LIFE INSURANCE AND WEALTH MANAGEMENT PRACTICE COMMITTEE

Information Note: Framework for setting life insurance best estimate assumptions April 2017

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1. Introduction

1.1 Status of Information note

This Information note (IN) was prepared by the Life Financial Reporting Sub-Committee (LFRSC) of the Actuaries Institute. It does not represent a Professional Standard, Practice Guideline or Information Note of the Actuaries Institute.

This is the first version of this Information note.

1.2 Objective

The objective of this Information note is to provide life insurance practitioners with a resource that discusses common considerations for assumption setting. This is intended to be an aid to actuaries when undertaking their work. Links to other resources are also provided.

Whilst this Information note outlines matters for consideration when determining assumptions for different purposes and in different contexts, the need to apply actuarial judgment in all situations continues to apply.

1.3 Scope

The scope of this DN is best estimate assumptions used for actuarial modelling of life insurance business. This note gives greater focus to material assumptions where there is a regular, comprehensive experience investigation such as annual financial reporting.

This DN relates to life insurance and reinsurance business. It does not discuss, assess nor have any application to general insurance or health insurance policies.

2. Framework

Actuarial investigations are an important part of the Actuarial Control Cycle for life insurance business. These investigations provide feedback on actual experience compared to the expected experience and enable both the updating of assumptions and for strategic advice to be provided to the business if action is required. In some cases, they are also a regulatory requirement.

Assumptions about future experience are required for projections of business for various purposes such as financial reporting, regulatory capital and pricing. The outcomes of experience investigations can guide the setting of assumptions about future experience.

Moreover, assumption setting exercises and their associated business analytics can enrich the advice that actuaries give to companies regarding strategic and product decisions. This can be a factor in decisions around granularity of assumption reviews, as opposed to the actuary's needs for regulatory or financial reporting requirements.

The key stages of the process and the structure of this Information note are as follows:

- Considering existing guidance and regulations - section 3
- Planning the timing and frequency of each investigation - section 4
- Identifying and collecting data and ensuring it is fit for purpose - section 5
- Analysing past experience and emerging trends - Section 6
- Considering future drivers and converting analysis to assumption sets – section 7
- Having proposed assumptions reviewed – section 8
- Documenting the assumption review for internal and external stakeholders – section 8

3. Guidance and regulations

This section lists reference material used in compiling this Information note. For clarity, this Information note is supplementary to these sources and not a replacement.

Links to standards, regulations and guidance referred to in this section are provided in Appendix A.

3.1 Australian Life Prudential Standards

LPS 340 (Valuation of Policy Liabilities) requires assumptions for policy liabilities to reflect a best estimate of the likely experience. They must be set having due regard for, but not limited to:

- The materiality of the benefits being considered
- The effect of particular assumptions on the determined result
- Reasonably available statistics and other information
- Any options or asymmetrical distribution of liability outcomes

The Standard states that these best-estimate assumptions about future experience must be neither deliberately overstated nor deliberately understated. Specific requirements are also set with relation to expense assumptions.

LPS 320 (Actuarial and Related Matters) also requires the Appointed Actuary to document in the Financial Condition Report the methodology and assumptions used in the calculation of policy liabilities and regulatory capital.

3.2 Accounting standards

The Australian Accounting Standard Board (AASB) accounting standard AASB 1038 (Life Insurance Contracts) requires the present value of life insurance liabilities to be valued using assumptions that are best estimates.

3.3 Institute Standards and Guidance

The Institute's Professional Standard PS 200 (Actuarial Advice to a Life Company or Friendly Society) sets requirements for Appointed Actuaries concerning experience investigations and assumptions. For instance, the Appointed Actuary must be satisfied as to the suitability of all material assumptions about the expected future experience.

At the time of writing, the Institute has also published the following Technical Papers and Information notes, which are relevant to assumption setting:

- Information note: Analysing Disability Income Experience and Assumption Setting (2017)
- Information Note: Framework for setting life insurance risk margins for regulatory capital (2016)
- Information note: IBNR (2014)
- Technical Paper: Asymmetric risks (2013)
- Technical Paper: Discount rates for APRA capital standards (2012)
- Technical Paper: Development and use of volatility assumptions (2012)
- Technical Paper: Product Advice Regarding Policies and Reinsurance to a Life Insurer or Friendly Society Under LPS 320 (2012)
- Practice Guideline: Economic Valuations (2011)
- Technical Paper: Risk-free Discount Rates under AASB 1038 (2010)
- Code of Professional Conduct

3.4 International and overseas standards

The International Actuarial Association has published a standard of actuarial practice (ISAP 1) which covers general actuarial practice on data, assumptions and methodology, peer review and documentation.

In the UK, the Board for Actuarial Standards has published various actuarial standards including ones for data, modelling and reporting for actuarial work falling within their scope.

