Institute and Faculty of Actuaries

GIRO40

BIG things come in small packages:

Actuaries of Smaller Insurers Working Party

Agenda

- Working party origins
- Mission and objectives
- Themes from paper
- Pros and cons
- In summary
- A common problem
- Helpful methods (expanded in appendices)
  - Large claims modelling for small firms
  - Claims reserving using 'R'
- Considerations about the job
- Tips and how to make the most of it
- Next steps

Working party origins

- The opportunities and hazards of being a lone actuary
  - Paper produced in 2008
  - Professionalism implications of working alone
  - Other areas covered included
    - Advantages and disadvantages
    - Communication
    - Managing expectations
- Increasing number of professionals working alone as actuaries move further in to general insurance space
  - Companies recognising advantages
  - Legislative requirements

Mission and objectives

- You are not alone!
  - Offer some support and guidance to those already in small functions or working independently
  - To give those considering working in smaller teams the confidence to do so
  - Provide a basic toolkit of methodologies
- Outcomes
  - GIRO paper 2013
    - A users guide to small teams
  - Community
    - Website
    - Regular seminars

- *The views expressed are those of the presenters and not their employers*

Topics covered in WP paper

- Managing expectations
  - Baptism of fire
  - Deviation from job description
  - Jack of all trades
- Building and managing teams
  - Recruitment
  - Structures
  - What if your boss is not an actuary?
- Decision making and innovation
  - Toolkit
  - Mitigating the downside

Topics covered in WP paper

- Data
  - Lack of it
  - Data management
  - Warehouses and systems
  - Quality
- Training
  - Legislation
  - CPD
  - Solvency 2

Topics covered in WP paper

- Professionalism issues
  - Conflicts of interest
  - Proportionality
  - Regulatory attention
- Other
  - Managing use of consultancies
  - Independent peer review

Common themes

- Roles are challenging but rewarding
- More variety than working for larger companies
- Potential to innovate, set your own agenda and for some serious CV enhancement
- Visibility and expectation are both high
- There is always too much to do and it can feel lonely
- You're unlikely to have any handover
- The job is likely to deviate from the initial job description - you'll be expected to contribute to areas where you're not an expert and stick your neck out
- Recruitment can be challenging, particularly at the junior level
- You may have to fight for a training budget and actuarial study
- Independent peer review / validation is a consistent problem area
- Data is often less well organised and you'll often have less of it

Pros and cons

- Advantages
  - Respect of your peers and colleagues
  - Immediate recognition (and reward)
  - Broad range of challenges
  - Less bureaucracy
  - Hands-on work is satisfying and helps you to understand the business
- Disadvantages
  - Visibility and expectations will be high
  - Often required to give an opinion with little or no peer review
  - Resources are scarce
  - Hands-on work can time be consuming and repetitive
  - Lack of 'joined up' thinking and processes

A common problem

- You have been working on your own for over a year and are regularly using consultants to assist with actuarial work. There is a medium term initiative for bringing all actuarial services in house. You have sign off to hire a mid level actuarial student. What type of skills would you go for?
  - Reserving/pricing/capital, complimentary?
  - Experience levels – technical, IT, etc?
  - Good/slow exam progress?
  - High flyer or plodder – university, FIFoA?

Large claims modelling for small insurers

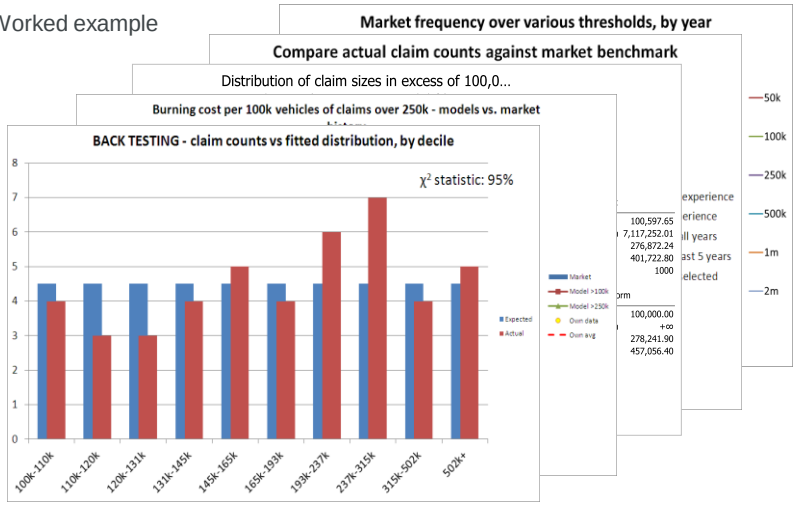
- Methodology included in WP toolkit
- Situation
  - We want to determine a large claim frequency and claim size distribution for e.g. 2013
- Uses
  - Large claim loadings in pricing
  - Initial expected ultimate for reserving
  - Simulating large claim occurrence in capital model and RI analyses
  - Answer questions like “what are the chances of a €5m claim in 2013?”
- Problem
  - We have a small portfolio, and we’ve only ever had two claims over €1m – this isn’t enough to parameterise a large claims model
  - We think two €1m claims is better than the market average; but is this a fluke or is there something about our portfolio that makes it less large-claims-y?

