

Reserve Uncertainty Framework

Measuring Uncertainty Qualitatively (MUQ) Working Party 2018



May 2018

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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.executive@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 [website](#).

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

Background

The GIROC survey of 2014 recommended that more focus should be directed by the profession towards reserve uncertainty. The survey concluded that on the whole, there was a positive feeling about how reserving was being conducted in the UK.

“However, there was one significant area where improvement is still needed. i.e. uncertainty - both in measurement and communication. Reserving actuaries are all doing this in different ways which can be confusing for stakeholders. In addition the use of percentiles, whilst popular, can have the potential to be (at worst) misleading for stakeholders where there is a mismatch between expectations and what information they provide.”

The MUQ working party was formed in the wake of this finding. Our collective view on how to approach reserve uncertainty can be summed up as:

1. **Actuarial curiosity** is at the heart of reserving – remember to “**look out of the window**”. That is, an actuary should understand how numbers in the triangles relate to what is happening in the real world. They should also investigate, drill down, and challenge - ask questions of the wider business.
2. The MUQ working party **cautions the use of percentiles** in communicating uncertainty.
 - If providing a reserve estimate at, e.g., the 75th percentile, what is the person receiving the advice going to conclude from this? Do they understand the degree of uncertainty in the shape and size of the distribution, and the key assumptions that have gone into deriving it?
 - Could the way the percentiles have been presented be conceived as over-promising the accuracy of the level of uncertainty, or could they even be misleading?
3. One of the most effective ways for humans to communicate is by **telling a story**. Explain what the **key drivers of uncertainty** are and support this with quantitative illustrations (scenarios or sensitivity tests) where feasible. Consider the exercise from the user's point of view.
4. The skill of the actuary is in identifying what these key drivers of uncertainty are. Much complex and detailed actuarial work and judgement will underlie a simplified and targeted message.

The idea of the framework came from work that has been done by actuaries in Australia. After being required to report reserves at the 75th percentile, it was widely recognised that stochastic techniques could understate the reserve uncertainty distribution. A detailed framework and process to adjust stochastic results was developed. See the [MUQ website](#) for more information.

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Reserve Uncertainty Framework and the TAS

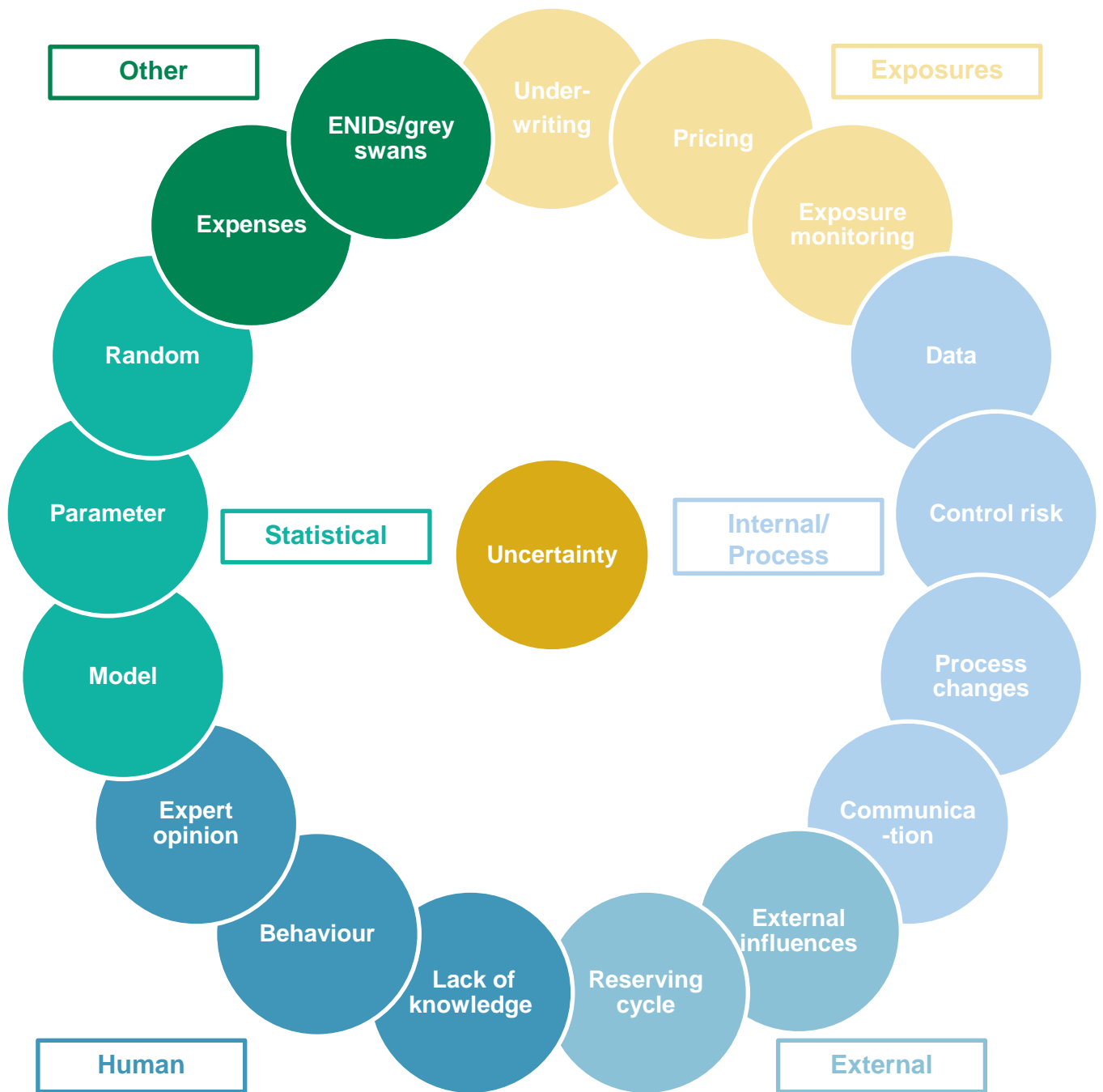
The framework should be seen as complementary to the new technical actuarial standards (TAS). A couple of examples of how this is the case are explained here.