4. Timing considerations

The timing and extent of assumption reviews will vary from entity to entity and depending on the purpose for which they are used and their materiality. The frequency of the assumption setting exercise may depend on the frequency of reporting, the materiality of the assumption, uncertainty in setting the assumption and the potential for the experience to develop and change rapidly. Assumptions that are less material or more certain may be reviewed less frequently, though value can be gained from periodic re-assessment of all assumptions in use.

New assumptions might be set following external factors such as a change in policy terms and conditions or launch of a new product, regulatory change, changes to distribution and known industry impacts that may not yet be apparent in experience studies. Additionally, new assumptions may be set on an ad-hoc basis for valuing large bulk transactions such as group insurance or reinsurance quotes.

Reinsurers may also consider when and how often data is available to them to update their analyses.

It is advantageous to conduct the assumption review in a timely manner, to allow robust analysis and investigation of specific items before assumptions are implemented. This is to be balanced with the value gained from incorporating the most up to date credible experience possible. It may be possible to supplement a detailed investigation with more recent high-level analysis. It is also important to consider how well developed the experience is – a large proportion of unreported claims for the final period of the investigation, for example, means the results for that period are subject to more uncertainty, to the point where their inclusion may not assist the assumption setting process.

For the review of a major assumption, the time taken to perform the following potential stages of the assumption review may require planning:

- Collecting data and checking it is fit for purpose
- Performing the analysis and calculations, and having them reviewed
- Considering additional information and applying judgement to formulate draft assumptions
- Assessing the financial impact
- Communicating the results and insights to internal and external stakeholders
- Obtaining general agreement and sign-off (including any rework)
- Implementing the assumptions and updating the actuarial model or other models that use the assumption
- Documenting the investigation throughout this process

A point for consideration when analysing experience and setting assumptions is their interaction with other assumptions.

For a fast developing experience issue, there may be a desire for frequent assumption reviews which can be completed quickly using less rigorous techniques (e.g. using the analysis of profit), or targeted investigations focusing on particular aspects of the experience. These investigations may be sufficient in the circumstances and negate the need to complete a detailed investigation making use of all available data and modelling techniques. The downsides of doing extra full investigations in response to emerging experience issues, are that there may be insufficient new observations to statistically conclude the assumption is inappropriate, and the full investigation requires significant effort and time to complete. Qualitative evidence can be insightful on the cause and sustainability of new experience issues. Stakeholder communication at this time is very important.

Consideration as to the ordering of Incurred But Not Reported (IBNR), Reported But Not Admitted (RBNA) and Claims in Course of Payment (CICP) assumption reviews is also usually undertaken. This is because RBNA and CICP assumptions will be used in determining ultimate claims and hence the IBNR assumption.

5. Data considerations

This section discusses some of the considerations that might be made with regards to data used as part of the assumption setting process. As with other sections of this DN, the actuary is expected to apply judgement in determining the relevance of data considerations discussed in this section given the materiality of an assumption and the purpose for which it will be used.

5.1 Data requirements

An important early step in an experience investigation is to consider what data may be available and how to source it. It may not be sufficient for the actuary's purpose to only update the prior experience investigation data.

The investigation may benefit from a fresh consideration of whether the data used is defined, reliable and relevant. The data is defined if it is not open to misinterpretation (Section 5.3). Data is reliable if that information is materially accurate (Section 5.4 and 5.5). Relevance is assessed by how insightful and useful the data will be in predicting the future level of an assumption. The applicability of past experience in setting assumptions is considered further in Section 7. Sources of data

To the extent possible and appropriate when setting assumptions, entity specific data can be informative to the assumption being made. Particularly, in the case of demographic assumptions, the entity's assumption setting may involve calibrating the entity's own data to an externally derived base table, such as an industry standard table.

Where such data is not available, relevant, or credible, for example when pricing for a new product or benefit, the actuary could consider industry data, data from other comparable sources, population data, or other published data, adjusted as appropriate.

External data could be sourced from:

- industry publications such as FSC experience investigations
- regulator publications such as APRA statistical bulletins
- population demographic information (ABS and other)
- reinsurers
- publicly available economic information from sources such as the ASX and RBA
- economic data providers such as Bloomberg and Reuters
- socioeconomic data providers
- medical data sourced from private and public studies

Australian data could be supplemented with overseas equivalents if the actuary considers the data would enrich their other data and be insightful for predicting experience.

5.2 Defining the data

It is helpful to define all items of data used to set assumptions to give clarity and avoid errors for both users and providers of data. Examples of areas where ambiguities can arise include:

- Sum insured (for example, this could be interpreted as initial sum insured or current sum insured inclusive of loyalty bonus, or gross/net of reinsurance)
- Claim payments (this could be taken to mean sum insured only, or inclusive of claim expenses, interest or premium refunds)
- Premiums (could be gross or net of stamp duty)
- Claim date (may refer to date of incidence, diagnosis, notification, decision or payment).

It can be helpful to the actuary and other users to define data consistently over time or make allowance for differences. Inconsistency can arise from changes in processes and sourcing data from multiple sources.

