The Actuarial Profession
making financial sense of the future

GIRO 2011 – Navigating Risk: Are actuaries at the helm?

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Capital and Excess of Loss Reinsurance Pricing

13 October 2011

Agenda

Excess of Loss Reinsurance Pricing:

1. Refresher on Methodologies
2. Survey Results
3. State of Reinsurance Market

1. Refresher on Reinsurance Pricing

- PV[Premium] = PV[Losses] + PV[Expenses] + Profit
- Return on Risk Adjusted Capital (RORAC)
  = Profit / Capital
- Managing by RORAC, capital is critical.

1. Refresher on Capital Allocation

1. Determine Overall Capital Required for UW risk
2. Allocate Capital to segment/contract
   - Theoretical, not real
   - Define granularity
   - Additivity
   - Create incentives / understand impact
   - Diversification
   - Reflect risk over time
   - Integrated into business
   - On relative “risk” of business
   - What do you care about?

1. Methodologies– Determine Overall Capital

- Variance/Std Dev Load
  - Expected Losses plus Risk Factor x (σ or Variance)
- Value at Risk (VaR)
  - Expected losses at a percentiile
- TVaR
  - Expected losses above percentile
- XTVar
  - Expected losses above percentile: distance from μ

1. Methodologies– Determine Overall Capital

Lognormal distribution
Mean 10.0
Standard Deviation 5.0

Simulated Mean = 10.1

VaR 95%: 19.4

TVaR 90%: 21.7

XTVaR <90%: 5.3>
typically at mean

Percentile	Value
88.0%	15.55
89.0%	15.95
90.0%	16.35
91.0%	16.84
92.0%	17.34
93.0%	17.96
94.0%	18.60
95.0%	19.43
96.0%	20.36
97.0%	21.74
98.0%	23.47
99.0%	26.67
99.5%	29.42
99.8%	34.53
99.9%	38.10

1. Methodologies– Allocate Overall Capital

- Variance/Std Dev
- VaR
- TVaR
- XTVar
- Myers-Read
  - Covariance, additive
- Co-measures (Ruhm – Mango – Kreps)
  - Measures relative risk contribution

1. Methodologies– Allocate Overall Capital

"RMK" (Ruhm – Mango – Kreps)
Allocate capital based on simulated amount of capital required
Example: Threshold = **20.0**

Sim #	Line 1	Line 2	Total	Impact	Cont. 1	Cont. 2	Total Cont.
1	5.6	10.2	15.8	0.0	0.0	0.0	0.0
2	8.2	9.6	17.8	0.0	0.0	0.0	0.0
3	13.6	7.4	21.0	1.0	3.6	-2.6	1.0
4	4.3	4.5	8.8	0.0	0.0	0.0	0.0
5	6.5	11.3	17.9	0.0	0.0	0.0	0.0
6	10.8	13.2	24.0	4.0	0.8	3.2	4.0
7	11.6	9.3	20.9	0.9	1.6	-0.7	0.9
8	5.4	14.9	20.2	0.2	-4.6	4.9	0.2
9	5.1	7.3	12.4	0.0	0.0	0.0	0.0
10	15.0	4.8	19.8	0.0	0.0	0.0	0.0
Average	10.0	10.0	20.0		0.14	0.48	0.61
				Allocation:	22.2%	77.8%	

This example is illustrative only, 1st 10 iterations of simulation.

1. Methodologies – Allocate Overall Capital

- Vaughn compared the allocation of fixed capital to different classes under various methodologies.

Reference:

Vaughn, Trent, “Comparison of Risk Allocation Methods –Bohra-Weist DFAIC Distributions”, CAS Forum, Casualty Actuarial Society, Winter 2007 http://www.casact.org/pubs/forum/07wforum/07w335.pdf

1. Methodologies – Allocate Overall Capital

	Capital Cost Allocations by Method					
Line of Business	Standard Deviation Load	TVaR at 99%	Risk to Reward	RMK with Capital Consumption	Variance Load	Mango Capital Consumption
Commercial Auto	4.8%	1.4%	8.0%	7.0%	0.7%	2.9%
Commercial Multi-Peril	11.5%	3.7%	20.2%	25.1%	3.2%	8.7%
Homeowners	59.4%	**84.6%**	28.6%	**8.6%**	88.9%	67.7%
Private Passenger Auto	14.5%	**8.0%**	26.2%	**40.3%**	4.8%	13.7%
Workers Compensation	9.8%	2.4%	17.0%	19.0%	2.4%	7.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Vaughn – “Comparison of Risk Allocation Methods”

1. Methodologies – Allocate Overall Capital Example

Example: Pricing of contracts using Std Dev Loading

	Inwards Loss Cost	Coef. Of Variation	20% Loading for Std Dev Pricing
HO	**10.00**	**68%**	**1.36**
PPA	**40.00**	**10%**	**0.77**
Total	**50.00**		**2.13**

1. Methodologies – Allocate Overall Capital Example

Example: Pricing of contracts using T-VaR 95% Allocation

	Inwards Loss Cost	Capital Factor VaR 99.5%	VaR 99.5% Capital Required	T-VaR 95% Allocation	Cost of Capital	15% CoC Loading for T-Var 95% Capital Allocation
HO	**10.00**	**206%**	**10.58**	**43.1%**	**15%**	**1.10**
PPA	**40.00**	**128%**	**11.05**	**56.9%**	**15%**	**1.46**
Total	**50.00**		**17.10**			**2.57**
	Diversification Benefit		*4.53*			

1. Methodologies – Allocate Overall Capital Example

Example: Comparison of the two pricing methods

	Inwards Loss Cost	20% Loading for Std Dev Pricing	15% Loading for T-Var 95% Capital Allocation	Price Loading per £ of E[losses] Std Dev Pricing	T-VaR 95% Allocation
HO	**10.00**	**1.36**	**1.10**	**13.6%**	**11.0%**
PPA	**40.00**	**0.77**	**1.46**	**1.9%**	**3.7%**
Total	**50.00**	**2.13**	**2.57**	**4.3%**	**5.1%**

2. Survey

2. Survey

At what granularity do you allocate capital?

1. Contract layer
2. Programme
3. Line of Business
4. Other
5. We don’t.

2. Survey

Which method do you use to allocate capital?

1. Standard deviation loading
2. VaR
3. TVaR
4. RMK
5. Other
6. We don’t.

2. Survey

Is market price above/below technical price?

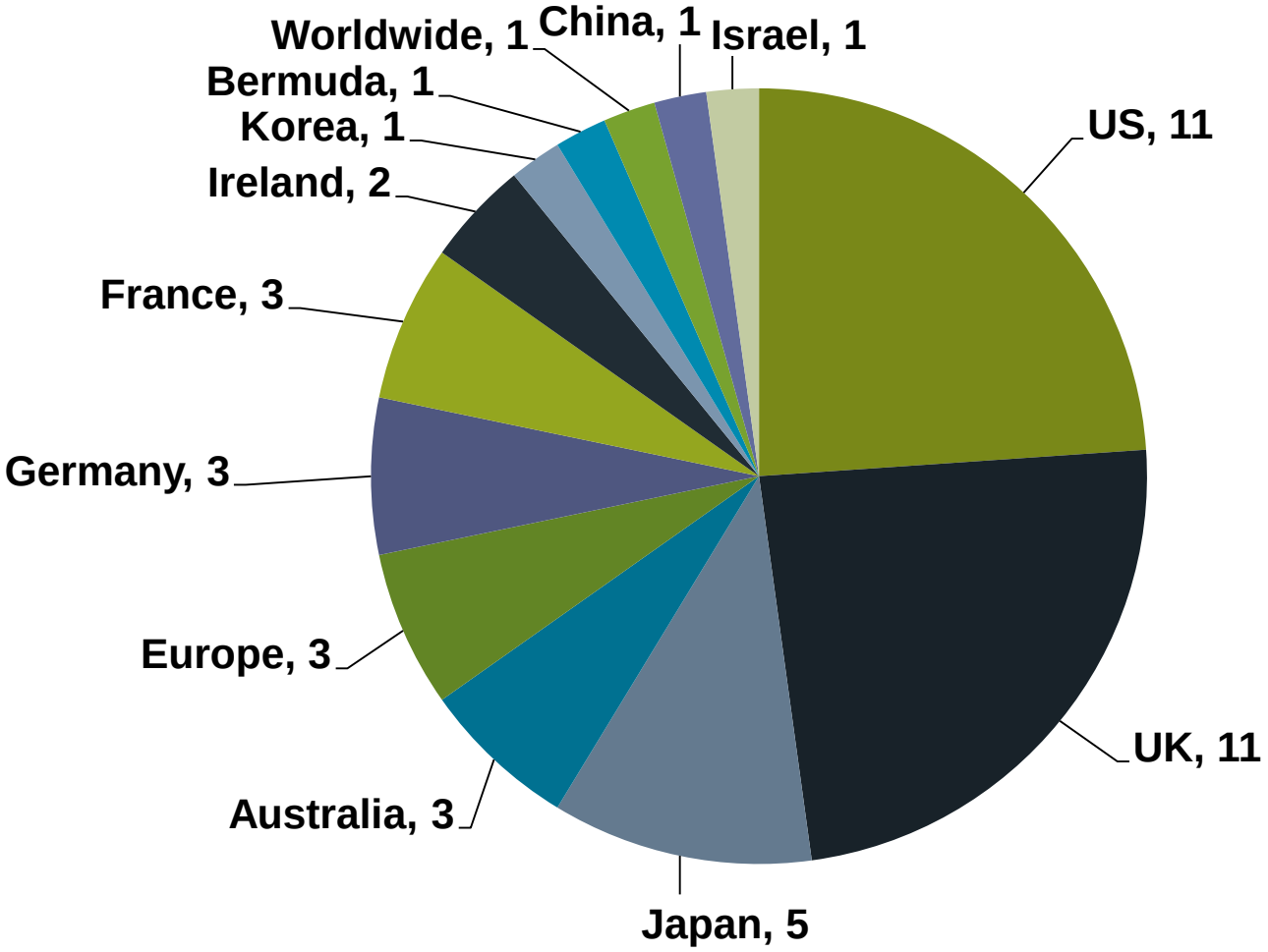
1. Market price is above technical price
2. Market price is about the same as technical
3. Market price is below technical price
4. We don’t know what the technical price is.