1. The purpose of the TAS-100 includes reference to “users for whom actuarial information is created should be able to place a high degree of reliance on that information’s relevance, transparency of assumptions, completeness and comprehensibility, including the **communication of any uncertainty inherent in the information**”. Points 1 – 4 in the background section of the Reserve Uncertainty Framework indicate that communication is a key theme underlying this framework.
2. Separately, it could be noted that a number of the principles of the TAS-100 (such as 1. Judgement and 2. Data) can be linked directly to 2 of the 6 broad categories of uncertainty included in the Reserve Uncertainty Framework (respectively Human and Internal Process). This implies that the use of the framework would likely promote the communication of material judgements to users of actuarial work so that they are able to make informed decisions based on Data that is appropriate for the purpose of that work, resulting in an increased business understanding and awareness of the impact of deficiencies in these areas.

This framework is not a standard, and is not intended to be one, nor is it associated with the TASs or FRC.

Reserve Uncertainty Framework

Categories



Exposures

Underwriting Risk

How has the level of cover changed?

Have any of the following changed?

- Terms and conditions
- Sums insured
- Limits
- Types of risk written, e.g.:
 - Country or geographical area
 - Industry
 - Specialism
 - Type of individual
 - Catastrophe- or non-catastrophe-prone areas
- Mix of business
- Personnel changes – have the underwriters themselves changed? What is the anticipated impact of this?
- Delegated authority strategy
- New accounts within the reserving line or new intermediaries

Has a record been kept of changes, so it is easy to refer to in future years and the knowledge built up each year?

Exposure

Is the underlying exposure and any changes over time understood?

Have you considered the following?

- Accumulations of risk
- Changing business volumes
- Changes in mix of business - by distribution channel, geography, industry, cover level and so on
- New sources of business with particular concentrations
- Changes in underwriting limits leading to a different sum insured profile or mix
- Changes in legislation or rules
- Changes in economic factors – e.g. inflation-linking or negative equity in Mortgage Indemnity Guarantee business
- Changing competitive environment driving appetite in particular sectors
- Impacts of reinsurance and coinsurance

Is the understanding of exposure and any changes over time clearly documented and understood and agreed across the business?

Have areas where the underlying exposure is not clear been identified and documented? Can the potential impact on reserving estimates be quantified? What improvements can be made going forward?

Have new risks evolving with unknown frequency, severity or development patterns, been considered? e.g., cyber risk and risks associated with driverless cars.

Pricing Risk

How has the pricing basis changed over time?