The expense data, often provided by a finance department, would typically be used to consider the terms of the expenses required for the actuary's reporting purpose compared to the original purpose – for example, whether they include allocations of overheads from a parent company.

Care may need to be taken in understanding the definitions of any externally sourced data. This may result in adjustments to make external data comparable to internal experience. For example, external data may have been measured on a life basis, while internal assumptions are weighted by amounts.

5.3 Validation

It is common during the review of major assumptions for data to be reviewed and checked for consistency, completeness and accuracy. An example of the type of validation checks that might be performed are listed below (re-produced from the International Actuarial Association's ISAP 1):

- Undertaking reconciliations against audited financial statements, trial balances, or other relevant records, if these are available
- Testing the data for reasonableness against external or independent data
- Testing the data for internal consistency
- Comparing the data to that for a prior period or periods

The extent of the checks to be carried out is a matter of judgement and will depend on matters such as:

- Purpose the assumptions will be used for
- Understanding of the process involved in creating the data
- Source of the data
- Nature of the assumption review
- Extent and nature of checks known to have been carried out by other parties
- Materiality of the assumption being used

As an example, a split between acquisition and maintenance expenses may be provided by Finance who do not require such a split for their own reporting. In such a scenario, it is

worthwhile for the actuary setting an expense assumption basis to consider the reasonableness of the methods used to apportion the split since the importance to the actuary may not be well understood by the data provider.

As part of the validation, consultation with others on the outcome can be a valuable exercise. For example, meeting with claims staff may provide useful background for emerging trends or explain some unusual movements e.g. a large reduction in pending claims.

Consistency between the experience analysis and projection model is important. Where possible, a control may be worthwhile on reconciling the data in the experience analysis and that within the projection models.

It is important to assess whether externally sourced data is reliable. It may have been gathered for some purpose that did not require the level of rigour appropriate to the purpose to which it is being used.

5.4 Data deficiencies

It is worthwhile considering the possible effect of any data deficiencies. Examples of data deficiencies are inadequacy, inconsistency, incompleteness, inaccuracy and unreasonableness. If such deficiencies in the data will not materially affect the results, then the deficiencies may not require further consideration.

It is important to consider whether the reliability of the data can be improved by adjusting or supplementing it, and the costs and benefits of such efforts. An example of a way in which data could be adjusted is the use of average values in place of invalid or missing entries for a small subset of policy data. This avoids having to lose other policy information for affected policies. Data might be supplemented using additional sources of data, proxies or sampling methods, though the relevance of additional sources of data may need to be considered.

If a satisfactory way to resolve the deficiencies cannot be found, then the actuary may wish to consider whether to:

- Benchmark against data for products thought to be similar
- Obtain appropriate additional data
- Subject to compliance with the actuary's Code of Professional Conduct, perform the actuarial services as well as possible and disclose the data deficiencies in the report (including an indication of the potential impact of those data deficiencies).

Reinsurers will usually have some additional data limitations to consider and manage compared to direct insurers. Generally, the three main differences will be operational delays, data granularity and data consistency across multiple cedants. It can be helpful for the consequences of such limitations to be communicated to, and mitigated, by colleagues liaising with cedants.

There is sometimes an issue with grouping data to achieve credibility but at the expense of losing information about any underlying diversity. The implications of the lost granularity may

require assessment, which could involve consideration of how the assumptions will ultimately be used.

6. Analysing experience

This section is primarily relevant for the review of demographic assumptions, as opposed to expense assumptions. As with other sections of this DN, the actuary is expected to apply judgement in determining the relevance of this section given the materiality of an assumption and the purpose for which it will be used.

6.1 Purpose of experience analysis

An often important component of assumption setting is to first arrive at an understanding of past experience. The benefits that can be gained from analysing past experience is the identification of historical:

- levels of experience;
- trends in experience
- drivers and risk factors behind experience and trends in experience
- interactions between variables
- volatility of experience
- effects of change in business process

The objective is usually to obtain from the data the most relevant analysis/information to inform the selection of future assumptions. The analysis/information can also be used to provide strategic advice to the business for action.

In some cases, changes (e.g. to benefit design) may be incorporated through adjustments to the experience investigation and/or the data used for it. This reduces the need to make further adjustment or allowance to the experience investigation results. For example, if removing a benefit or condition when a benefit gets paid, it may be possible to allow for this by removing claims paid under this condition from the data in the experience investigation.

6.2 Extent of analysis to perform

When assessing the depth of analysis required to derive particular assumptions, consideration may be given to their materiality, for each intended use. For Australian financial reporting, the balance sheet impact of an assumption change in a financial year will depend on the valuation approach adopted (i.e. accumulation or projection methods), the profit carrier and how close to loss recognition the subset of business is. Additional work may be appropriate when a block of business is close to loss recognition given the financial reporting consequences. Changes in assumptions for claims reserves can impact the current year profit for insurers.

Care is expected to be taken when assessing impacts at a point in time. At the time of an assumptions initial implementation, there might be limited exposure to claims in payment for long durations, but as a subset of business matures, exposures might change and previously immaterial assumptions might become significant.