Large claims modelling for small insurers

- Analysis process
  - Collect market large claim data
  - Build a model for the market as a whole
  - Compare your history against market; assess whether your experience is better / worse
  - Rescale market model for your risk profile
  - Fit claim size distribution
  - Validate (sense checks, back testing, etc.)

Large claims modelling for small insurers

- Worked example

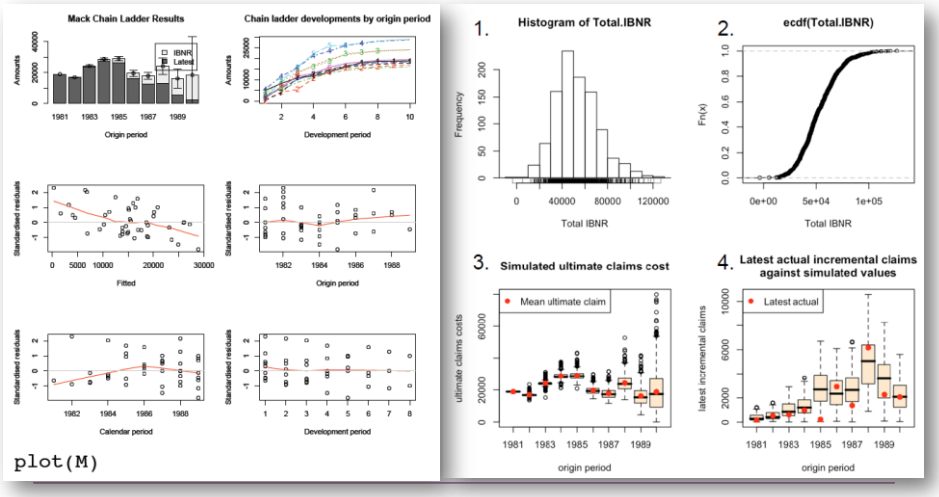


Claims reserving using 'R'

- Methodology included in WP toolkit
- R provides a good foundation for very detailed analysis and management information
  - Large number of resources available
  - Active and broad development community – help quick and easy to get.
  - NO financial commitment
- Simple two step process
  - Prepare data in suitable format to import into R
  - Run pre-programmed modules to produce claims reserving analysis

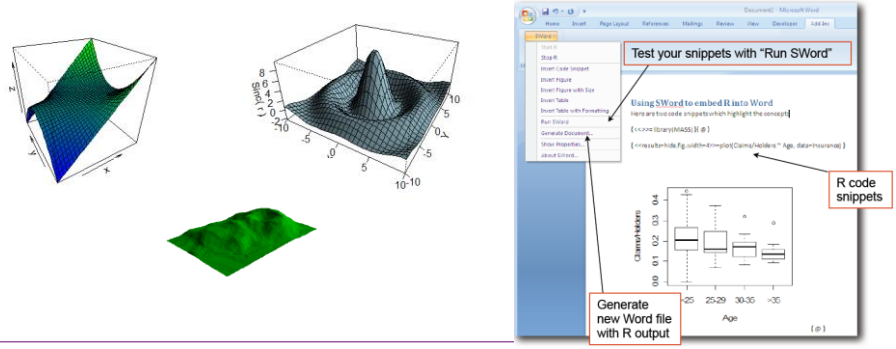
Claims reserving using 'R'

- Graphical and detailed analysis



Claims reserving using 'R'

- Detailed and Automated Management Information
  - R simple to combine with MS Office (Power Point, Word) to create regular reports.
  - Process can be significantly automated using Macro functions and VBA.
  - Option to use powerful R graphing tools (**`image`**,**`plot`**,**`persp`**) or export data for graphical analysis into Excel or other Graphing tool.



