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# Allowing for Qualitative Risk: Reserving and capital collide...

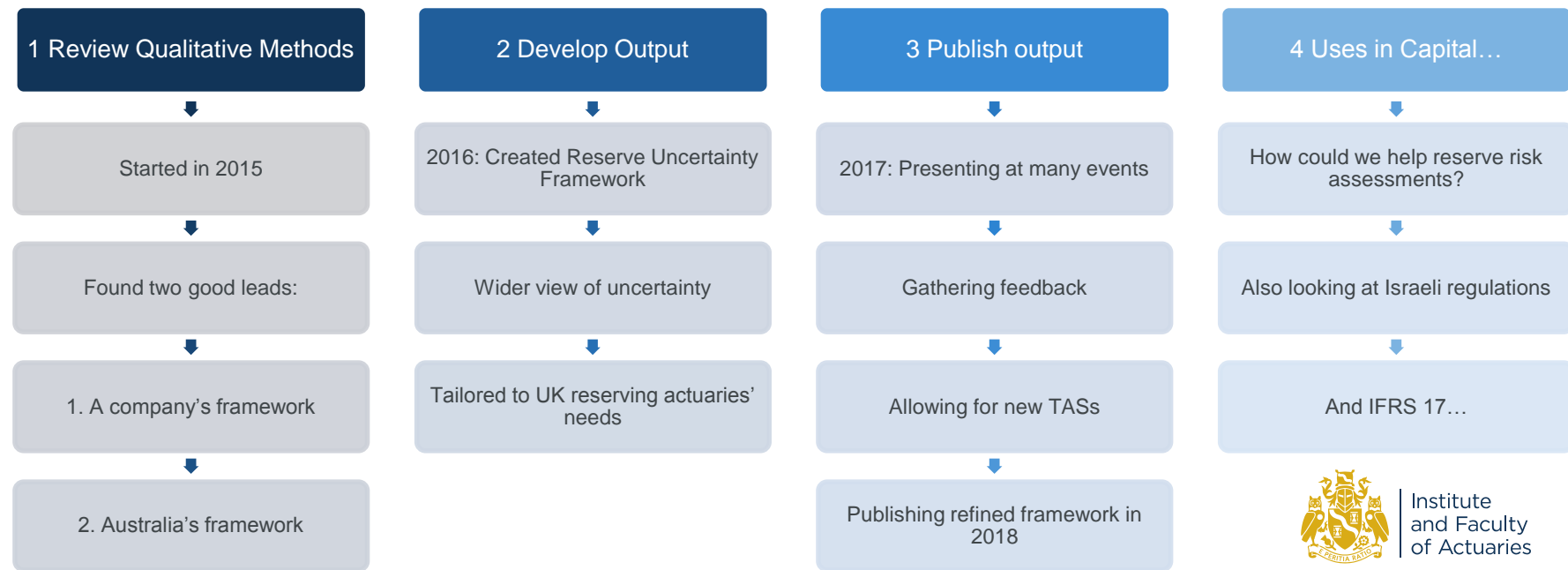
MUQ Working Party

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Hemant Rupani  
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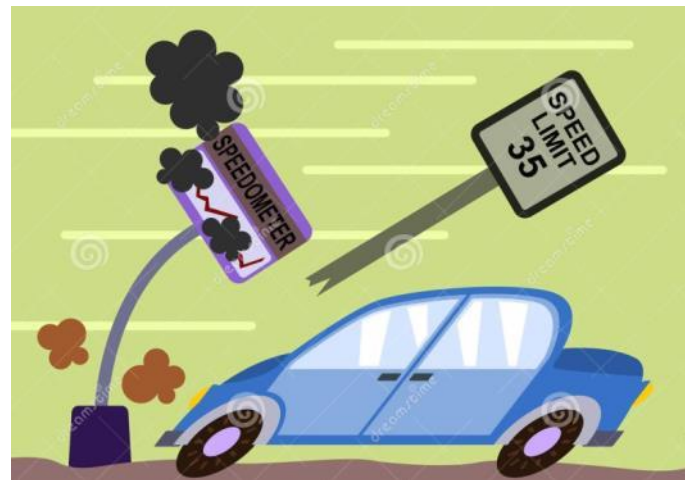
# The Measuring Uncertainty Qualitatively (MUQ) Working Party