2. Survey Results

- Survey sent to 45 large reinsurers
- 21 reinsurers responded
- The results include 6 out of the top 10 reinsurers (GWP 2008, Wikipedia)

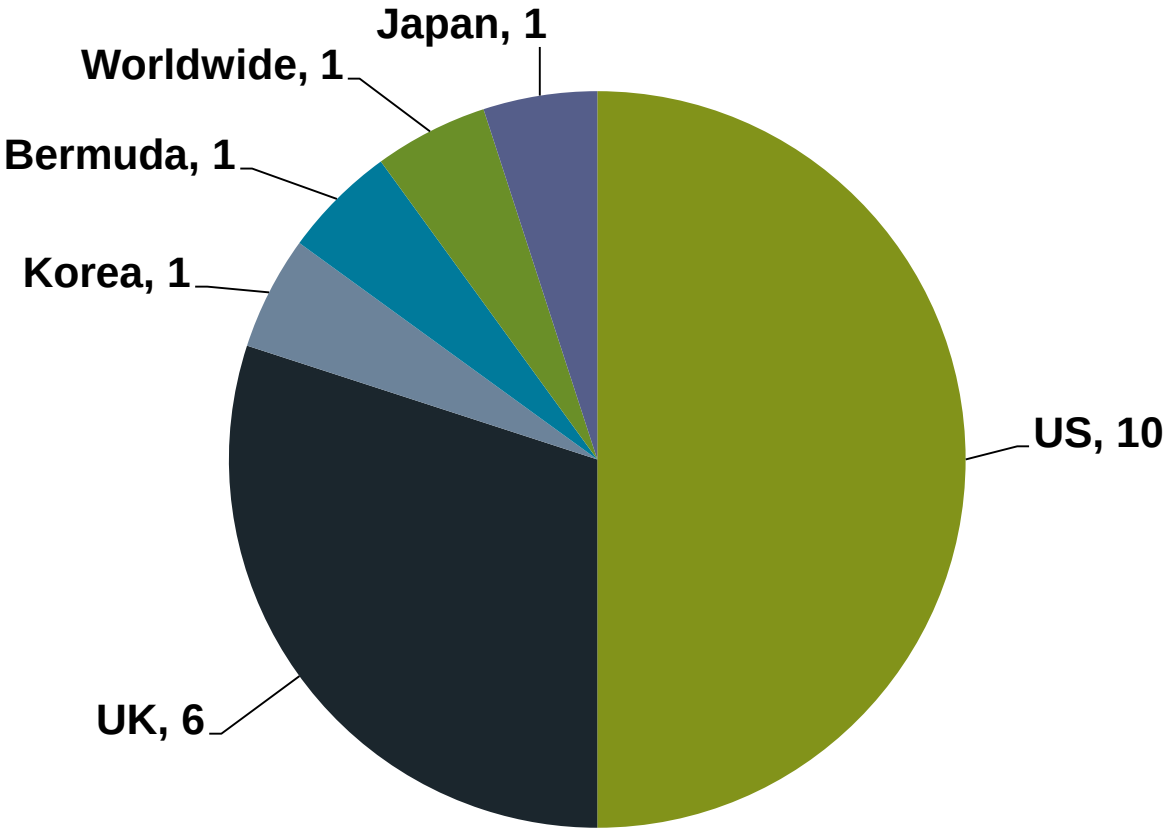
2. Survey Results

Q1: In which countries do you price the most reinsurance excess of loss reinsurance contracts (top 3 countries)?

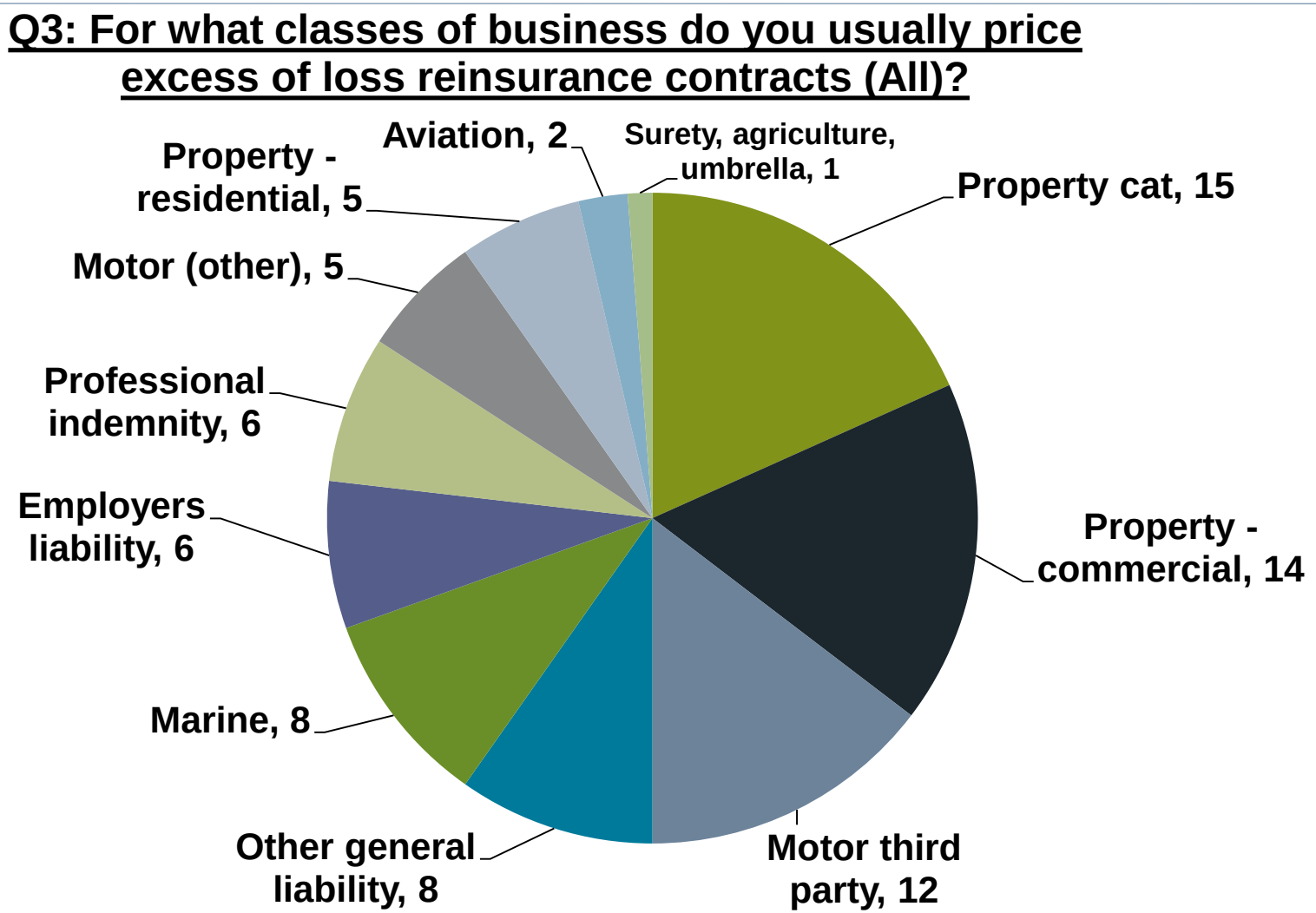


2. Survey Results

Q2: In which countries do you price the most reinsurance excess of loss reinsurance contracts (top country)?