These considerations on importance are relevant when assumptions are updated.

6.3 Available tools and techniques

A number of analytical tools and techniques are available to assist the actuary. These include, but are not limited to, Bayesian network modelling, generalised linear modelling, univariate and multivariate analysis, statistical credibility theory, predictive modelling, forecasting, logistic regression, neural-networks, Monte Carlo simulation, time series analysis, data mining, constrained optimisation, machine learning, hierarchical clustering, k-means clustering and principal components analysis.

Details on commonly used techniques are included in Appendix B.

6.4 Considerations when selecting tools and techniques

When assessing which modelling tool or technique to apply, an actuary may consider the following points:

- Use of a range of models to better understand any underlying driver of experience and the suitability of various models to particular circumstances and trends
- Understanding the strength, weaknesses and any underlying explicit/implicit assumptions of any tool/technique applied, for example in estimations of IBNR feeding into 'actual' claims results.
- Checking that experience analysis models have been applied correctly. This includes issues such as
  - IBNR / RBNA adjustments for claim incidence assumptions
  - Reopened claims adjustments for termination assumptions
- Validating analysis. The explanation of how the experience analysis model is a satisfactory representation can be supported by techniques such as:
  - comparing the outputs of analytics with actual experience and actual analysis of profit results
  - quantitative analysis of the predictive properties of the model using back-testing
  - analysis of movements
  - sensitivity testing
- Maintaining controls over experience analysis models used, such as maintaining a version history and peer-reviewing updated inputs and methodology changes.

6.5 Procedural documentation

It is advisable to maintain documentation of the procedures performed to arrive at the final experience investigation outputs. The documentation might come in a number of formats and could include:

- Annotation - where appropriate within models for data extraction, grouping of products and merging with other datasets. This is particularly helpful for program routines and scripts, but also for spreadsheet calculations that may not be obvious to another similarly experienced actuary.
- Process documentation that is complete, consistent with actual practice and may otherwise allow another similarly experienced actuary to re-perform the experience analysis.
- A log of known limitations of data and models being maintained and regularly re-visited. The log could include any adjustments, approximations or assumptions made.

7. Setting the assumption set

This section is primarily relevant for the setting of material assumptions. As with other sections of this DN, the actuary is expected to apply judgement in determining the relevance of this section given the materiality of an assumption and the purpose for which it will be used.

7.1 Model requirements

When constructing an assumption set, it is expected that it will be considered for relevance to its intended use. Examples of considerations include:

- Whether the weighting applied in the experience investigation is consistent with how it is applied in the model, for example by policy count or by premium
- Whether the products have sufficiently different characteristics and credible data to require more granular separation of experience results
- Whether adjustments are required for inflationary purposes given the point in time the assumption will apply from, for expenses for example
- The importance of granularity of the assumption set. For instance, there may need to be greater focus on on-sale or loss making business. For pricing, a higher level of granularity may be required than for valuation if an understanding of the profitability contribution of particular product features or pricing points is desired.
- The homogeneity of assumption groups, and whether cross-subsidies within an assumption group will change over time

If in doubt, the actuary preparing the assumptions would typically consult with the model developer or the performer of the experience investigation.

7.2 Applicability of the results of experience analysis and external data

The results of experience analyses are often the starting point for an actuary's assumption setting process. As per Section 6, it can be more informative to prepare experience analytics that reflect what the experience in the past would have been, if the drivers of assumption had been at the levels they are expected to be at in the future. It may not be possible to completely normalise historical results in this way. Hence the actuary may consider that the results of experience analysis still require adjustment to form an appropriate assumption set for estimating future experience. Possible topics that could require specific consideration include:

- Changes to regulation that affect new business volumes and expected lapses compared to past experience;
- Changes to product design, policy interpretation and business processes such as claims definitions, underwriting eligibility, claim eligibility and claims handling procedures that affect future claim costs compared to past experience;
- Investment in retention activities that lead to lower lapse rates compared to past experience;
- Expected changes to the economic environment, such as unemployment rates, that may have an effect on savings rates and claim costs;
- Possible change in policyholder or beneficiary behaviour that may impact claim costs;
- Where past experience data is unreliable, asymmetric or lacks statistical credibility; and
- Where observable trends in the past experience exist, and whether they may continue into the future.

In addition, for externally sourced data, consideration may be required for:

- Differences in the profile of the population underlying any externally sourced data relative to that which the actuary is trying to model experience for.
- Whether or not the definition of an event in the data is consistent with the definition of an event for the assumption. For example, medical definitions as reported in health insurance statistics may be different from trauma policy definitions.

7.3 Setting the Assumptions

Some areas involving professional judgement are:

- The number of years of experience over which to base an assumption upon
- What credibility to apply where internal experience is not available or well developed. Reference material is provided in Appendix A and a brief explanation of credibility theory provided in Appendix C.
- Any 'one-off' adjustments required to remove outliers or non-repeating items. Conversely, adjustments to take account of tail outcomes that may not be adequately represented in an observed sample.