- After developing a [Reserve Uncertainty Framework](#), we now seek to enable practitioners to be more confident in allowing for qualitative risks in day-to-day reserving activities including risk assessments

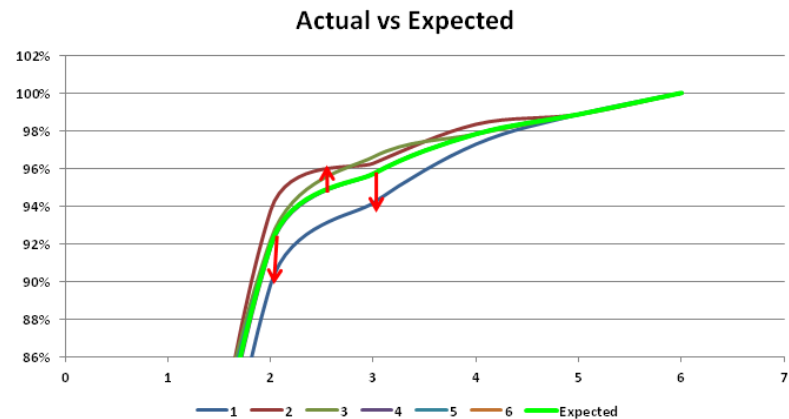
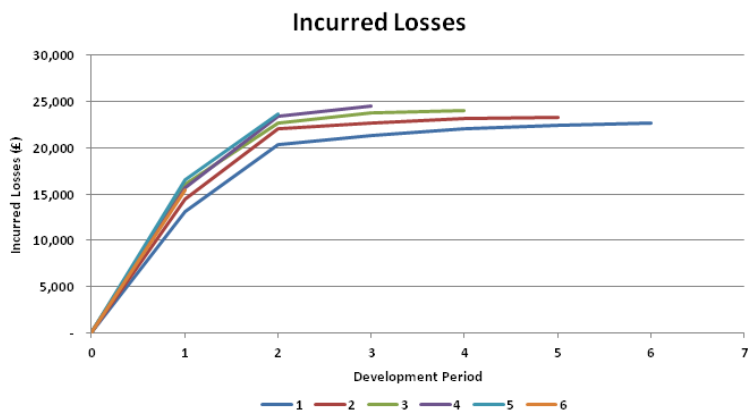


# Bootstrapping – Quick Recap

- Why Uncertainty?
- Reality  $\neq$  Expectation
- Could be due to,
  - Expectation not accurate
    - Model not suitable (Model uncertainty)
    - Parameters not accurate (Parameter uncertainty)
  - Reality never matches expectation (Process uncertainty)
- Does history entirely line up with expectations? NO!
- The future could behave in the same manner!
- Get something extra out of existing historical data.



# Expectation vs Reality



- Differences feed into residuals
- Some assumptions:
  - Paid/Notified, Gross/Net
  - Inflate data?
  - Data points to include/exclude
  - Pattern (All, Last 5, etc.), Tail or not?

# More Choices along the way...

- Method (Mack / ODP)
- Derived from residuals
  - Scale factor (ODP) / Alpha (Mack)
  - Process uncertainty distribution
  - Parameter uncertainty distribution
- Scaling (additive / multiplicative / others)
- Adjustments for tail
- Heteroscedasticity
- Other variants of bootstrapping
- Further loading for uncertainty



# Scenario 1: Two insurers merge

- *Onwards and upwards insurance* (A) acquires *Can't be too careful insurance* (B) which is about half the size and also a motor insurer
  - The acquisition's due diligence notes that pooling of risk should reduce the uncertainty
- During the merger, some employees unfortunately lose their jobs to realise expense savings and the claims are now handled by one team
  - The teams had two different ways of handling claims: *Onwards & Upwards* reserve on a known facts basis and *Can't be too careful* are open about the benefits of their very prudent estimating philosophy
- It is 18 months later and the reserving actuary is doing their first risk assessment after some interesting reviews...