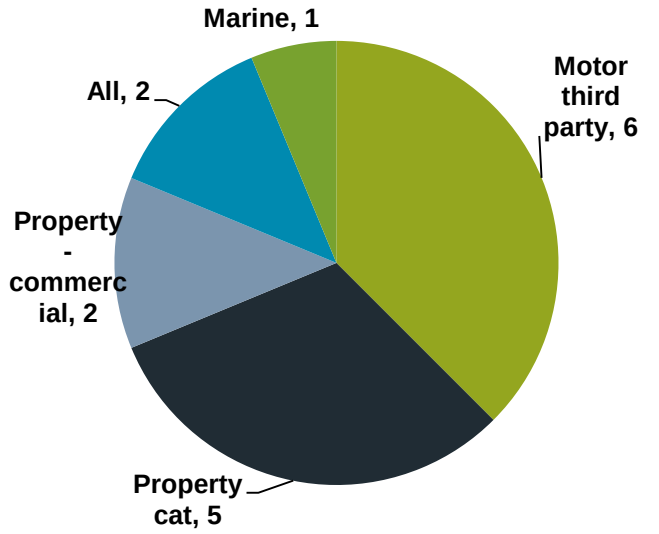
2. Survey Results



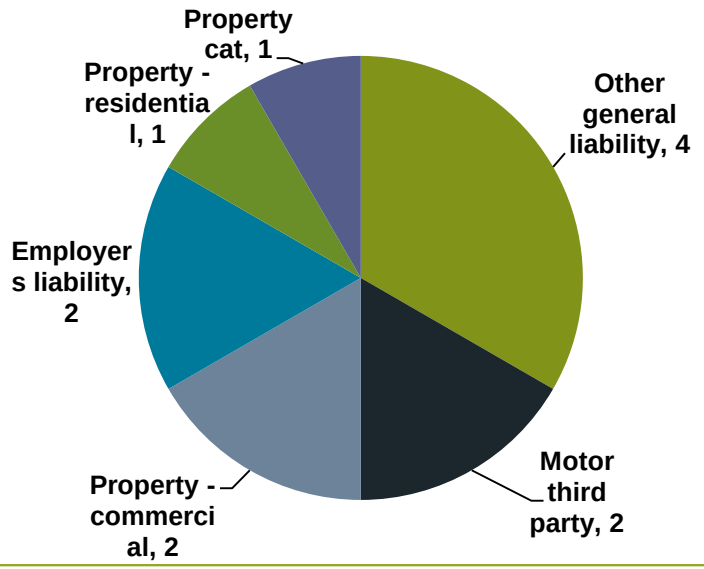
2. Survey Results

Q4: For what classes of business do you usually price excess of loss reinsurance contracts?

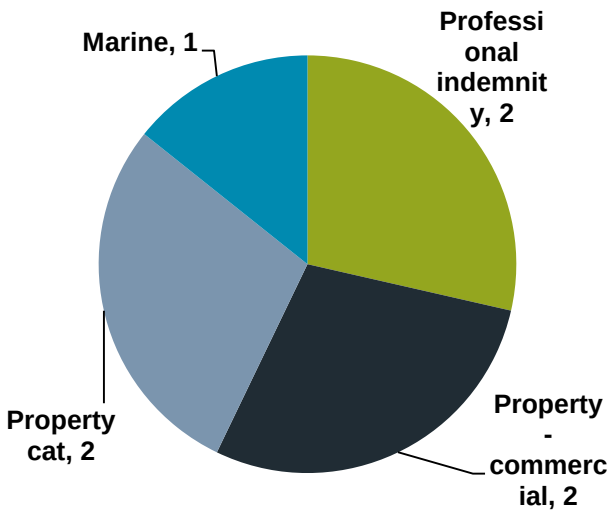
Top class



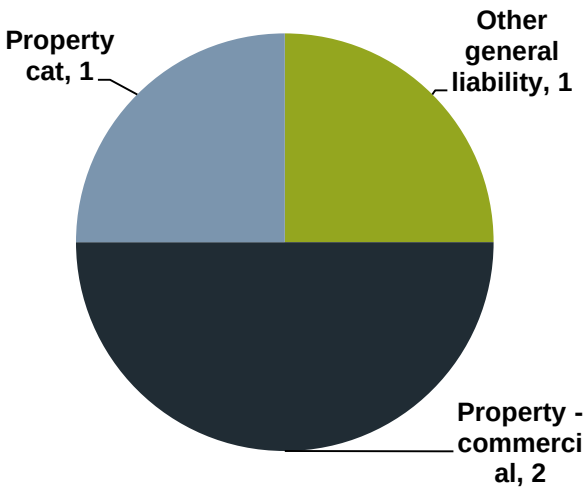
Second class



Third class

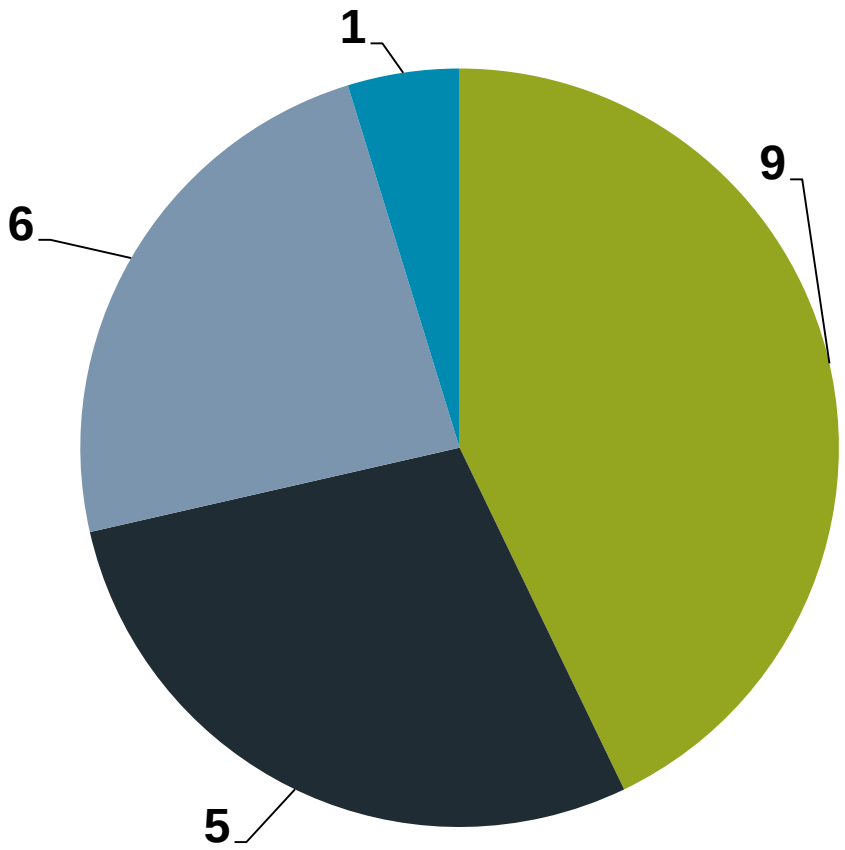


Fourth class



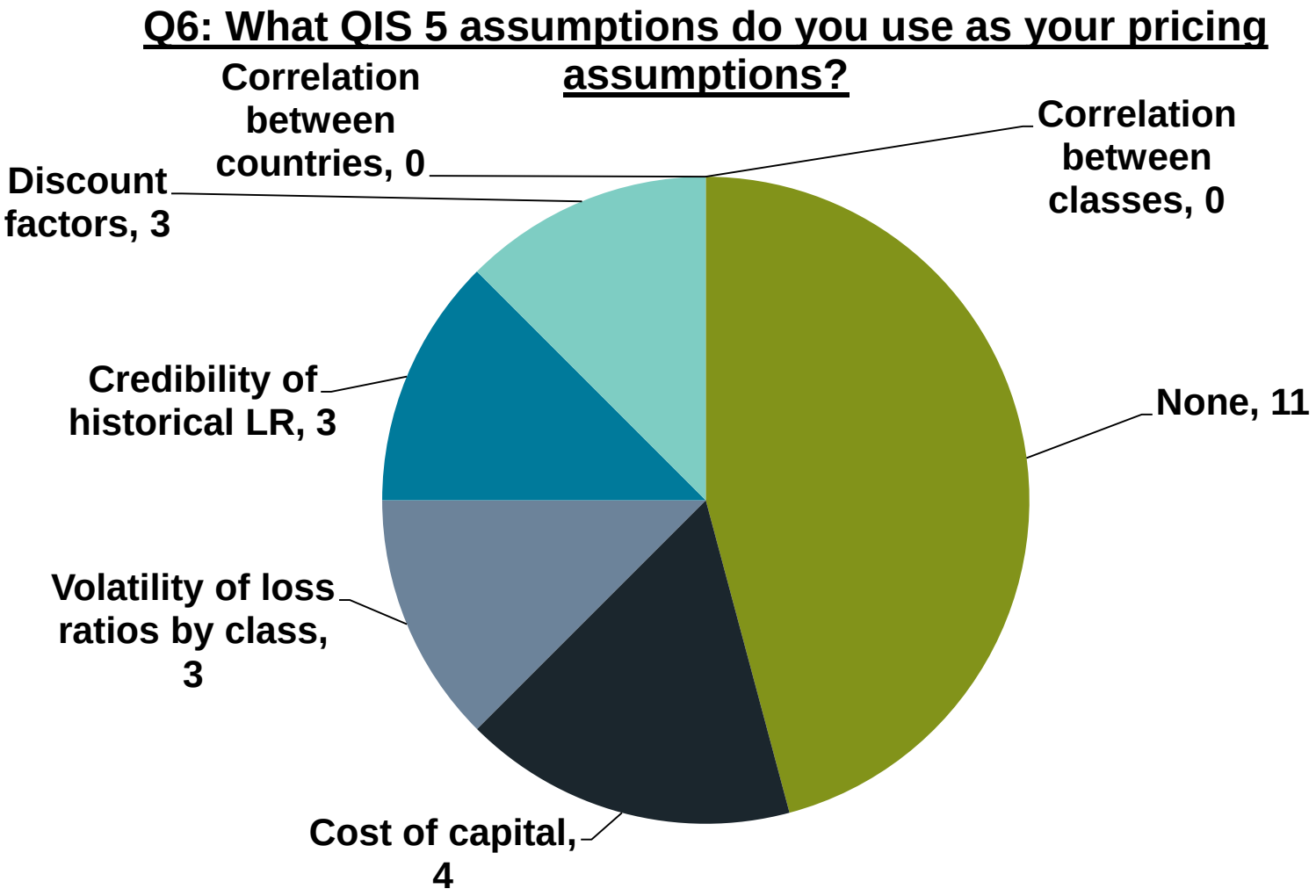
2. Survey Results

Q5: Are pricing methodologies prescribed by a pricing policy?