- Have the pricing models been adequately parameterised and when were they last updated?
- How much have the underwriters deviated from the technical price? Has this been influenced by level of competition in the market or specific business strategy?
- Level of cross-subsidies?
- To what extent are the pricing loss ratios used as IELRs (initial expected loss ratios) for setting reserves? Do they look reasonable (e.g. can they be record breaking every year or at planned levels for every product)?
- Have changes in terms and conditions been adjusted for (i.e. where past claims were not reflective of the future)?
- Have policy features been allowed for correctly (e.g. aggregate limits and deductibles or reinstatement premiums)? Is it a hard or soft point in the underwriting cycle, and how is this affecting the price?
- What exposure measure has been used for pricing? If it is premiums, have historic rate changes been adjusted for appropriately? This also applies to use of IELR technique.
- For reinsurance covers, are exposure curves available, and if so, how reliable are they?
- What large losses have been allowed for in the price? Is this consistent with underwriters' and reserving actuaries' views?
- Is there a risk of anti-selection and how would this affect IELRs and claims development?
- Can a risk-mix index be used, which is popular in personal lines.
 - This is constructed from either the burning cost model or a measurable change in mix that correlates with changes in the projected KPIs.
 - It gives the relative level of frequency, severity and other KPIs which can be tested for fit to initial reserving projections and then used to guide assumptions for methods to project forward, e.g. Bornhuetter-Ferguson (BF) methods.
 - How much of the account is covered by the risk mix and has this been allowed for if it does not cover 100% of the risk profile?

Internal/Process

Data

Could there be any data issues?

- Is it clearly understood what the data represents? Could it have been misinterpreted?
- Is the terminology clear? Don't make assumptions!
- What reconciliations and high-level checks have been undertaken, e.g. reserving data against the general ledger? Are there key risk indicators to monitor data quality?
- If the data is not correct, how wrong is it? Can this be quantified? Consider monitoring the impact over time. Can it be improved going forward?
- Is the data complete; could anything have been missed?
- Has anything changed that could have affected the data since the last review?
- Could better data be available?

Take care to understand:

- Bordereau data, especially if sourced from a third party. How do you know it is correct?
- Data shown at different levels of granularity, perhaps from different sources. Is the mapping between these sources understood? Does the data reconcile? How appropriate are any corrections?
- Timing and consistency, e.g. gross vs RI data, this may be produced at different times and so not necessarily available at a given time on a consistent basis

Inwards Communication

Is there anything I am not aware of? Feedback loops are important

Maintain communication with all relevant areas:

- Claims operations - changes in process, delegated authority levels, new loss adjusters, suppliers, repair networks, staff turnover and so on
- Case reserving philosophy practices and changes and practice, e.g., are factor reserves being used (keep the incurred constant until the case settles or payments exceed it)?
- Changes in consumer behaviour, new types of claim or changes in reporting speed
- Changes in claims mix - more claims of a particular type
- Changes of supplier providing items and services for the claim
- Backlogs impacting the time taken to assess claims
- Loss adjusters - what is happening on the ground?
- Underwriters - changes in mix of business by distribution channel, geography, cover level or industry.
- Legal rulings impacting liability
- Wider environment - market trends, economic factors.
- Fraud monitoring - more claims or tighter controls?
- IT teams - changes in systems, recording of claims etc.
- What is considered "inside" the reserve and what is outside
- External actuaries and auditors, internal audit and other financial considerations, reinsurers and market trends

Process Changes

Have there been any changes in the process?

- Have any internal processes changed?
- Is there a backlog forcing tactical changes to processes?
- Have there been any changes to the way claims administer policy terms and conditions?
- Has the way processes are recorded into the claims system and therefore data changed?
- Have any suppliers changed and what are the cost and handling-speed implications?
- Have loss adjusters changed?
- Have initial reserve amounts changed over time?
- How are currency conversions recognised in the data and has this remained constant?
- What IT legacy features affect your patterns and have you taken them into account?
- Have intermediaries or outsourced elements changed their procedures?
- For automated claims systems, has the programming been changed?
- Are any process changes planned for the future?
- Are the origin periods granular enough to spot a change in development patterns?
- Do claims and actuarial have the same understanding of what process changes are important or relevant? It is not always clear what will impact actuarial projections. Has enough been done to mitigate this by working together and communicating to each other, as well as setting up more formal logs or procedures for notifying changes?