# Bootstrapping of Scenario 1

- As noted in the due diligence, having the two portfolios should reduce capital requirements from the pooling of risk, however the reserve reviews haven't been predictable from the pattern changes...
- Could we allow for the uncertainty in the bootstrapping parameters?



# Initial bootstrap model runs (all years, reserves)

- As the pattern has changed, and we need to allow for the pooling of risk, a potential starting point could be the combined triangles (merger) run on paid claims
- This is less like to be affected by the changes to claims teams and better reflect the inherent uncertainty compared to incurred with case estimates.

Model Run (£k)	Mean	SD	1 in 4	1 in 10	1 in 20	1 in 200
Onwards and Upwards - Notified	4,302	1,432	5,066	5,977	6,598	8,615
Onwards and Upwards - Paid	3,912	2,543	5,528	7,428	8,491	10,789
Careful - Notified	-561	2,103	-26	660	1,162	7,546
Careful - Paid	-527	1,704	572	1,614	2,352	4,021
Merger - Notified	4,705	933	5,301	5,902	6,322	7,092
Merger - Paid	2,555	2,989	4,439	6,414	7,534	10,294





# Bootstrapping adjusted

- When we know there is uncertainty beyond what we see, paid combined (merger-paid) may not be the place to stop...

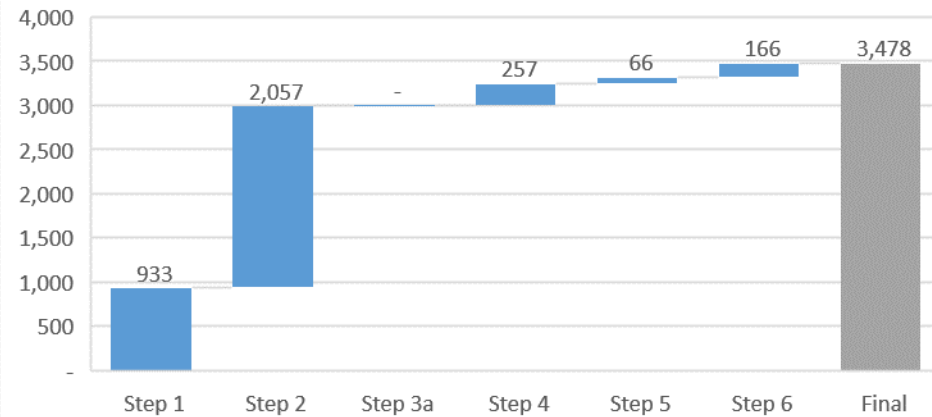
Step	Model Run (£k)	Mean	SD	1 in 4	1 in 10	1 in 20	1 in 200
Step 1	Merger - Notified	4,705	933	5,301	5,902	6,322	7,092
Step 2	Merger - Paid	2,555	2,989	4,439	6,414	7,534	10,294
Step 3a	Scaling Paid to Notified - Additive	4,705	2,989	6,589	8,564	9,684	12,443
Step 3b	Scaling Paid to Notified - Multiplicative	4,705	5,504	8,174	11,810	13,873	18,953
Step 3c	Scaling None	2,555	2,989	4,439	6,414	7,534	10,294
Step 4	Increase parameter uncertainty (10% increase in residuals)	4,705	3,246	6,754	8,836	10,137	13,157
Step 5	Increase process uncertainty (ODP to Lognormal)	4,705	3,312	6,781	8,834	10,113	13,706
Step 6	External Loading (5% for ENIDs)	4,940	3,478	7,120	9,275	10,618	14,391