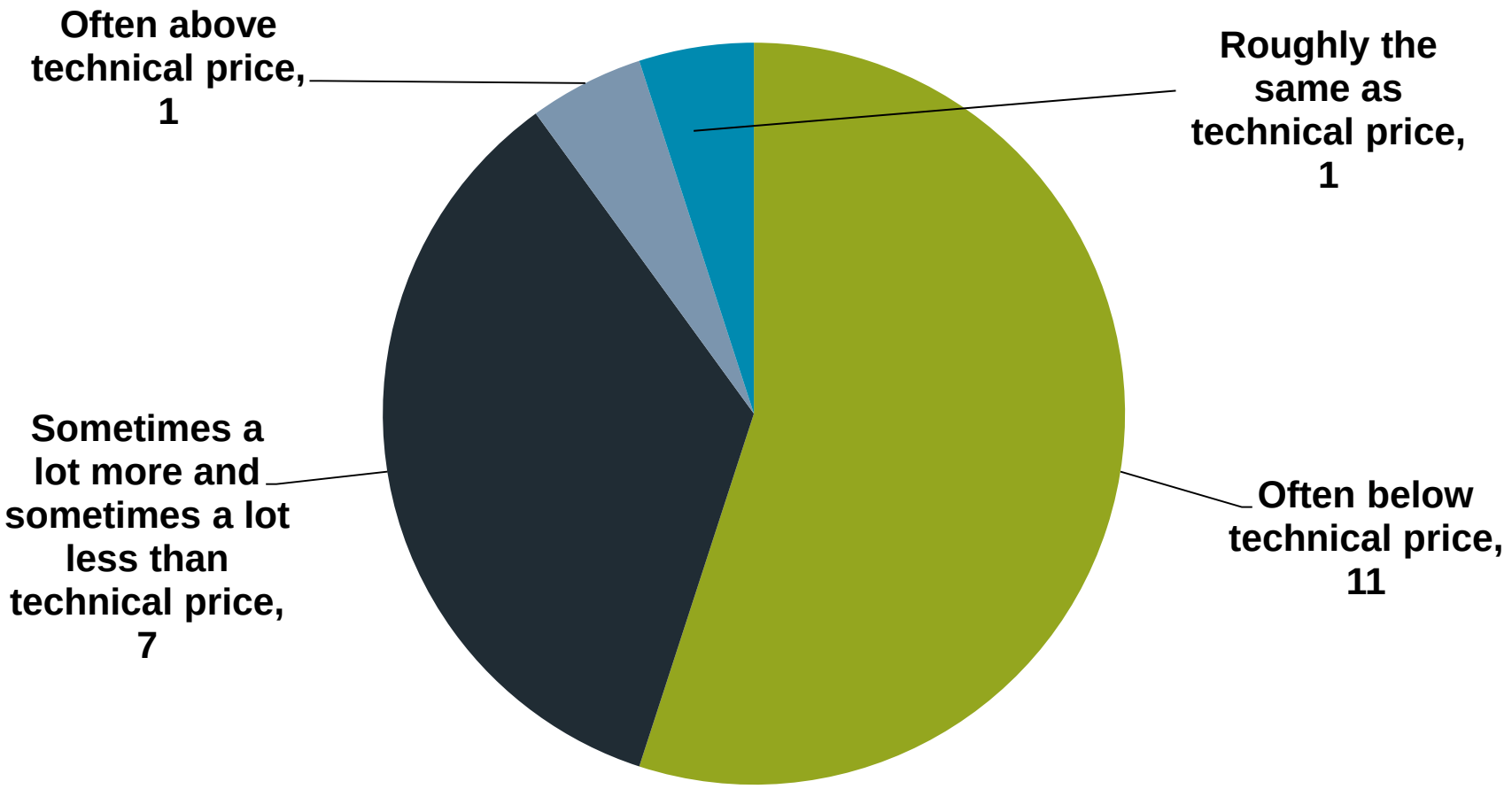
- No, it is up to the judgement of the actuary to use the most appropriate pricing methodology, in line with high-level management guidelines.
- Pricing methodologies are prescribed for some classes, and it is up to the judgement of the actuary for other classes.
- Yes, the company pricing policy sets out the pricing methodology that needs to be used by class and type of reinsurance contract.
- No reply

2. Survey Results



2. Survey Results

Q7: In your opinion, do you think that market price is

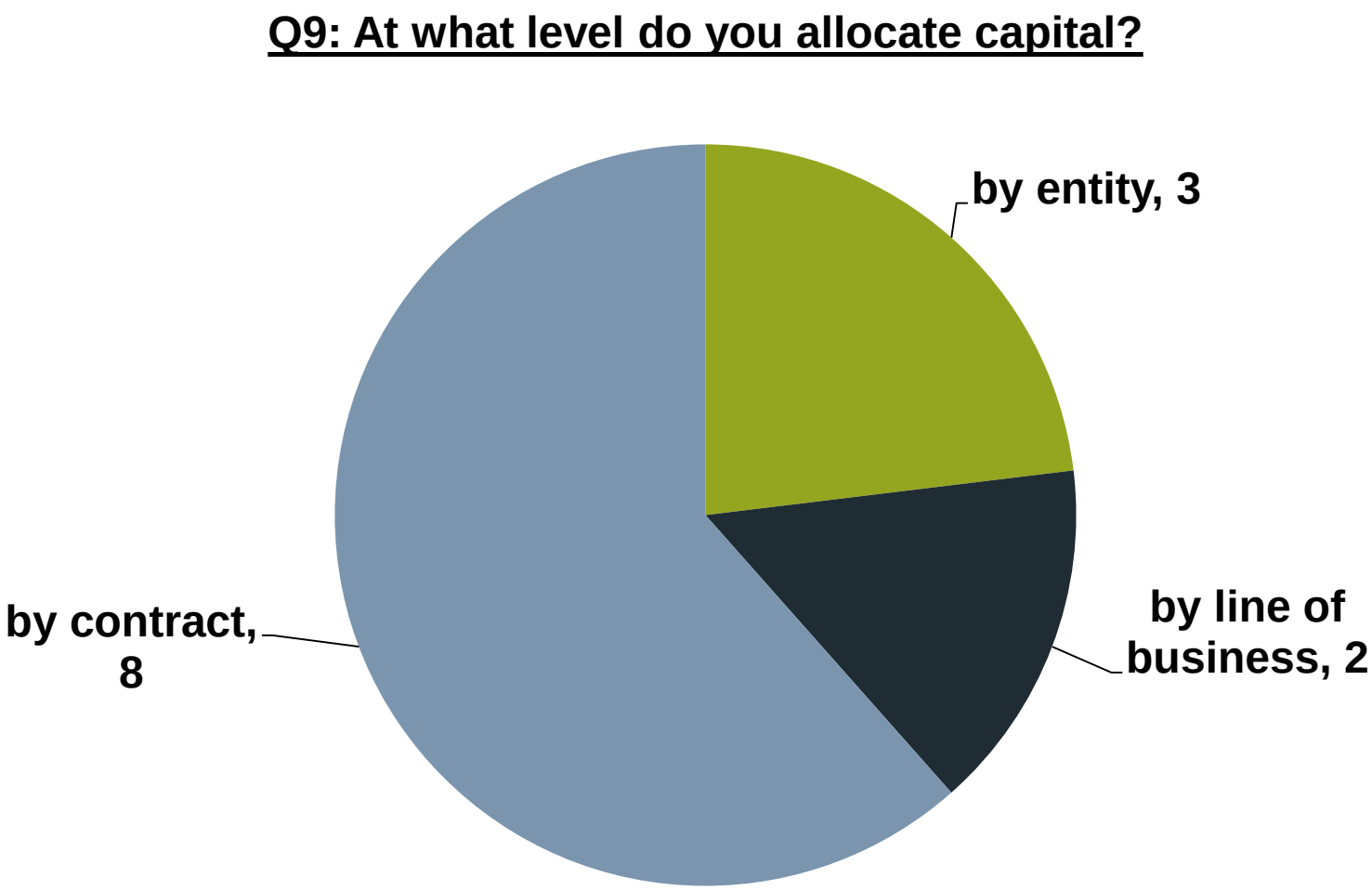


2. Survey Results

Q8: What pricing methodologies do you use to price Excess of Loss contracts?