Considerations about the job

- Agree terms of reference carefully
- Think about areas of the business you would like to be involved in; if you prove yourself then opportunities are likely to emerge
- Discuss how your personal appetite for innovation and change fits with the company culture
- Know about the company's approach to decision making
- Find out about the company's relationship with the regulator
- Do your homework about data modelling
- Set expectations about how much effort you will need to spend getting data models in place

Tips and how to make the most of it

- Be open minded about where you can add value
- Look at the baptism of fire as an opportunity to establish yourself
- Know that the role will develop over time
- Be brutally organised, in your personal organisation, and in how the function is structured
- Focus on activities that make a difference and add value; avoid the temptation to tackle familiar issues first
- Maximise the resources available to you, particularly the intellectual assets of colleagues (even PAs)
- Use guidance and regulation as often as you can to reinforce your views

Next steps

- Lists of data sources
- Toolkit (some samples in the appendices)
- Xmas drinks
- http://www.linkedin.com/groups/Actuaries-Smaller-Insurers-5078519/
- **Leave us your contact details!!**

Appendix 1 - Large claims modelling

- Methodology included in WP toolkit
- Situation
  - We want to determine a large claim frequency and claim size distribution for e.g. 2013
- Uses
  - Large claim loadings in pricing
  - Initial expected ultimate for reserving
  - Simulating large claim occurrence in capital model and RI analyses
  - Answer questions like “what are the chances of a €5m claim in 2013?”
- Problem
  - We have a small portfolio, and we’ve only ever had two claims over €1m – this isn’t enough to parameterise a large claims model
  - We think two €1m claims is better than the market average; but is this a fluke or is there something about our portfolio that makes it less large-claims-y?

Large claims modelling for small insurers

- Analysis process
  - Collect market large claim data
  - Build a model for the market as a whole
  - Compare your history against market; assess whether your experience is better / worse
  - Rescale market model for your risk profile
  - Fit claim size distribution
  - Validate (sense checks, back testing, etc.)

Market claim data – claim counts

Motor TPL vehicle years

Year	WVY
2,000	37,371,577
2,001	37,698,467
2,002	37,986,189
2,003	38,557,810
2,004	38,781,779
2,005	38,865,070
2,006	39,203,403
2,007	39,230,609
2,008	39,453,215
2,009	39,742,958
2,010	40,247,758
2,011	40,871,218

Number of TPL claims in each size band

Year	nil	<50k	50-100k	100k-250k	250k-500k	500k-1m	1m-2m	2m+	Total
2,000	370,792	2,616,807	6,332	4,138	1,473	437	197		3,000,176
2,001	352,614	2,552,224	6,539	4,368	1,484	445	196		2,917,870
2,002	359,787	2,508,698	6,704	4,488	1,365	471	217		2,881,730
2,003	360,300	2,453,965	6,322	4,981	1,424	456	192		2,827,640
2,004	353,580	2,404,578	6,361	4,634	1,345	443	204		2,771,145
2,005	334,105	2,338,917	6,733	4,428	1,339	568	195		2,686,285
2,006	331,316	2,293,146	6,110	4,081	1,323	523	214		2,636,713
2,007	313,118	2,297,864	6,063	4,334	1,305	513	196		2,623,393
2,008	311,123	2,242,018	5,791	4,185	1,177	485	217		2,564,996
2,009	322,007	2,307,385	5,478	4,319	1,290	399	122	49	2,641,049
2,010	333,488	2,426,146	5,310	4,130	1,044	335	129	61	2,770,643
2,011	331,190	2,376,212	5,410	4,333	1,131	389	114	57	2,718,836

Claim frequency over each threshold

Year	=nil	>nil	50k	100k	250k	500k	1m	2m
2,000	8.03%	7.04%	0.0337%	0.0167%	0.0056%	0.00170%	0.00053%	0.00000%
2,001	7.74%	6.80%	0.0346%	0.0172%	0.0056%	0.00170%	0.00052%	0.00000%
2,002	7.59%	6.64%	0.0349%	0.0172%	0.0054%	0.00181%	0.00057%	0.00000%
2,003	7.33%	6.40%	0.0347%	0.0183%	0.0054%	0.00168%	0.00050%	0.00000%
2,004	7.15%	6.23%	0.0335%	0.0171%	0.0051%	0.00167%	0.00053%	0.00000%
2,005	6.91%	6.05%	0.0341%	0.0168%	0.0054%	0.00196%	0.00050%	0.00000%
2,006	6.73%	5.88%	0.0312%	0.0157%	0.0053%	0.00188%	0.00055%	0.00000%
2,007	6.69%	5.89%	0.0316%	0.0162%	0.0051%	0.00181%	0.00050%	0.00000%
2,008	6.50%	5.71%	0.0300%	0.0154%	0.0048%	0.00178%	0.00055%	0.00000%
2,009	6.65%	5.84%	0.0293%	0.0155%	0.0047%	0.00143%	0.00043%	0.00012%
2,010	6.88%	6.06%	0.0274%	0.0142%	0.0039%	0.00130%	0.00047%	0.00015%
2,011	6.65%	5.84%	0.0280%	0.0147%	0.0041%	0.00137%	0.00042%	0.00014%