# Bootstrapping adjusted – plots

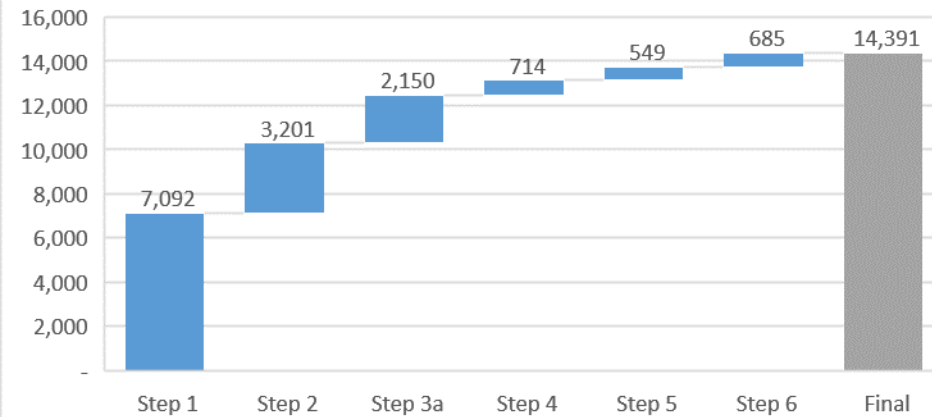
## Standard Deviation

■ Increase ■ Decrease ■ Total



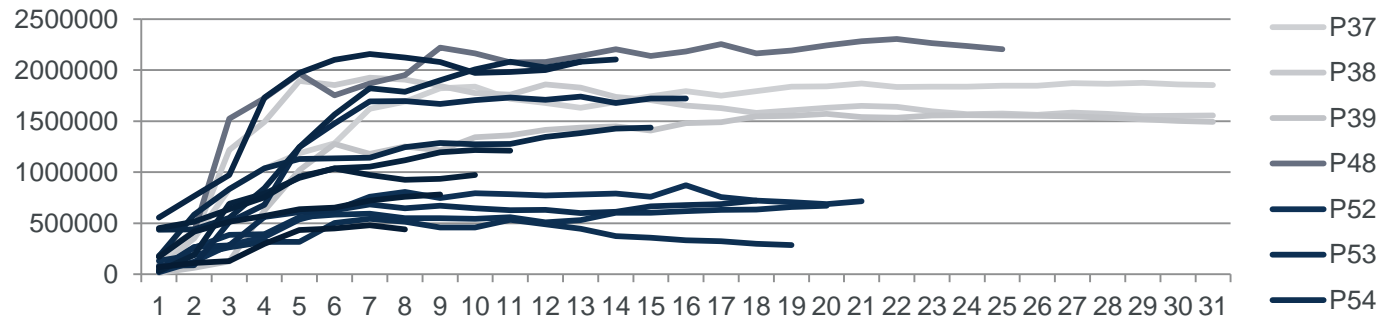
## 1 in 200

■ Increase ■ Decrease ■ Total



# Scenario analysis of the merger – a new pattern?

- The reserving team used a number of methods and much effort to come up with their neutral central estimate
- There is some uncertainty on *Careful* but due to the larger size and sudden flatter development there is a greater magnitude of uncertainty on *Upwards*
- Is it possible *Upwards* is now being more careful?



# Scenario analysis of the merger – the results

- The reserving team performed sensitivity analysis on the current-year results to demonstrate the uncertainty
  - For *Careful*, the low estimate considered a more recent set of development factors and the high estimate assumed this only affected the first development factor, giving ultimates from £7.2m to £8.6m
  - For *Upwards*, the possibility of two blocks of development factors before and after the merger is more evident and the low estimate places full reliance on them and the high no reliance, giving a range of £13.1m to £16.8m
- The reserving actuary spoke to members of the claims team to help estimate the likelihood of each current-year projection become a reality
  - *Upwards*' pattern giving a total ultimate of £25.5m with a 10% chance of being as high or higher
  - Neutral central estimate £23.6m
  - *Careful*'s pattern £20.3m, 30% chance of being this low or lower



# Comparing the current year results

- We can now compare the judgement-adjusted bootstrap result to the reserving actuary's and operation's estimates

Measure (£m)	Scenario	Raw bootstrap	Adjusted bootstrap	Actual*
90 <sup>th</sup> percentile	25.5	22.3	26.2	n/a
Mean	23.6	19.2	22.9	21.9
30 <sup>th</sup> percentile	20.3	18.1	21.8	n/a

- Comparing the two methods of expert judgement gives some validation to results, but also gives rise to some questions...
- The scenario also allows a common sense explanation that can be challenged by subject-matter experts