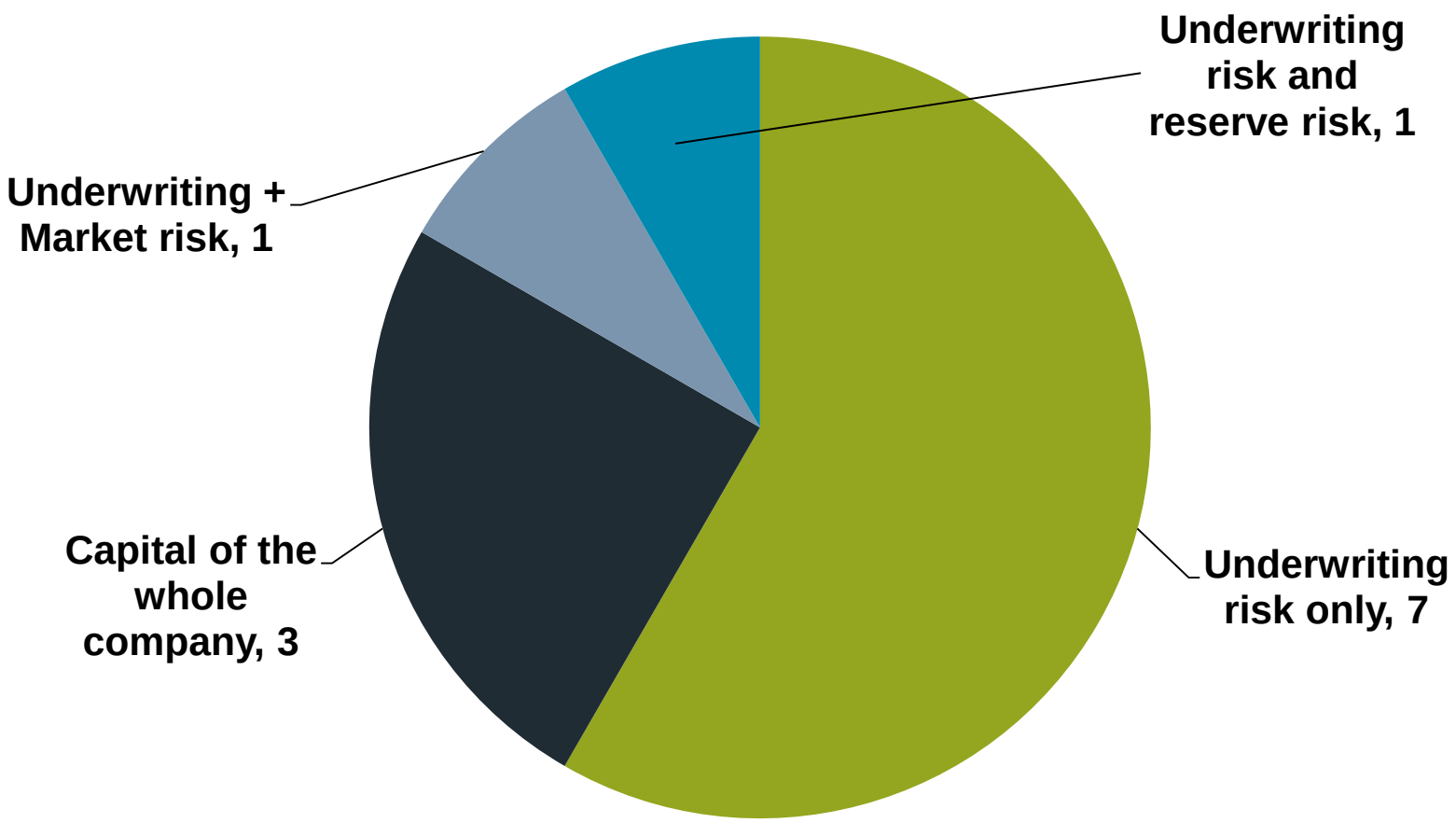
LoB	Std Dev loading	T-VaR	VaR	Internal P/L Target	Increm. Capital	Total
Property cat	6	2	-	-	-	**8**
Property - commercial	5	1	1	1	-	**8**
Motor third party	5	2	-	-	-	**7**
Other general liability	-	1	-	2	-	**3**
Marine	2	-	-	-	-	**2**
All	1	-	-	-	1	**2**
Employers liability	-	1	-	-	-	**1**
Property - residential	-	-	1	-	-	**1**
Professional indemnity	-	1	-	-	-	**1**
Total	**19**	**8**	**2**	**3**	**1**	**33**

2. Survey Results

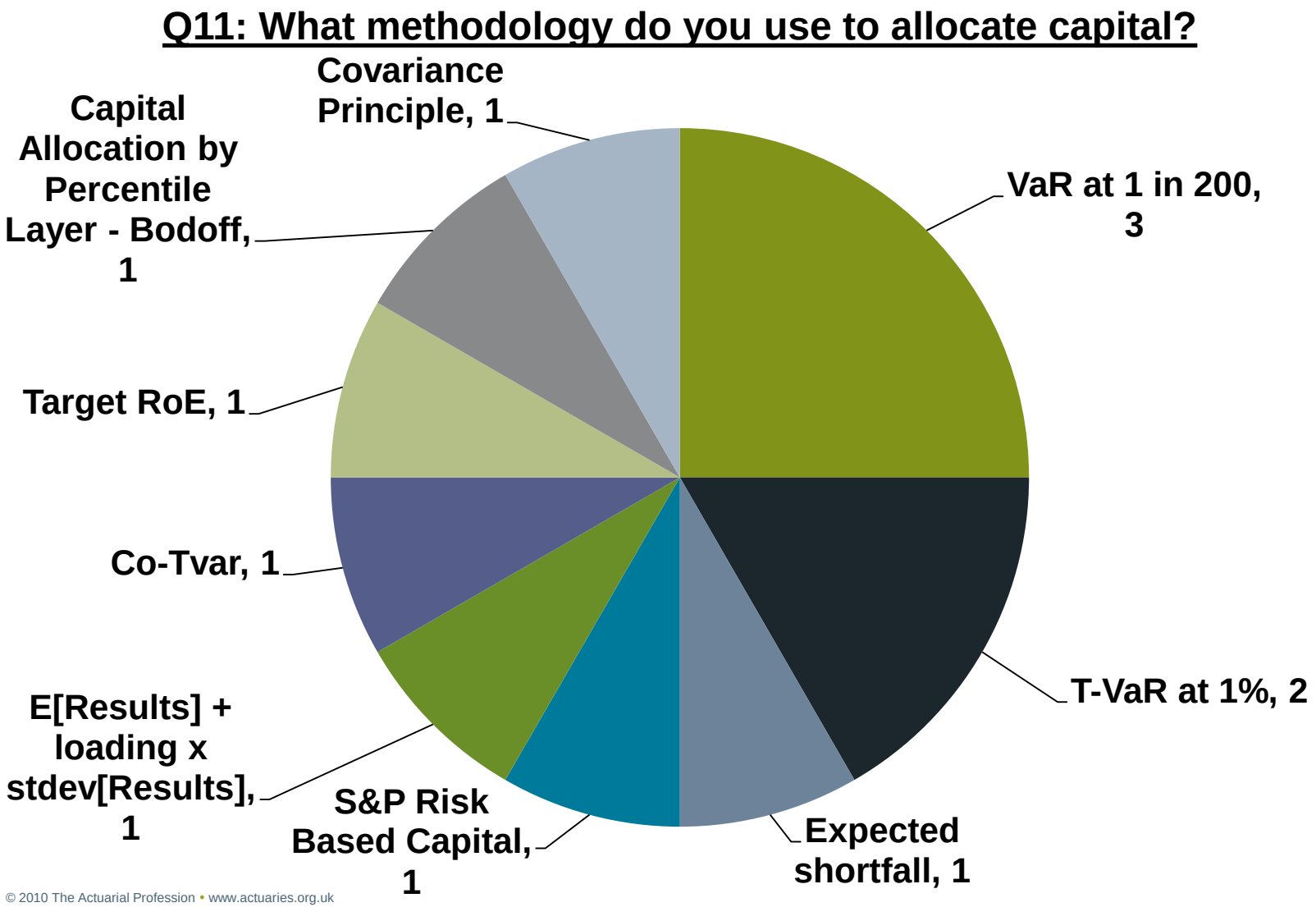


2. Survey Results

Q10: What capital do you allocate at this level?