Control Risk

Are there sufficient controls around the reserving process?

- Is there an audit trail?
- Is the level of checking sufficient?
- Who has undertaken the data manipulation? Is it a third party?
- Are the controls around spreadsheet change sufficient? If a change is made by one person, will it be adequately understood by the next person to use the spreadsheet (e.g. if a row as been inserted that could have knock on effects)?
- Are there any potential areas of risk, e.g. changes in personnel, volumes or levels of experience?
- If the results have been aggregated, have any risks been picked up?

External

External Influences

What external influences may have affected the level of risk or the development pattern of the claims?

- Claims environment – e.g., solicitor behaviour, rise of a new claim type, class actions and so on
- Legislative environment – e.g. LASPO, trigger litigation for asbestos or the Thompsonstone v Tameside case where PPOs were linked to ASHE, tariffs for injury.
- Class actions, already in progress, or in the pipeline
- Consumer behaviour – propensity to claim, fraud, driving habits etc.
- Insurer behaviour: referral fees, competitor strategy
- Inflation: claims, RPI/CPI, medical inflation, earnings inflation, discounting rate, legal costs and so on
- Economic environment - particularly for certain classes of business like Mortgage Indemnity Guarantee (MIG) or Professional Indemnity
- Weather: particularly in relation to catastrophe risk. Also consider long-term changes.
- Regulatory Issues: e.g. what should or should not be allowed for in best estimate guidance from PRA or Lloyd's on certain reserving classes
- Emerging market practices, e.g. from PPO and Asbestos Working Party best practice and associated market benchmarks
- Reinsurer behaviour and potential availability of reinsurance in future
- Possible rating agency pressures
- Not at fault income from repair and salvage on motor.

Reserving Cycle

There seems to be a tendency for insurers to over-reserve when underlying loss ratios are low (hard market) and to under-reserve when underlying loss ratios are high (soft market)

Some suggested causes are:

- “Actuarial” methods go wrong (i.e. are skewed) because they are driven by the rating cycle, economic cycle or other influences
 - Suggested that IELR used in BF “dampens” the emergence of good or bad news initially as based on prior years’ out-turns
 - Tail-length may be correlated with loss ratios, but not picked up by chain ladder (CL) methods
- Judgements applied to the methods may be skewed. e.g. by overriding figures that appear to be too extreme but turn out to be realistic
- It may be that reserves are not set using actuarial methods – the methods actually used may be distorted by the rating cycle (over-reliance on loss ratios from underwriting)
- Actuaries or management may deliberately choose to move away from best estimate figures at different stages in the cycle
- Anchoring to other benchmarks, e.g., a third party review
- Ranges themselves can fuel the reserving cycle. Executives may not want to see adverse scenarios, and they cannot really be presented alone so that then provides a lower estimate they can choose. However without ranges, they may not be able to understand the risk well.

Human

Lack of Knowledge

What are the limits of my knowledge?

- Have you 'looked out of the window' to see what is going on?
- Is the model, and data captured, a fair representation of what is really happening?
- Can you explain what you are seeing in the data with what you know of the real world?
- When introducing new models or adapting existing ones, do you have enough knowledge to understand if it is an improvement or just a change?
- How do you know if you sufficiently understand a problem to make sure its modelled appropriately?
- Can you do more to expand your knowledge of the real life processes? Have you visited the claims teams to see how they work?

Behaviour

The risk that the actuaries exhibit biases or behaviours which mean that the reserving valuation process will not provide an independent and appropriate estimate

Examples are:

- Anchor Bias - Valuations are overly influenced by reference to prior year valuation exercises
- Reserving results overly influenced by the likely effect on financial results and variation to plans
- Overly optimistic or pessimistic treatment of historical events as being likely or unlikely to re-occur
- Herd Mentality - Actuaries wishing to be "in the pack" of their peers in use of methods or treatment of claim types
- Loss Aversion - Actuaries may view estimates asymmetrically (unconsciously being "prudent")
- Pressure to allow for claims improvements when there is little or no evidence. Ignoring this may be too prudent, but can actuarial reserves be adjusted without understanding the improvements and how successful they are?
- Impact of risk tolerance limits.