In each case, it can be helpful to document any material judgement applied, why it has been applied and how sensitive the outcome is to the judgement applied.

When an adjustment to past experience is applied to derive an appropriate assumption set, consideration may be given to what extent there is quantifiable information available to produce an adjustment. This information may be sourced externally, if appropriate. A credibility weight could be applied to any estimated impact, particularly if it were to involve taking early credit for assumed improvements. The cost or resource requirement needed in assessing additional observable information, may need to be balanced against cost against the additional comfort expected from the assessment.

This places a considerable emphasis on the use of reasonable judgement by the actuary. For this reason, an actuary may wish to consider:

- Requesting another part of the organisation assist with generating an assumption where that part of the organisation is better placed to produce it, such as sales volumes for business planning purposes
- Consulting widely on material areas of judgement applied, giving equal consideration to views that are contrary, as well as in favour, of the actuary's views. A positive correlation generally exists between the materiality and subjectivity of the judgement, and the extent to which the actuary consults with informed peers.
- Highlighting any material areas of judgement applied and, preferably, indicate the sensitivity of the outcome to that judgement, when communicating assumptions to approvers or reviewers.

7.4 Consistency across assumptions and time

Consideration may need to be given to the consistency and reasonableness of the outworking of the assumption set. For example, the projected margins on cohorts of unit linked business can become excessive where income and expenses are projected with different drivers.

Another consideration is whether the projected profitability is likely to be achieved, or whether the company may take management actions that may need to be reflected in the assumptions, or whether competitive pressures need to be reflected in the assumptions.

A further question is whether the assumption set will remain suitable in the future, assessing parts of the insured population for which the assumption may not be appropriate, and considering whether these parts will become more or less significant going forward.

8. Review and approval considerations

This section is primarily relevant for the review and approval of major assumption setting exercises, such as the annual review for policy liability assumptions. As with other sections of this DN, the actuary is expected to apply judgement in determining the relevance of this section given the materiality of an assumption and the purpose for which it will be used.

8.1 Review

There can be control benefits from checks and procedures existing for calculations and sourcing of data. Depending on the area in which the actuary works, others may

automatically review the derived assumption set, such as the Appointed Actuary or external auditor. Notwithstanding any existing or statutory reviews, it may be worth considering the extent to which other reviews are required to help ensure material accuracy, reasonableness and completeness of the investigations and the reasonableness of the proposed assumptions.

The review may be for the entire assumption setting process, or for specific areas. Areas that are often subject to review are:

- Judgement applied in forming the assumption set
- Models used to perform the experience investigation
- Checks and controls applied by the actuary
- Assumption documentation completeness

Factors that may affect the actuary's determination on whether a review is required for an area of the assumption setting process could include its materiality, complexity, proneness to error, extent to which judgement is applied and the effectiveness of current controls. Other factors include the reasonable expectations of users of the information and the recentness of any past review. When considering who is to perform the review, factors that might be considered are the reasonable expectations of other stakeholders towards the independence and technical knowledge of the reviewer.

8.2 Consistency between the way assumptions are set and used

It is critical that there is consistency between the way assumptions are set and the way that they are used. While ensuring consistency may not be the explicit responsibility of the person carrying out an assumption setting exercise, it is critical that care be taken to avoid inconsistencies arising.

8.3 Approval process

Material assumptions recommended for use in calculation of certain key results will often pass through an approval process before implementation.

The company's approval framework may describe the process for implementing assumptions for different purposes. This may cover the role of:

- Those responsible for the calculated results according to the company's approval framework
- The Appointed Actuary;
- Actuarial advice committees, Board sub-committees, and senior management;
- The Board.

The company's approval framework usually serves to support those charged with the overall responsibility of setting assumptions. The actuary may wish to be clear on who has ultimate responsibility for an assumption.

In such cases where the Board will approve assumptions, it may be beneficial for the actuary, or broader management, to provide the analysis and support needed by the Board.

When planning the assumption setting process, it may be helpful to plan time for appropriate review and approval.

8.4 Assumption report documentation

Different documents relating to proposed assumptions may be produced for different purposes or audiences, but in aggregate, these form the assumption report documentation.

Assumption report documentation can play a pivotal role in the assumption setting and approval process. As such, these documents may perform the following functions:

- Communication tool to users of the assumption information
- Communication tool to reviewers or approvers of the derived assumption set
- Evidence for work performed

The most effective documentation will be that which is transparent and targeted to the audience. It may be beneficial for results to be presented in a manner that allows each intended stakeholder to place a high degree of reliance on the relevance, transparency, completeness and comprehensibility of the assumptions. This might include the communication of any inherent uncertainty, to allow each stakeholder to draw their own conclusions.

Ultimately, it can be a good target for documentation to be at a level such that a technical, competent person with no prior knowledge of the assumption set could understand the reasons for decisions made and assess the judgement applied.