## Scenario 2 – Writing business in a new geography

- Able Explorers Insurance write casualty business and expanded into a new geographic territory called Utopia 3 years ago
- The insurance policy sold in Utopia is the same as in their current territory: The Doldrums
- However the actuary undertaking the reserve risk assessment has just been to a market conference in Utopia. Not everything is as similar as they thought. Whereas the statute of limitations is two years in The Doldrums, it is five years in Utopia and it's no dreamland - a late rush of claims is common in Utopia!
- Obviously they have not seen this yet in the development curves and now need to assess their reserving ultimates and risk assessments



# Scenario analysis of the potential late notified claims

- The reserving team undertook further research and discussed this with Utopia's claim team (with some being experts in Utopia's legal system)
- They believe that there is a possibility of 5% additional late claims that up to 15% could come through, although they note this is very unlikely. Allowing also for uncertainty on average cost of claims give the following scenarios

Current year	Low	Central	High
Late claims	0%	5%	15%
Claim numbers	23,483	24,979	26,273
Average cost	13,602	13,964	14,793
Ultimate (m)	319	349	389
Difference	-29	n/a	40

# Scenario analysis – getting ready to compare

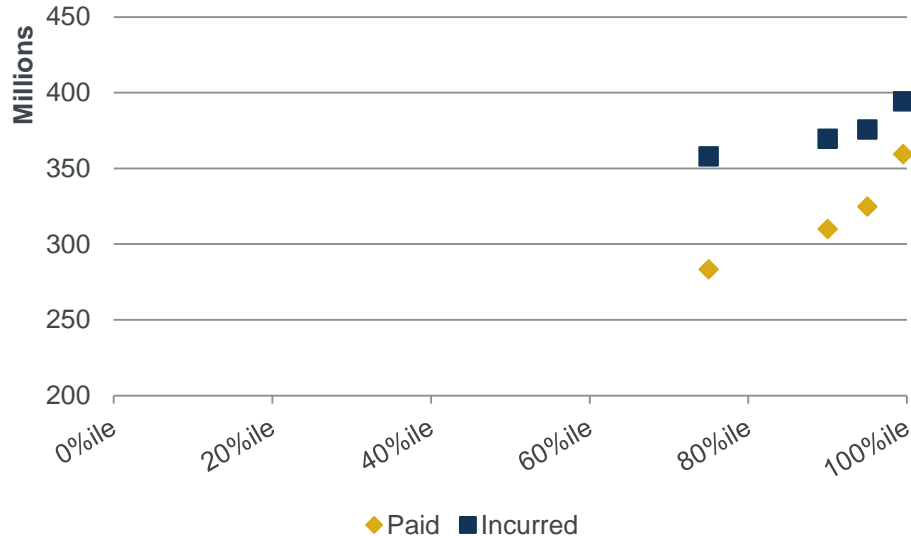
- The reserving team then sat down again with a number of colleagues from across the business to estimate their likelihood
- This gave a number of percentiles that can then be sense-checked to the adjusted bootstrapping and vice-versa to understand the potential uncertainty to advise the capital and reserving committees of Able Explorers Insurance

Reference	Current-year Ultimate	All-year reserves
33 <sup>rd</sup> percentile	319m	319m
Mean	349m	358m
75 <sup>th</sup> percentile	389m	403m



# Unadjusted bootstrapping results

- The IBNR calculated is 346m versus 358m in reserving (the former not allowing for future claims and the later does)



Scenario Bootstrap

Reference	Incurred	Paid
Mean	346m	259m
75 <sup>th</sup> percentile	358m	283m

Reference	All-year reserves
33 <sup>rd</sup> percentile	319m
Mean	358m
75 <sup>th</sup> percentile	403m



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# Bootstrapping adjustments

- Should we make use of the reserving scenarios and how could we do this?
- What external benchmarks could we use and could we combine with our own claims' experience?
- Should we just use the reserving numbers and fit it to a lognormal?