Market claim data – claim costs

Cumulative TPL claim amount in each size band

Year	nil	<50k	50-100k	100k-250k	250k-500k	500k-1m	1m-2m	2m+	Total
2,000	0	8,140,229,539	8,572,859,911	9,201,700,675	9,701,224,736	9,991,780,688	10,318,016,535		##############
2,001	0	7,982,080,120	8,426,318,128	9,100,033,570	9,603,002,730	9,889,685,298	10,232,582,880		##############
2,002	0	7,768,159,825	8,223,156,304	8,893,274,771	9,359,829,173	9,664,789,911	10,051,958,469		##############
2,003	0	7,541,060,939	7,968,426,570	8,723,259,907	9,209,489,126	9,513,758,286	9,886,484,798		9,886,484,798
2,004	0	7,487,291,552	7,915,003,995	8,607,454,600	9,062,798,587	9,347,416,489	9,751,366,730		9,751,366,730
2,005	0	7,290,561,545	7,743,687,129	8,404,292,105	8,862,943,471	9,237,241,543	9,575,512,926		9,575,512,926
2,006	0	7,031,035,290	7,443,878,095	8,069,699,070	8,529,692,807	8,883,672,821	9,298,290,492		9,298,290,492
2,007	0	7,165,833,426	7,575,931,864	8,235,626,540	8,677,382,187	9,021,046,740	9,401,442,741		9,401,442,741
2,008	0	7,052,729,194	7,441,213,099	8,079,337,724	8,483,751,799	8,800,831,589	9,220,731,375		9,220,731,375
2,009	0	7,247,674,935	7,614,767,394	8,293,546,578	8,727,121,804	8,989,314,282	9,150,526,299	9,299,090,268	9,299,090,268
2,010	0	7,531,343,564	7,888,866,552	8,531,446,377	8,882,421,811	9,108,918,504	9,283,095,499	9,469,734,944	9,469,734,944
2,011	0	7,479,235,821	7,842,873,854	8,518,338,573	8,895,442,191	9,152,507,684	9,302,554,078	9,476,231,379	9,476,231,379

Average cost of TPL claims in each size band

Year	nil	<50k	50-100k	100k-250k	250k-500k	500k-1m	1m-2m	2m+	Total
2,000	0	3,111	68,324	151,967	339,120	664,888	1,656,020		3,439
2,001	0	3,127	67,937	154,239	338,928	644,230	1,749,477		3,507
2,002	0	3,096	67,869	149,313	341,798	647,475	1,784,187		3,488
2,003	0	3,073	67,600	151,543	341,453	667,257	1,941,284		3,496
2,004	0	3,114	67,240	149,428	338,546	642,478	1,980,148		3,519
2,005	0	3,117	67,299	149,188	342,533	658,975	1,734,725		3,565
2,006	0	3,066	67,568	153,350	347,690	676,826	1,937,466		3,526
2,007	0	3,118	67,640	152,214	338,510	669,911	1,940,796		3,584
2,008	0	3,146	67,084	152,479	343,597	653,773	1,935,022		3,595
2,009	0	3,141	67,012	157,161	336,105	657,124	1,321,410	3,031,918	3,521
2,010	0	3,104	67,330	155,588	336,183	676,110	1,350,209	3,059,663	3,418
2,011	0	3,148	67,216	155,888	333,425	660,837	1,316,196	3,046,970	3,485

Forecast for 2013

Claims in size band as proportion of claims in previous size band

Year	nil	<50k	50-100k	100k-250k	250k-500k	500k-1m	1m-2m	2m+
2,000		87.64%	0.48%	49.65%	33.74%	30.09%	31.07%	0.00%
2,001		87.92%	0.51%	49.82%	32.73%	30.16%	30.58%	0.00%
2,002		87.51%	0.53%	49.38%	31.39%	33.51%	31.54%	0.00%
2,003		87.26%	0.54%	52.73%	29.38%	31.27%	29.63%	0.00%
2,004		87.24%	0.54%	51.02%	30.06%	32.48%	31.53%	0.00%
2,005		87.56%	0.56%	49.23%	32.19%	36.30%	25.56%	0.00%
2,006		87.43%	0.53%	50.13%	33.55%	35.78%	29.04%	0.00%
2,007		88.06%	0.54%	51.15%	31.73%	35.20%	27.64%	0.00%
2,008		87.87%	0.53%	51.15%	30.99%	37.36%	30.91%	0.00%
2,009		87.81%	0.50%	53.01%	30.10%	30.65%	30.00%	28.65%
2,010		87.96%	0.45%	51.77%	27.53%	33.46%	36.19%	32.11%
2,011		87.82%	0.48%	52.68%	28.07%	33.12%	30.54%	33.33%