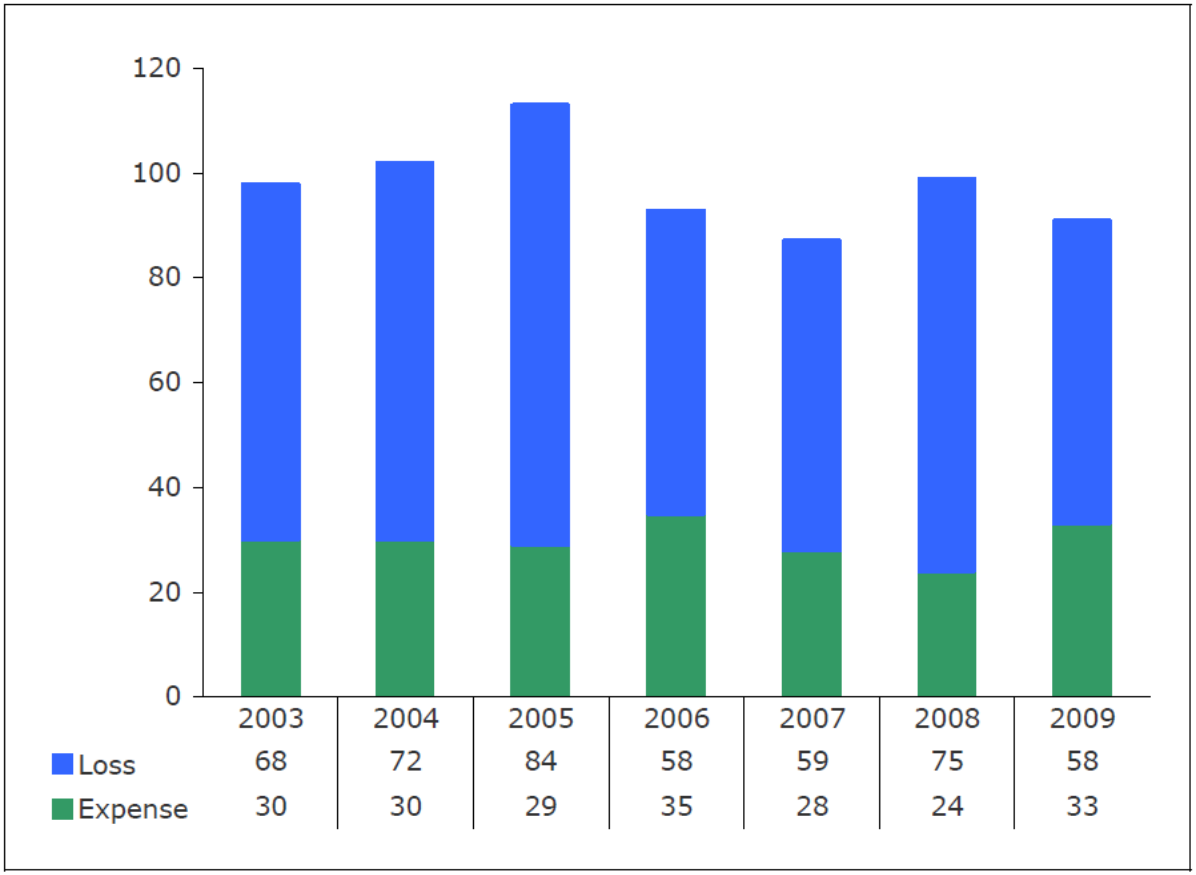
2. Survey Results



3. State of Reinsurance Market

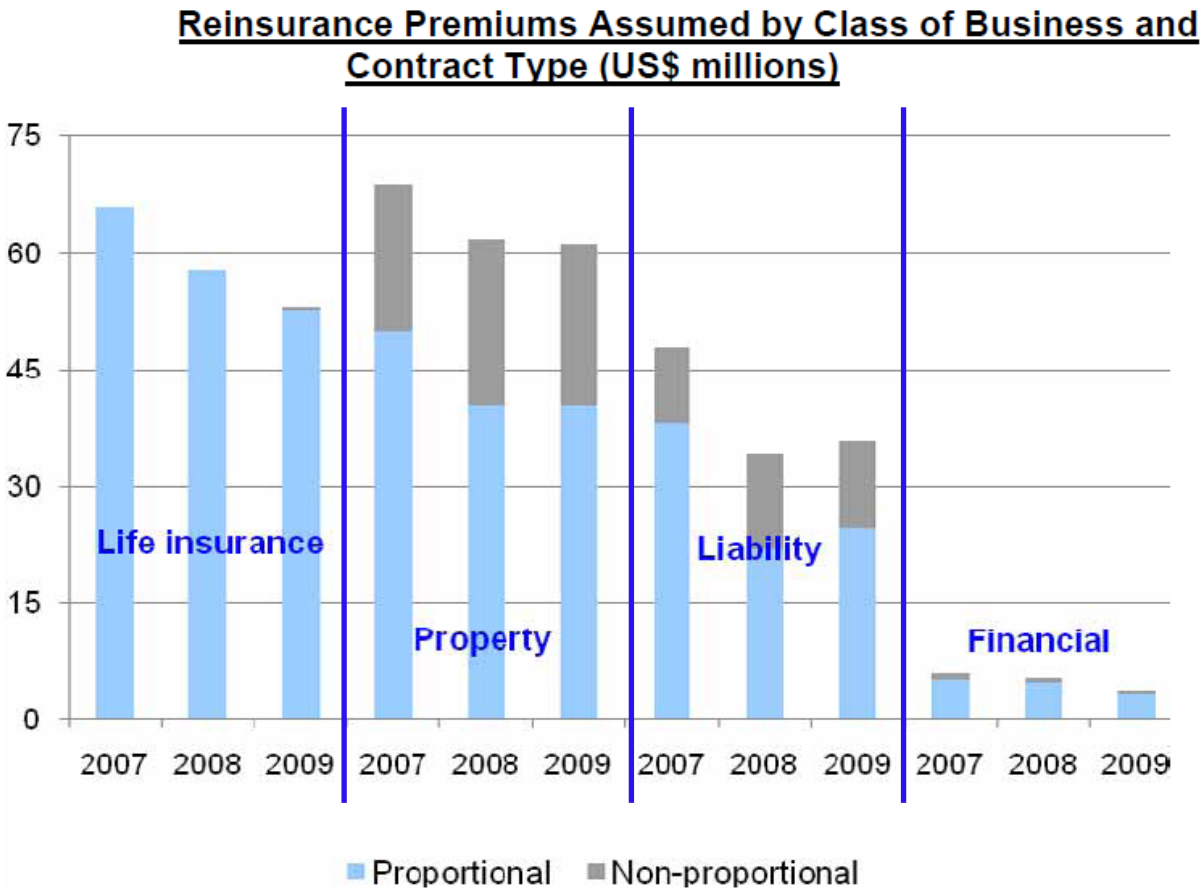
- Worldwide reinsurance profitability

Loss and Expense Ratios (2003 – 2009)