The style and structure of the assumption report documentation can be important. Non-material information is worth excluding or minimising to avoid obscuring material information.

Documentation for a larger-scale assumption setting exercise could cover the following areas:

- **Purpose and scope of review**, including anticipated uses of derived assumptions
- **Recommendations**, to improve the data, processes, modelling etc.
- **Compliance statements,** setting out which Prudential Standards, regulation and / or professional standards the documentation is required to comply with.
- **Summary of assumption changes** from the current assumption set, including an explanation or quantification of financial impact. Where an impact may not affect the initial purpose of the basis, but may have other consequences, it is best to highlight this to avoid later problems; for example, a lapse assumption change may have a low impact for policy liabilities but have more impact on profit margins and product profitability testing. Additionally, better practice is for the impact to be calculated on all relevant reporting bases.
- **Key areas of judgement applied**

- **Description of each assumption type,** this may include an explanation of its importance and comment on any asymmetry that may exist in terms of the assumption's impact on modelling.
- **Description of the data used** to derive the assumption. This may include sources of information, date that the data set covers, extent to which manual adjustment performed (e.g. removal of unusable data), checks performed on the data, consistency (or otherwise) of the data with that used for other purposes and any uncertainty there is over the accuracy of the data.
- **Derivation method,** particularly where an assumption is being used for the first time, or there are significant changes in approach from previous assumptions.
- **Results of experience analysis** including credibility of the results, any statistical tests performed and the presence and consequence of any significant trends and features of the experience. Comparison of expected past experience using the recommended assumptions with actual past experience, and key reasons for significant differences.
- **Comparison to external experience** where relevant and possible, for example with benchmarking surveys.
- **Description of relevant external factors**, for example, forthcoming regulation or industry trends observed amongst peers.
- **Assumption setting methodology,** areas that may be expected to be covered are the period that average experience is taken from, the extent to which external environment factors have been considered, areas where judgement was applied and explanatory variables considered but rejected.
- **Sensitivity of assumption** to changes in methodology or judgement. Examples are using a different period for assessing average experience, or applying judgement in the weight attached to data sources used.
- **Results sensitivity to assumption.** Alternatively, this may be provided as part of a results report.
- **Known limitations** of analysis performed. For example, if a large element of the historic claims experience is IBNR, then the fact that the experience is itself based on an assumption is worth highlighting.
- **A list of assumptions**, but may not be useful for some assumption documents, depending on the audience.

It is important for the user of the assumption report to understand precisely what the assumption represents. This may include clear documentation of:

- What the assumption represents, and how it interacts with other assumptions. For decrement assumptions, this may include what decrement events are covered /

excluded. For a maintenance expense assumption, this may include whether the assumption is effective at the middle or start of the period;

- What the assumption was weighted by e.g. claim amounts or claim count;
- The effective term of the assumption: monthly rate, annual rate, or compound rate; and
- Period the assumption is expected to be correct for. For instance whether the assumption will become out of date over time due to expected mortality improvements, or expected economic effects.

Depending on the stakeholder, it may be beneficial to convey to the audience:

- An explanation that assumptions can only represent an estimate of future experience, actual experience will be different and may be better or worse
- Where an assumption has been provided by a different area of the business (e.g. projected sales volumes for business planning), what steps the actuary has taken to assess their reasonableness and what their conclusions on reasonableness are. In some circumstances, the actuary may decide they are not best placed to provide a view on reasonableness, whereby it is a sensible precaution to state this to avoid the perception that the actuary endorses the assumption, along with a summary of any information the assumption provider has given to support their assumption
- A statement offering to make a full list of assumptions available on request (if these are not included in the document already)
- How consistent the proposed assumptions are with other bases used by the company
- A version history log for the document(s) indicating who has reviewed and when.

Additional care may be helpful with regards to checking the documentation is appropriate for the stakeholder. This might include considering the language used in reports, and how technical terms are defined and technical concepts explained.

Appendix A – Further reading

Accounting standard

- Australian Accounting Standards Board (2014). AASB 1038: Life Insurance Contracts.

http://www.aasb.gov.au/admin/file/content105/c9/AASB1038_07-04_COMPdec13_01-14.pdf

Australian prudential standards

- Australian Prudential Regulatory Authority (2013). Life Prudential Standard LPS (115): Insurance Risk Charge.

http://www.apra.gov.au/lifs/PrudentialFramework/Documents/LPS-115-Capital-Adequacy-Insurance-Risk-Charge-January-2013.pdf

- Australian Prudential Regulatory Authority (2013). Life Prudential Standard (LPS) 320: Actuarial and Related Matters.

http://www.apra.gov.au/CrossIndustry/Documents/141120-LPS-320.pdf

- Australian Prudential Regulatory Authority (2013). Life Prudential Standard (LPS) 340: Valuation of Policy Liabilities.

http://www.apra.gov.au/lifs/PrudentialFramework/Documents/LPS-340-Valuation-of-Policy-Liabilities-January-2013.pdf

Institute professional standards, guidance and learning material

- The Institute of Actuaries of Australia (2015). Professional Standard PS 200: Actuarial Advice to a Life Company or Friendly Society.

http://actuaries.asn.au/Library/Standards/LifeInsuranceWealth/2015/PS200July2015Clean.pdf

- The Institute of Actuaries of Australia (2017). Information note: Analysing Disability Income Experience and Assumption Setting

This paper provides information on issues to consider when reserving for disability income products and analysing claims experience to assist with setting assumptions regarding future claims experience.