	Frequency	Proportions...						
Average	7.07%	87.67%	0.52%	50.98%	30.95%	33.28%	30.35%	
Average ex hi	7.03%	87.68%	0.52%	50.95%	31.02%	33.19%	30.25%	
Average 06-1	6.68%	87.83%	0.50%	51.65%	30.33%	34.26%	30.72%	31.36%

Trend extrapolated from historical data

	Frequency	Proportions...					
2,011	6.39%	87.86%	0.50%	52.32%	28.96%	34.84%	30.97%
2,012	6.27%	87.90%	0.50%	52.56%	28.60%	35.12%	31.08%
2,013	6.15%	87.93%	0.49%	52.80%	28.23%	35.41%	31.19%

Pick 2013	6.68%	87.93%	0.49%	52.80%	28.23%	35.41%	31.19%	33.33%
Frequency >	6.68%	5.88%	0.0291%	0.0154%	0.0043%	0.00154%	0.00048%	0.00016%

Own data

Own experience

Incident year	Exposure, EVYs	Expected number of claims > threshold				
		50k	100k	250k	500k	1m
2,000	2,000	0.67	0.33	0.11	0.03	0.01
2,001	6,000	2.07	1.03	0.34	0.10	0.03
2,002	10,000	3.49	1.72	0.54	0.18	0.06
2,003	18,000	6.24	3.29	0.97	0.30	0.09
2,004	30,000	10.05	5.13	1.54	0.50	0.16
2,005	43,000	14.67	7.22	2.33	0.84	0.22
2,006	55,000	17.19	8.62	2.89	1.03	0.30
2,007	65,000	20.56	10.52	3.34	1.17	0.32
2,008	70,000	21.03	10.76	3.33	1.25	0.39
2,009	72,000	21.12	11.19	3.37	1.03	0.31
2,010	70,000	19.15	9.91	2.73	0.91	0.33
2,011	65,000	18.18	9.58	2.69	0.89	0.27
2,012	68,000					
2000-2011	506,000	154.43	79.31	24.17	8.25	2.48

- If our experience had been in line with market average, we would have had 154 claims over €50k, 24 claims over €250k and 2.5 claims over €1m

Own data

Own experience

Incident year	Exposure, EVYs	Expected number of claims > threshold					Observed number of claims > threshold				
		50k	100k	250k	500k	1m	50k	100k	250k	500k	1m
2,000	2,000	0.67	0.33	0.11	0.03	0.01	1	1	0	0	0
2,001	6,000	2.07	1.03	0.34	0.10	0.03	1	1	1	0	0
2,002	10,000	3.49	1.72	0.54	0.18	0.06	1	1	1	0	0
2,003	18,000	6.24	3.29	0.97	0.30	0.09	3	3	0	0	0
2,004	30,000	10.05	5.13	1.54	0.50	0.16	7	4	1	1	1
2,005	43,000	14.67	7.22	2.33	0.84	0.22	9	5	2	1	0
2,006	55,000	17.19	8.62	2.89	1.03	0.30	8	5	2	0	0
2,007	65,000	20.56	10.52	3.34	1.17	0.32	7	5	1	1	0
2,008	70,000	21.03	10.76	3.33	1.25	0.39	10	6	1	1	1
2,009	72,000	21.12	11.19	3.37	1.03	0.31	6	3	2	1	0
2,010	70,000	19.15	9.91	2.73	0.91	0.33	8	5	3	0	0
2,011	65,000	18.18	9.58	2.69	0.89	0.27	8	6	2	0	0
2,012	68,000						2	0	0	0	0
2000-2011	506,000	154.43	79.31	24.17	8.25	2.48	69.00	45.00	16.00	5.00	2.00

- In reality we had 69 claims over €50k, 16 claims over €250k, and 2 claims over €1m