Source: IAIS

3. State of Reinsurance Market



Source: IAIS

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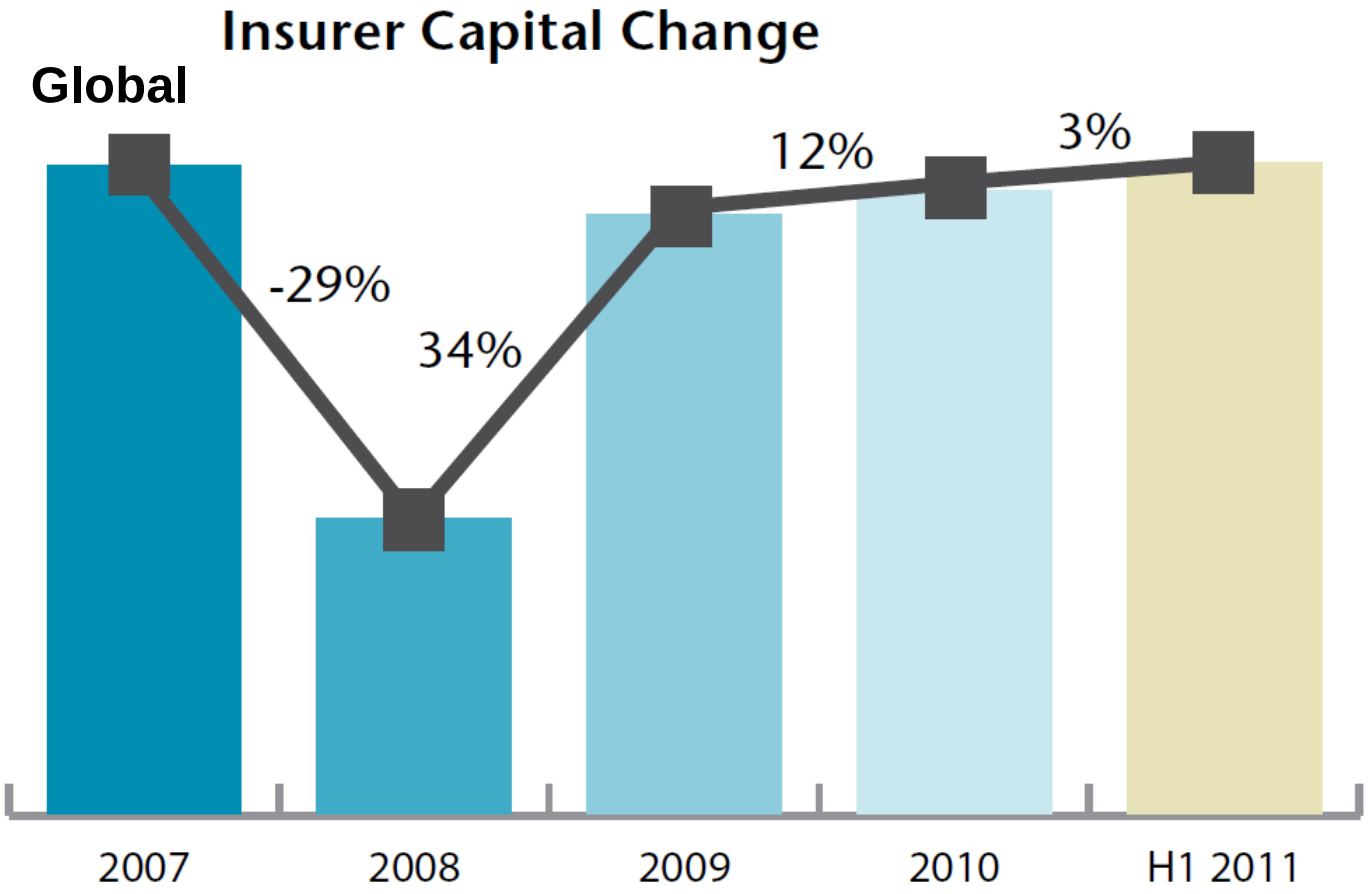
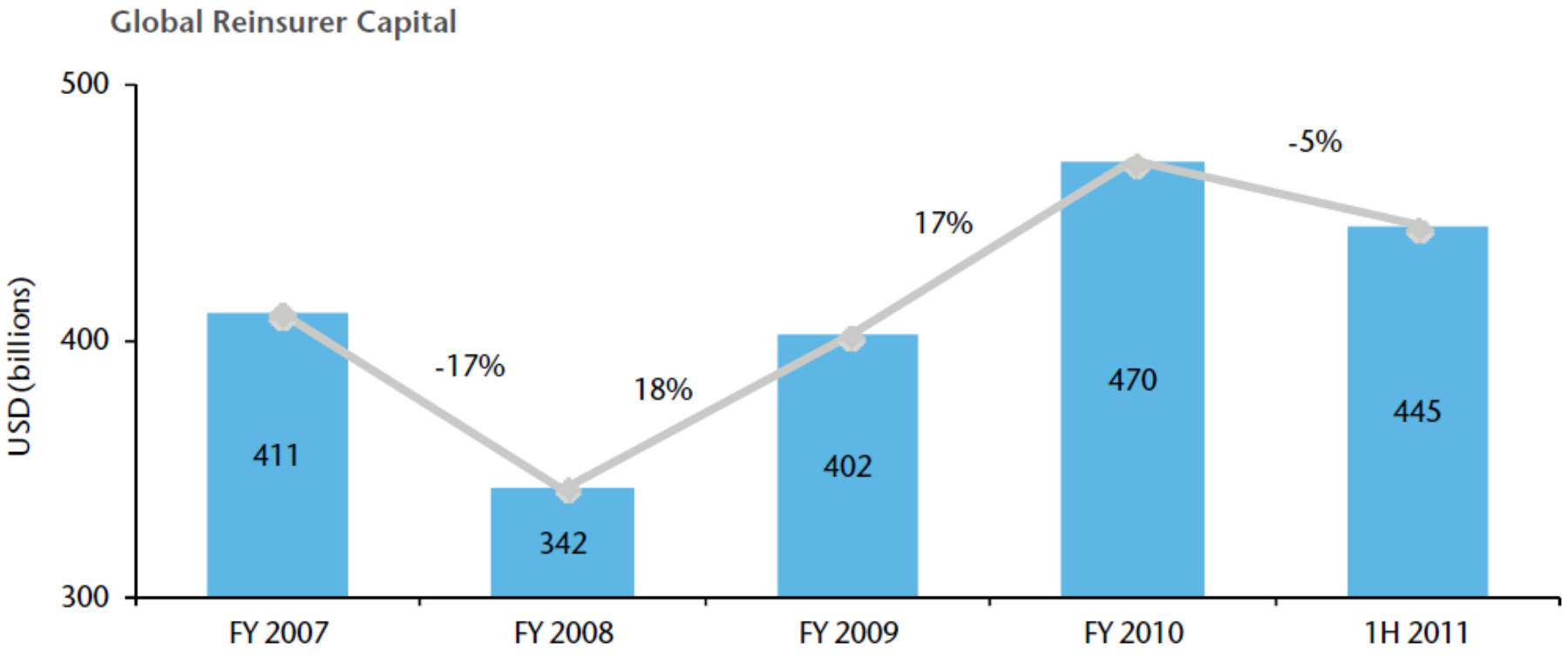


Source: Individual Company Reports, Aon Benfield Analytics

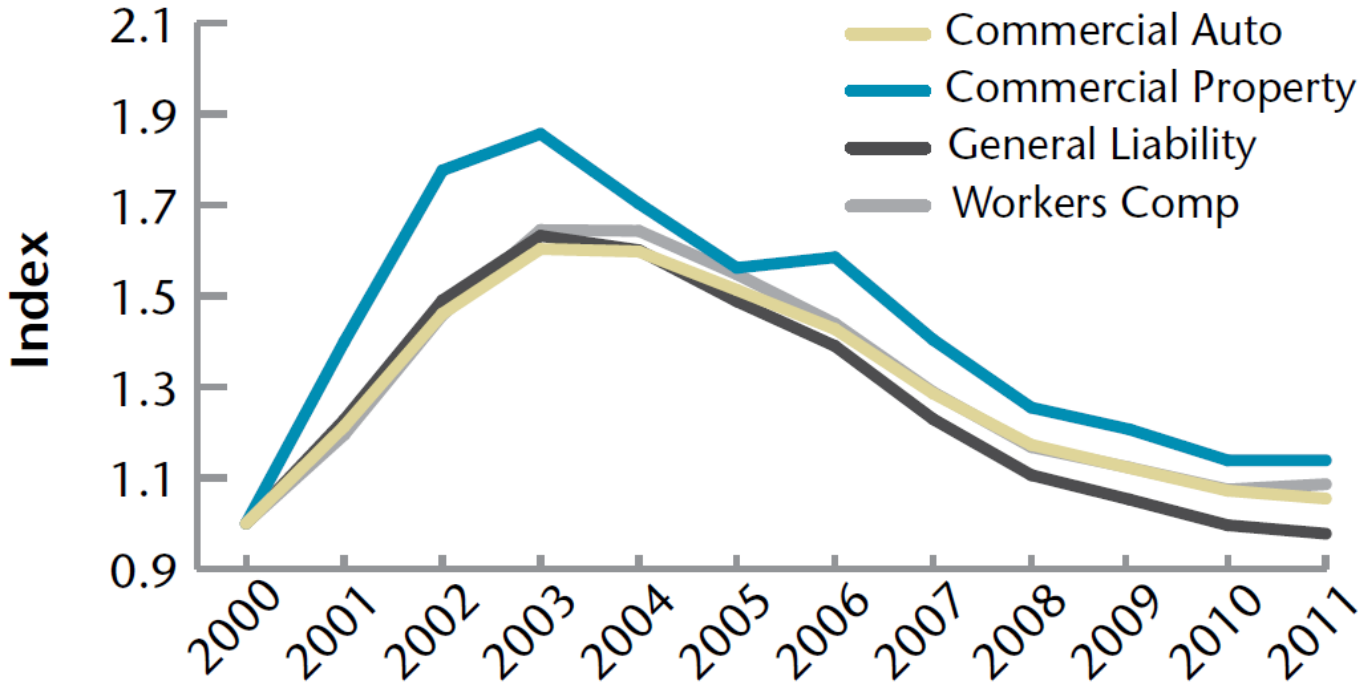
3. State of Reinsurance Market



Source: Company reports, Aon Benfield Analytics

3. State of Reinsurance Market

"Reinsurers will again have capacity in excess of demand from insurers in every region" (Aon Benfield Reinsurance Market Outlook, September 2011)