- The Institute of Actuaries of Australia (2016). Information note: Framework for setting life insurance risk margins for regulatory capital

http://actuaries.asn.au/Library/Standards/LifeInsuranceWealth/2016/LIWMPCDNSettinglifeinsuranceriskmarginsMarch2016Final.pdf

This paper provides information on the setting of risk margins for use in the calculation of the prescribed capital amount under LPS 110 (Capital Adequacy) and LPS 115 (Capital Adequacy: Insurance Risk Charge).

- The Institute of Actuaries of Australia (2014). Information note: IBNR

http://actuaries.asn.au/Library/Standards/LifeInsuranceWealth/2015/DNIBNRDec2014.pdf

This paper provides information on a subset of available methodologies to determine the best estimate of IBNR reserves, and the associated advantages and disadvantages, applications and examples of each method.

- The Institute of Actuaries of Australia (2013). Information note: Asymmetric risks

http://actuaries.asn.au/Library/Standards/LifeInsuranceWealth/2013/LIWMPC-Asymmetric%20Risk-Jan2013.pdf

This paper provides information on the issues when assessing asymmetric risks for, in particular, determining policy liabilities, economic valuations, product pricing, bonus philosophy and setting investment policy.

- The Institute of Actuaries of Australia (2012). Information note: Discount Rates for APRA Capital Standards

http://actuaries.asn.au/Library/Standards/LifeInsuranceWealth/2012/LIWMPC_GIPC_DiscountRateLAGICDec2012.pdf

This paper provides information on issues in determining discount rates (pre allowance for any applicable illiquidity premium) under regulatory prudential capital standards effective 1 January 2013.

- The Institute of Actuaries of Australia (2012). Information note: Development and use of volatility assumptions

http://actuaries.asn.au/Library/Standards/LifeInsuranceWealth/2012/LIWMPCVolatilityAssumptionsJan2012.pdf

This paper provides information on issues in developing and using volatility assumptions.

- The Institute of Actuaries of Australia (2010). Information note: Risk-free Discount Rates under AASB 1038

http://actuaries.asn.au/Library/Standards/InfoNoteRiskFreeDiscountRatesunderAASB1038Mar2010.pdf

This paper provides information on issues in determining risk free discount rates under AASB 1038.

- The Institute of Actuaries of Australia. The Practice of Life Insurance in Australia – Part A, (2014 ed.) Chapters 12, 13, 14, 15 and 16

The text book chapters 12 through to 16 cover the experience analysis and assumption setting for discontinuances and lapses, mortality, morbidity, expenses and economic assumptions.

International references

- Board for Actuarial Standards (2010). Technical Actuarial Standard D: Data, Financial Reporting Council.

http://www.frc.org.uk/Our-Work/Codes-Standards/Actuarial-Policy/Technical-Actuarial-Standards/TAS-D-Data.aspx

This paper provides UK data standards for actuarial work falling within its scope covering scrutiny and checking of data, and actions taken if data is inaccurate or incomplete.

- Board for Actuarial Standards (2010). Technical Actuarial Standard M: Modelling, Financial Reporting Council.

http://www.frc.org.uk/Our-Work/Codes-Standards/Actuarial-Policy/Technical-Actuarial-Standards/TAS-M-Modelling.aspx

This paper provides UK modelling standards for actuarial work falling within its scope.

- Board for Actuarial Standards (2010). Technical Actuarial Standard R: Reporting, Financial Reporting Council, Version 2.

http://www.frc.org.uk/Our-Work/Codes-Standards/Actuarial-Policy/Technical-Actuarial-Standards/TAS-R-Reporting-Actuarial-Information.aspx

This paper provides UK reporting standards for actuarial work falling within its scope.

- International Actuarial Association (2012). International Standard of Actuarial Practice 1: General Actuarial Practice.

http://www.actuaries.org/CTTEES_ASC/Documents/ReformattedISAP1FDNALOCTOBER_correctedJan2014.pdf

This paper provides guidance on general actuarial principles when carrying out actuarial services.

Generalised linear models and credibility

- Willis Towers Watson (2007). A Practitioner's Guide to Generalized Linear Models, 3rd Edition.

https://www.towerswatson.com/en/Insights/IC-Types/Technical-Regulatory/2010/A-Practitioners-Guide-to-Generalized-Linear-Models

This paper is written for the practicing actuary who would like to understand generalized linear models (GLMs) and use them to analyse insurance data.

A large amount of material on credibility is available on the Society of Actuaries website.