Own data

Own experience

Incident year	Exposure, EVYs	Expected number of claims > threshold 50k	100k	250k	500k	1m	Observed number of claims > threshold 50k	100k	250k	500k	1m	% of exp.
2,000	2,000	0.67	0.33	0.11	0.03	0.01	1	1	0	0	0	149%
2,001	6,000	2.07	1.03	0.34	0.10	0.03	1	1	1	0	0	48%
2,002	10,000	3.49	1.72	0.54	0.18	0.06	1	1	1	0	0	29%
2,003	18,000	6.24	3.29	0.97	0.30	0.09	3	3	0	0	0	48%
2,004	30,000	10.05	5.13	1.54	0.50	0.16	7	4	1	1	1	70%
2,005	43,000	14.67	7.22	2.33	0.84	0.22	9	5	2	1	0	61%
2,006	55,000	17.19	8.62	2.89	1.03	0.30	8	5	2	0	0	47%
2,007	65,000	20.56	10.52	3.34	1.17	0.32	7	5	1	1	0	34%
2,008	70,000	21.03	10.76	3.33	1.25	0.39	10	6	1	1	1	48%
2,009	72,000	21.12	11.19	3.37	1.03	0.31	6	3	2	1	0	28%
2,010	70,000	19.15	9.91	2.73	0.91	0.33	8	5	3	0	0	42%
2,011	65,000	18.18	9.58	2.69	0.89	0.27	8	6	2	0	0	44%
2,012	68,000						2	0	0	0	0	
2000-2011	506,000	154.43	79.31	24.17	8.25	2.48	69.00	45.00	16.00	5.00	2.00	
Own frequency as proportion of market frequency - all years combined							45%	57%	66%	61%	81%	
2000-2004 only							58%	87%	86%	89%	289%	
2005-2011 only							42%	52%	63%	56%	47%	
							Override		60%			
							Used		60%			

- Calculate ratio of actual to expected over different periods and size thresholds
- In this case, evidence of consistently better frequencies => choose 60% ratio
- If we'd only looked at claims >€2m, it would have been inconclusive

Own data

Incident year	Expected cost of claims > threshold 50k	100k	250k	500k	1m	Observed cost of claims > threshold 50k	100k	250k	500k	1m	% of exp.
2,000	116,548	93,395	59,741	33,009	17,459	113,086	113,086	0	0	0	97%
2,001	358,185	287,481	180,254	100,203	54,575	316,268	316,268	316,268	0	0	88%
2,002	601,218	481,439	305,028	182,206	101,924	252,003	252,003	252,003	0	0	42%
2,003	1,094,918	895,410	543,030	316,043	174,000	430,940	430,940	0	0	0	39%
2,004	1,751,396	1,420,535	884,884	532,648	312,479	2,466,095	2,279,608	1,748,301	1,748,301	1,748,301	141%
2,005	2,528,052	2,026,717	1,295,829	788,381	374,261	1,716,958	1,403,555	774,043	508,261	0	68%
2,006	3,180,822	2,601,628	1,723,639	1,078,296	581,683	1,190,125	970,222	600,232	0	0	37%
2,007	3,704,113	3,024,633	1,931,605	1,199,674	630,267	1,517,718	1,376,082	753,366	753,366	0	41%
2,008	3,846,585	3,157,316	2,025,122	1,307,588	745,009	2,480,808	2,200,564	1,496,252	1,496,252	1,496,252	64%
2,009	3,716,430	3,051,390	1,821,685	1,036,202	561,203	1,258,532	1,089,515	969,731	668,999	0	34%
2,010	3,371,303	2,749,489	1,631,897	1,021,471	627,542	1,583,344	1,381,883	979,538	0	0	47%
2,011	3,175,944	2,597,628	1,523,396	923,665	514,838	1,384,427	1,238,846	703,000	0	0	44%
2,012						183,233	0	0	0	0	
2000-2011	##########	##########	##########	8,519,385	4,695,239	##########	##########	8,592,735	5,175,180	3,244,553	
Own costs as proportion of market costs - all years combined						54%	58%	62%	61%	69%	
2000-2004 only						91%	107%	117%	150%	265%	
2005-2011 only						47%	50%	53%	47%	37%	

- We can repeat the exercise for actual claim costs vs. expected. In this case, actuals are around 50-60% of market benchmark => consistent with frequencies

Selected frequencies

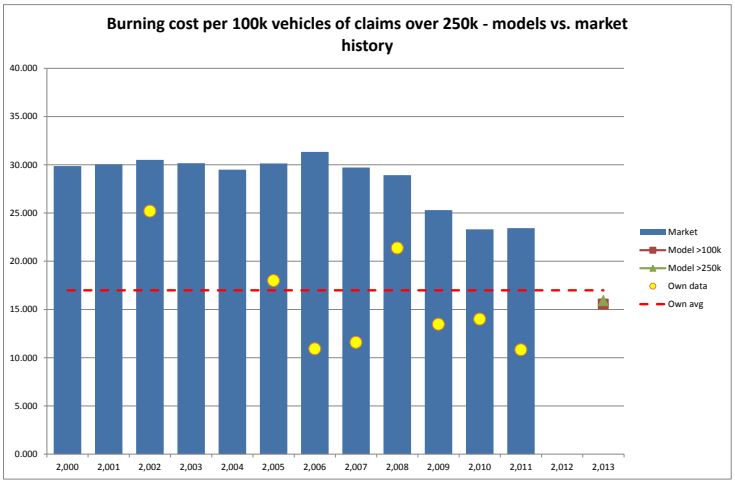
	Frequency per 100,000 risks - 2013		
Threshold	Market	Adjustment	Us
50k	29.09	0.6	17.45
100k	15.36	0.6	9.21
250k	4.34	0.6	2.60
500k	1.54	0.6	0.92
1m	0.48	0.6	0.29
2m	0.16	0.6	0.10