# Plans for the future

- Explore different models for impact of qualitative factors
- One such - **Individual Claims Reserving (ICR)**
  - Detailed methodology and increased number of assumptions
  - Increased flexibility in allowing for qualitative factors
  - Methodology diagram currently developed and is being reviewed
  - Intend to develop a prototype in R
  - Expected to help assess the impact of qualitative factors
- Intended for GIRO 2020



# Conclusion

- Bootstrapping can give more meaningful results with a more careful consideration of model choice and in some circumstances adjusting for increased parameter and process uncertainty
- Scenarios are vital – percentiles can be misleading to ourselves and others
- Scenarios allow for sense checking, could be used to set expert adjustments and make the whole exercise much less of a black box
- Comparisons between scenarios and stochastic models add value in both directions
- This will be vital for risk margins in IFRS 17, where decisions around reserve uncertainty now also affect the profit and loss directly, as well as the regulatory balance sheet



# Thank you

## Presentation

- Meena Nandakumar
- Hemant Rupani
- Keith Brown (Chair)
- James Keough

## Other current working party members

- Jeff Courchene
- Erin Bargate
- Yogesh Jalli
- Lucas Vilas Boas
- Jordon Ko
- Çağkan Başer
- Subbhashree Rivichandran
- David Martin

## Former members (Reserve Uncertainty Framework 2016)

- Syed Danish Ali
- Tim Jordan
- Chris Wren-Kirkham
- Jinnan Tang
- Marios Argyrou
- Sarah MacDonnell



# Questions

# Comments

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# Appendix

Expertise  
Sponsorship  
Thought leadership  
Progress  
Community  
Sessional Meetings  
Education  
Working parties  
Volunteering  
Research  
Shaping the future  
Networking  
Professional support  
Enterprise and risk  
Learned society  
Opportunity  
International profile  
Journals  
Supportin

# Chair required for the Measuring Uncertainty Qualitatively Working Party

- The current chair of the working party is stepping down to devote more time to leading GIROC (MUQ is a GIROC working party, so support will be available in the transition)
- This leaves a vacancy for others to develop their leadership skills whilst learning more about the art of allowing for uncertainty without needing to rely solely on percentiles from turn-the-handle bootstrapping. To apply, visit the link below
- <https://www.actuaries.org.uk/get-involved/volunteering-ifo/volunteer-vacancies/gi-measuring-uncertainty-qualitatively-working-party-chair>





# Reserve Uncertainty Framework

- <https://www.actuaries.org.uk/practice-areas/general-insurance/research-working-parties/measuring-uncertainty-qualitatively-muq>

## Reserve Uncertainty Framework Measuring Uncertainty Qualitatively (MUQ) Working Party 2018



## Reserve Uncertainty Framework MUQ working party 2018

### Aim of the framework

The aim of the framework is to encourage broader thinking around reserve uncertainty, to help structure the actuarial thought process and to kick-start idea generation.

When presenting reserve uncertainty to users of the reserving actuary's work (e.g. senior management or the board), we do not recommend presenting the detailed framework. We suggest highlighting the main drivers of uncertainty, which may be three to five areas, supported by quantitative illustrations where feasible. The framework would have been used during the process to help the actuary identify what the most significant reserve uncertainty elements were.

We have chosen to describe what we mean by each framework element very simply by listing examples of uncertainty that may be encountered.

This is not intended to be an exhaustive list and we actively discourage use of the framework as a checklist. We have suggested some ways the Framework may be used below, and we anticipate individual actuaries will develop their own framework and way of using it. We intend to keep improving and updating the framework. Please send feedback to [practice.muc@actuaries.org.uk](mailto:practice.muc@actuaries.org.uk).

For more information, including additional reading, resources on individual framework elements and ideas on how to deal with specific elements of uncertainty, please see the working party's [contacts](#).

### Uses of the framework

For the actuary

- Idea generation
- Base structure for own internal framework
  - Record of areas considered
  - Governance and validation
  - Likely not to need to change much from year to year
- Articulation tool
  - For example, to support communication to stakeholders
- Pooling knowledge and developing best practice in the profession
- Training tool

For the user of the actuarial work

- Awareness of areas of uncertainty
- What questions to ask



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