- Mahler. H C. and Dean. C. G. (2001). Credibility. Society of Actuaries, Chapter 8 Study Notes.

https://www.soa.org/files/pdf/C-21-01.pdf

This paper provides a comprehensive explanation and examples of credibility models including the classical credibility model and Buhlmann (Bayesian) credibility, as well as practical issues in the application of credibility theory including some examples of how to calculate credibility parameters.

- Taylor. G. (2015). A few basics of credibility theory. Institute of Actuaries of Australia

http://www.actuaries.asn.au/Library/presentation-Taylor050315.pdf

This presentation covers a few of the fundamental concepts of credibility theory.

- Taylor. G. (2007). Computation of Credibility Coefficients for Pricing. Institute of Actuaries of Australia

http://www.actuaries.asn.au/Library/GIPS%20ppt%20Greg%20Taylor.pdf

This presentation provides examples of credibility applied to pricing.

Appendix B - Analytical tools and techniques

B.1 General Linear Models

A General Linear Model ('GLM') is a tool that can be utilized to enhance the experience investigation and assumption setting process. This note does not provide details about fitting the model and interpreting and using the results. However, the following high level comments may be taken into account:

- A GLM can be used to understand significant variables and combinations of significant variables
- There is some degree of judgement required. Some variables are significant for males, but not for females or white collar and not blue collar. The user needs to consider what variables to include in the GLM and the impact on resulting assumptions
- A GLM can be difficult to interpret, adjust and understand movements
- A GLM will not necessarily deliver a good fit, as experience does not follow a formula
- Extensive iterations using different combinations of variables might be required to see which combination delivers a good fit and would also provide well-structured assumptions

B.2 Univariate versus multivariate analysis

Doing a series of univariate (one-way analysis) analyses might not capture interaction between different factors. For example, the drivers of accidents and sickness claims are very different and looking at incidence experience by gender but with combined accident and sickness claims experience might obscure some underlying interaction. The analysis could be expanded to three or more variables.

Judgement is required to balance the need for credibility within each data cell and the allowance for interaction effects. The more factors applied, the more difficult it also becomes to interpret the analysis and come up with a pragmatic assumptions structure.

As there are many possible factors, some judgement is required to decide which combinations of factors to consider, taking into account the nature of the event and what drives it. The use of a GLM can assist to identify which combinations of factors are significant.

The use of the assumptions might also dictate how granular the assumptions have to be.

- For pricing, there might be a need to get the expected experience as accurate as possible for every premium rating cell.
- For valuation, the overarching requirement is that the level of claims is correct at the portfolio level, however if there are cross subsidies in the assumptions this might lead to unintended consequences as the business mix changes in the projection.

In addition, to make sure that interaction effects are not double counted, the results may be standardised for each step change made to the assumptions. While the potential for double counting always exists, the impact is particularly acute when factors are strongly correlated. One optimal way to derive assumptions would be to:

- first, decide what the main driver of the experience is
- second, apply the loading to the assumptions
- third, recalculate the experience for the other factor.

This approach can be extended to deriving a "hierarchy" in which each assumption factor is assigned an order of importance in driving the experience, and the assumptions successively derived using that hierarchy. For example, for disability income terminations one possible hierarchy might be claim duration, cause of claim, age at claim, occupation, sex, etc.

Appendix C - Credibility theory

Companies attempt to forecast claim costs, for example, using two sources: the company's own historical claims experience ("internal") and external claims experience. This information is combined to derive the company's 'best estimate' for the future period.

The key issues faced are the following: *To what extent is it right and proper to forecast future claim costs by extrapolating the company's historical data? If we conclude that the experience data is not a completely reliable source for this exercise, what other sources should be used, and in what way?*

Credibility theory is a method employed to derive the company's best estimate assumption using a weighted average of the best value obtained using internal and external claims experience. For example, the internal loss ratio for a group scheme might be obtained as a weighted average between the company's overall group claims experience and the loss ratio based on the scheme's specific experience. Weighting could also be applied to the reinsurer's implied loss ratio.

The standard credibility methods and applications used by actuaries are the:

- Frequentist Method
  - Greatest Accuracy Credibility Method – also known as Bayesian credibility, linear Bayesian credibility and Buhlmann credibility
  - Limited Fluctuation Credibility Method
- Bayesian Methods
  - Least squares
  - Bühlman, Bühlman-Straub
  - Empirical Bayesian

Caution should be exercised when using the term 'credibility' with non-actuaries as low credibility might be interpreted as meaning not believable. The term 'statistical credibility' could be used to make clear the concept.

Typically, more weight should be applied to the company's own experience as the business for which the assumption is being derived increases. For example, for DI products, policyholders that file for a claim remain exposed to risk in future periods. For a closed or small block of DI active lives, the claims experience in one period is a good predictor of the claims experience in succeeding periods. Consequently, more weight should be applied to the company's own experience.

It is important to apply judgement and sense when assessing the credibility of historical data.

END OF INFORMATION NOTE