- In this example we use the same adjustment for all claim size thresholds, but we are free to select different factors
- Now we can use these frequencies to fit a claim size distribution

Fitting a claim size distribution

- Considerations:
  - You get a different fit if you plug in the frequencies for all ranges down to 50k than if you only use the frequencies down to 100k. What range should you use?
  - Is it better to minimise the error in the frequency of claims in each range or the aggregate cost of claims in each range? Frequency is the default approach, but using costs would give more importance to top end of distribution – may be more relevant for capital/reinsurance uses?

Validation – visual sense check



Validation – other methods

- Back testing: how our actual historic claims fall in the assumed claim size distribution

Range no	%ile from	%ile to	Value from	Value to	Expected	Actual
1	0%	7%	0	109,003	5	4
2	7%	13%	109,003	115,451	5	4
3	13%	20%	115,451	122,425	5	4
4	20%	27%	122,425	130,351	5	4
5	27%	33%	130,351	139,600	5	3
6	33%	40%	139,600	150,618	5	7
7	40%	47%	150,618	164,018	5	4
8	47%	53%	164,018	180,696	5	3
9	53%	60%	180,696	202,058	5	6
10	60%	67%	202,058	230,454	5	5
11	67%	73%	230,454	270,206	5	7
12	73%	80%	270,206	330,366	5	7
13	80%	87%	330,366	434,339	5	4
14	87%	93%	434,339	673,823	5	8
15	93%	100%	673,823	999,999,999	5	3
				Chi square test statistic		88%

Validation – other methods

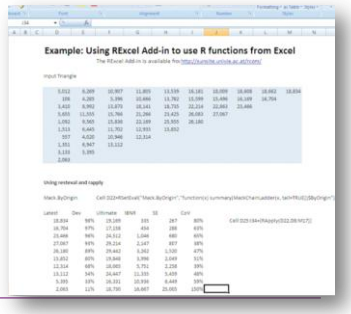
- Largest claim:
  - Simulate using the assumed distribution, for a portfolio of your size, the expected distribution of the largest claim size in each year
  - Compare this against the actual largest claim in each year
  - (relies on having several years of history to make the comparison meaningful)
- Comparison of market frequencies over various thresholds against reports produced by reinsurance brokers or other organisations (bearing in mind the potential for conflict of interest)

Appendix 2 - Claims reserving using 'R'

- Methodology included in WP toolkit
- R provides a good foundation for very detailed analysis and management information
  - Large number of resources available
  - Active and broad development community – help quick and easy to get.
  - NO financial commitment
- Simple two step process
  - Prepare data in suitable format to import into R
  - Run pre-programmed modules to produce claims reserving analysis

Data preparation

- Step 1 -Getting your claims data into “R”
  - Standard Windows Clipboard cut and paste (Ctrl C)
  - Built-in functionality to read and write to MS Excel files (`read.xls` / `write.xls`)
  - Embed into VBA code using **StatconnectorSrv** type library
  - ODBC connections to database platfomrs
  - Commercially available add-ins for Excel and Access
  - RExcel : allows R functions in Excel



R programmed options

- Step 2 – Pre-programmed tools (packages) in “R”
  - Current version offers
    - **ChainLadde**r – linear regression
    - **MackChainLadde**r – Development of the standard ChainLadder method
    - **BootChainLadde**r – Bootstrapping method using an assumed process distribution
    - **MultiChainLadde**r – forecast reserves based on several triangles simultaneously
  - Examples of each method covered in detail as part of the ChainLadder demonstration that forms part of this “package”

Demonstration

- Step 1 – Define data triangle

```
> library(ChainLadder)
> RAA
      dev
origin    1     2     3     4     5     6     7     8     9    10
  1981 5012  8269 10907 11805 13539 16181 18009 18608 18662 18834
  1982  106  4285  5396 10666 13782 15599 15496 16169 16704    NA
  1983 3410  8992 13873 16141 18735 22214 22863 23466    NA    NA
  1984 5655 11555 15766 21266 23425 26083 27067    NA    NA    NA
  1985 1092  9565 15836 22169 25955 26180    NA    NA    NA    NA
  1986 1513  6445 11702 12935 15852    NA    NA    NA    NA    NA
  1987  557  4020 10946 12314    NA    NA    NA    NA    NA    NA
  1988 1351  6947 13112    NA    NA    NA    NA    NA    NA    NA
  1989 3133  5395    NA    NA    NA    NA    NA    NA    NA    NA
  1990 2063    NA    NA    NA    NA    NA    NA    NA    NA    NA
```