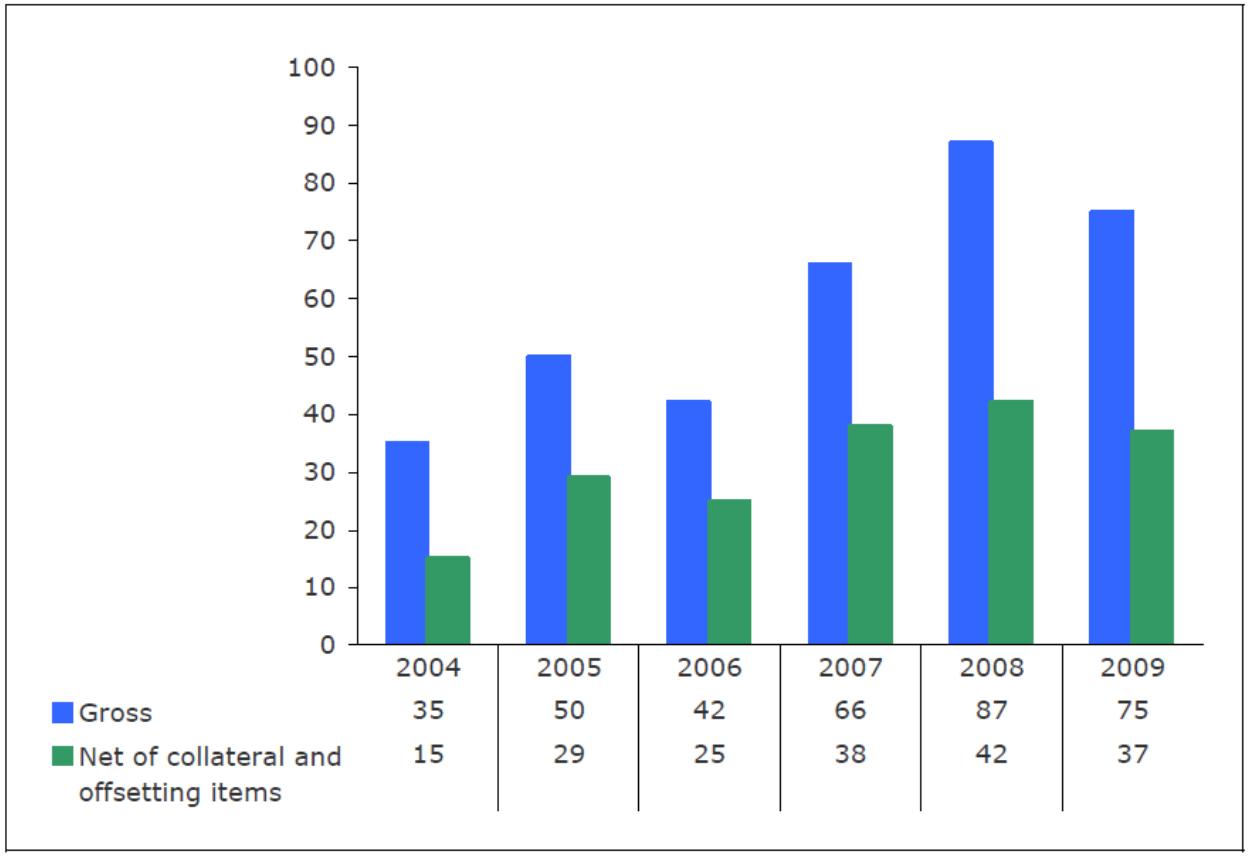


Source: Council of Insurance Agents & Brokers

3. State of Reinsurance Market

- Gearing ratio = (Expected losses on business written) / (Available Capital)

Gearing Ratios (2004 – 2009)



Source: IAIS

3. Diversity in Market Quotes - Property

- Comparison of modelled RoL (20% stdev + 15% expense loading) to market quotes
- LOB: Property
- Territory: Continental Europe

Layer	Modelled RoL	Quoted RoL		Relative to Modelled	
		RI 1	RI 2	RI 1	RI 2
Layer 1	60.98%	80.00%	93.50%	31.2%	53.3%
Layer 2	11.50%	14.35%	10.85%	24.8%	-5.7%
Layer 3	1.72%	2.24%	3.50%	30.2%	103.5%

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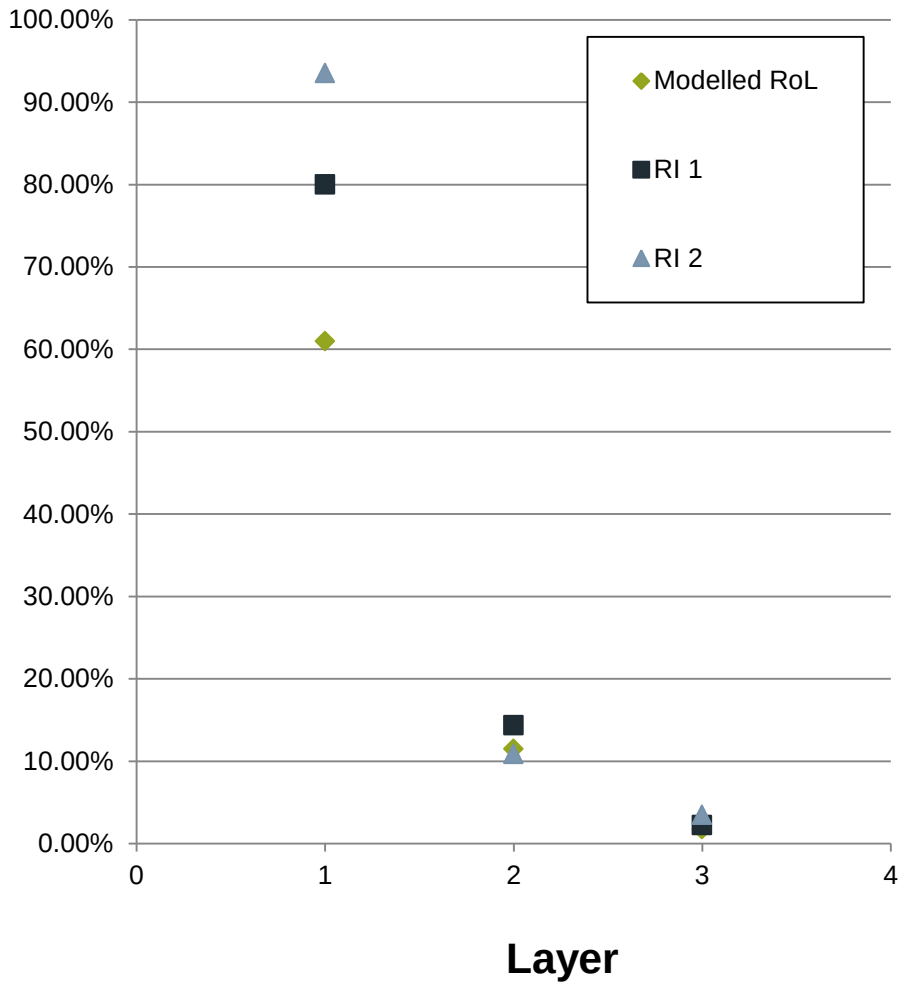

3. Diversity in Market Quotes - MTPL

- Comparison of modelled Rate (25% stdev + 15% expense loading) to market quotes
- LOB: MTPL
- Territory: Continental Europe

		Quoted Rate					Relative to Modelled				
	Modelled Rate	RI 1	RI 2	RI 3	RI 4	RI 5	RI 1	RI 2	RI 3	RI 4	RI 5
Layer 1	0.156%	0.130%	0.103%	0.110%	0.050%		-17%	-34%	-29%	-68%	
Layer 2	0.077%	0.170%	0.121%	0.190%	0.160%	0.110%	121%	58%	147%	108%	43%
Layer 3	0.004%	0.090%	0.053%	0.110%	0.050%	0.065%	2166%	1235%	2670%	1159%	1537%

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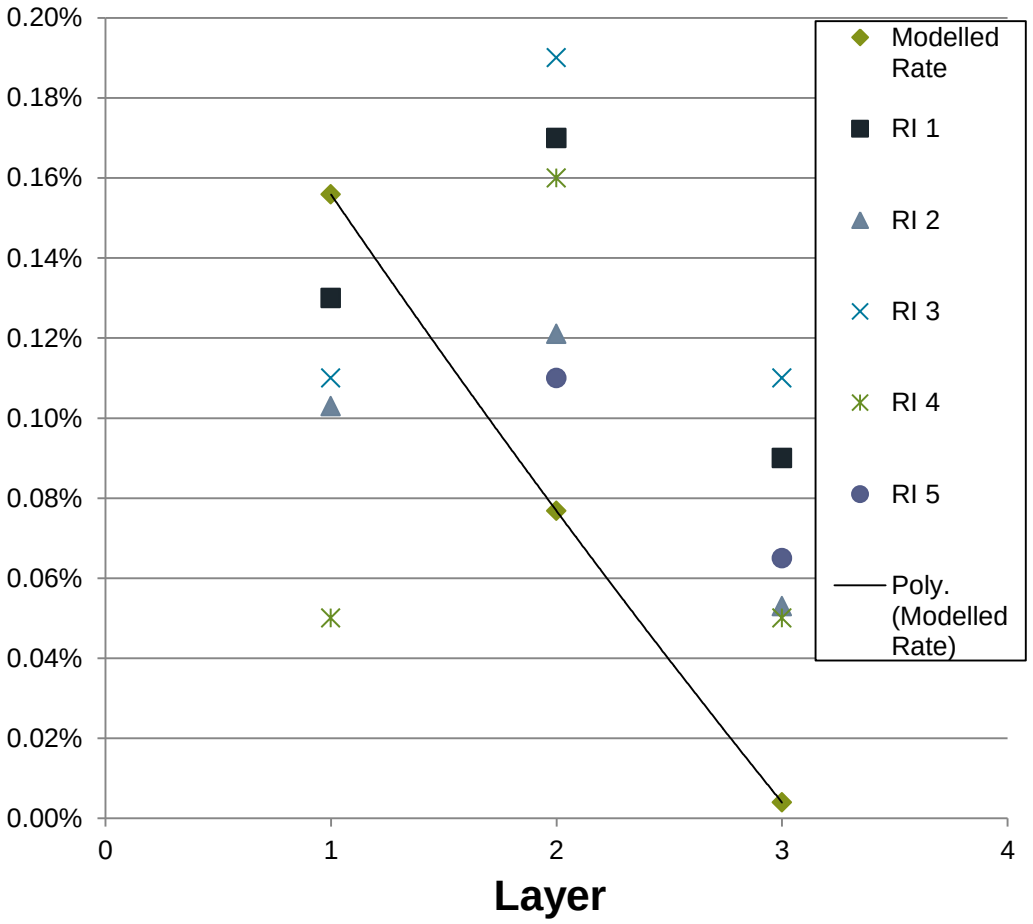

3. State of Reinsurance Market

Solvency II

- Solvency II captures diversification
- Reinsurers are more diversified by LoB and geographical area
- Demand for reinsurance is likely to increase

Summary

- What are you worried about?
- Capital allocation is a key factor in reinsurance pricing
- Survey says: Disconnect between pricing & capital allocation
- Availability of capital very strong
- Demand for reinsurance likely to increase.

Questions or comments?

Expressions of individual views by members of The Actuarial Profession and its staff are encouraged.

The views expressed in this presentation are those of the presenter.