Expert Opinion

Expert judgement may be used where little data is available

- Is it clear where expert judgement has been made?
- Is the judgement documented adequately and easy to follow, including keeping it up-to-date?
- Were questions of expert judgement framed appropriately to the experts?
- Has the expert judgement been used and interpreted correctly by the analyst using it?
- Could the judgement be wrong? Is the uncertainty around the judgement sufficiently understood? Can this be captured?
- Who made the judgement – do they have the appropriate expertise? What are the limits of their knowledge? Is there anyone else now available? Are alternative and additional sources of expert judgement needed?
- How do we get "good" expert opinion? Have we talked to the right people at the right time, considered the wisdom of crowds, recognised framing issues when asking questions of experts and any biases they may have and so on?
- Is there a risk of herd mentality? Is there a risk of bias?
- How do the results compare to high-level sense checks?
- Is an independent review of the expert judgement needed?
- When was the judgement last made or updated?
- Is data now available that could super cede judgement? Can systems be improved to reduce the reliance on judgement?
- What is the expert judgement policy (identifying items that are or need expert judgement and how these have been arrived at)?
- Have we recognised our own limitations and where additional expertise is required?

Statistical

Model

Is the model picking up the relevant features correctly?

For example, with the chain ladder technique, what are the impacts of any external influences or process changes? Does the method allow adequately for the variation of development pattern by origin year?

Questions to consider:

- Why have you selected this model?
- What alternatives are there?
- Is this the most appropriate model?
- What are the limitations of the model?
- Is the level of segmentation and granularity (e.g. annual/quarterly/monthly) appropriate?
- What action(s) have been taken to mitigate any limitations of the model?

Random

Random error or process risk relates to the fundamental uncertainty (insurable risk) i.e. insured by the policyholder.

The sources of process risk arise as a result of the inherent uncertainty in statistical estimation.

- A small dataset will generally be more susceptible to random error than a larger one
- Have you used enough data for a reliable estimate?

Parameter

Parameter risk relates to the uncertainty associated with whether the estimated parameters are appropriate for what we are attempting to model

The following can lead to parameter uncertainty:

- Poor raw data - inconsistency, incompleteness or it being unrepresentative
- Changes to data-storage protocols, e.g. gross or net of RI, to include or exclude claims handling costs
- Impact of outsourcing claims-handling function on data
- Case-reserving philosophy, changes in senior personnel
- Large claims definitions, threshold changes, management decisions, loading for large claims when there are no large claims
- Overreacting to the latest diagonal
- Fitting distribution when lacking tail data
- Certain claim events, such as those related to global weather patterns may change at a pace rendering historical data inappropriate
- Inflation assumptions
- Different expense profiles of different distribution channels
- Changes in the mix of business

Other

Expenses

Have expenses been appropriately taken into account in the reserve exercise?

- Are there any issues with the expenses that could impact reserves? e.g., have there been any changes in practice impacting expenses or case estimates.
- Are the different expense elements and the terminology surrounding them clearly understood? Is it clear where they are in the data?
- Have they been adequately allowed and reserved for in long-tail liabilities such as PPOs?
- Who is responsible for setting the claims-handling expense reserve? Is this consistent with the overall reserves?
- Where are the expenses recorded and do they need to be reserved for? What is on your indemnity line?
- Is the book is expected to change size and how will the expense base respond?
- How long is the duration of the liabilities?
- How has the mix of claims changed and what are their relative costs?
- Has the area servicing the claims been restructured or outsourced?
- How are internal and third-party expenses expected to respond to inflation?

ENIDs/Grey Swans

Significant events, often not in historic data and not normally considered, but that may occur in the future

- Have these been considered elsewhere in the company?
- Are the approaches taken understood?
- Have they been incorporated adequately?
- Are they consistent with the overall view of reserve uncertainty and the company's risk appetite?

ENID - Event Not In Data

MUQ working party members

Current Members

- Çağkan Başer
- David Martin
- Emma Montague
- Erin Bargate
- Hemant Rupani
- James Keough
- Jeff Courchene
- Jordan Ko
- Keith Brown (Chair)
- Lucas Vilas Boas
- Meenakshi Nandakumar
- Rajeshwarie V
- Samir Zeidan
- Subbhashree Ravichandran
- Syed Danish Ali
- Yogesh Jalli

Selected Past Members

- Tim Jordan
- Chris Wren-Kirkham
- Jinnan Tang
- Marios Argyrou
- Sarah MacDonnell (Former Chair)