Demonstration

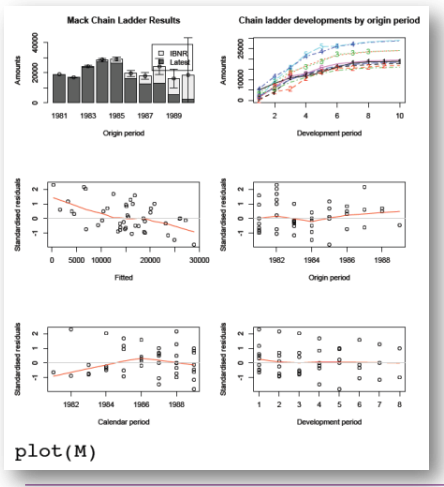
- Step 2 – Apply **`ChainLadder`** function to dataset.

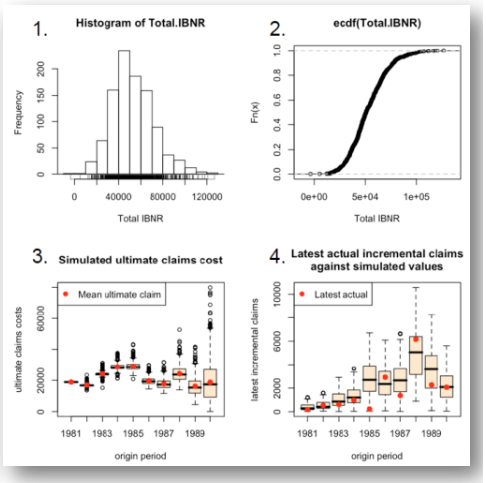
```
library(ChainLadder)
M <- MackChainLadder(Triangle = RAA, est.sigma = "Mack")
M
     Latest Dev.To.Date Ultimate   IBNR Mack.S.E CV(IBNR)
1981 18,834       1.000   18,834      0         0      NaN
1982 16,704       0.991   16,858    154       206    1.339
1983 23,466       0.974   24,083    617       623    1.010
1984 27,067       0.943   28,703  1,636       747    0.457
1985 26,180       0.905   28,927  2,747     1,469    0.535
1986 15,852       0.813   19,501  3,649     2,002    0.549
1987 12,314       0.694   17,749  5,435     2,209    0.406
1988 13,112       0.546   24,019 10,907     5,358    0.491
1989  5,395       0.336   16,045 10,650     6,333    0.595
1990  2,063       0.112   18,402 16,339    24,566    1.503

               Totals
Latest:    160,987.00
Ultimate:  213,122.23
IBNR:       52,135.23
Mack S.E.:  26,909.01
CV(IBNR):       0.52
```

Advanced application

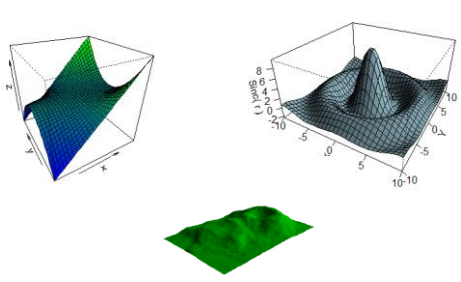
- Graphical and detailed analysis

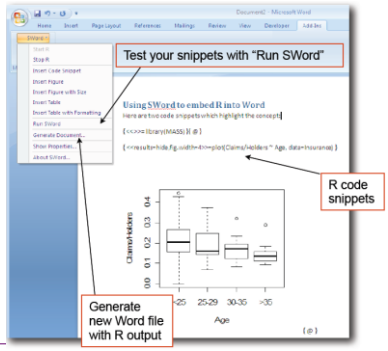




Output MI

- Detailed and Automated Management Information
  - R simple to combine with MS Office (Power Point, Word) to create regular reports.
  - Process can be significantly automated using Macro functions and VBA.
  - Option to use powerful R graphing tools (**`image`**,**`plot`**,**`persp`**) or export data for graphical analysis into Excel or other Graphing tool.





Summary

- Long Term: Bespoke In-house Development and Tailoring
  - Each company will be unique and data not standard – R puts no limit on the user /developer for tailoring and expanding existing functions or building new methods.
  - Tools in the ChainLadder package allow data to be manipulated and prepared to cater for individual requirements.
  - R not just a reserving tool – wide range of other applications in data analysis
- Acknowledgment
  - All materials and illustrations by:
    - Markus Gesmann: markus.gesmann@googlemail.com
  - Further details: http://code.google.com/p/chainladder/