optimization monitoring Performance Campaign Claims prevention and mitigation management management

(Low loss = Low risk transfer) ≠ Low risk management



Contact information and biography



Stephen Mildenhall
Global Chief Executive Officer of Analytics
stephen.mildenhall@aon.com
Singapore: +65 6872 7668

US: +1 312 381 5880

Stephen Mildenhall is global CEO of Analytics for Aon. He leads the Aon Center for Innovation and Analytics in Singapore, which leverages Aon's data assets to provide analytically driven solutions for clients across all of Aon's businesses.

Steve joined Aon in 2003. Prior to Aon, he held various actuarial positions at Kemper Insurance, CNA Re Facultative and CNA Personal Lines, all in Chicago. He started in the insurance industry in 1992.

Steve is a Fellow of the Casualty Actuarial Society, an Associate of the Society of Actuaries and a Member of the American Academy of Actuaries. He is a Chartered Enterprise Risk Analyst. He received his Masters and PhD degrees in Mathematics from the University of Chicago, and a BSc in Mathematics from the University of Warwick in England.

