LIFE INSURANCE AND WEALTH MANAGEMENT PRACTICE COMMITTEE

Information Note: Framework for setting life insurance risk margins for regulatory capital

March 2016

Contents

1.0 Introduction

This Information Note was prepared by the Life Insurance Risk Margins Task Force on behalf of the Life Insurance and Wealth Management Practice Committee (LIWMPC) of the Institute of Actuaries of Australia (Institute). This Information Note does not represent a Professional Standard or a Practice Guideline of the Institute.

It has been prepared for the purposes of providing information and generating discussion on the setting of risk margins for use in the calculation of the prescribed capital amount under Life Prudential Standard (LPS) 110 Capital Adequacy (LPS 110) and LPS 115 Capital Adequacy: Insurance Risk Charge (LPS 115).

This Information Note takes ideas from the 2009 general insurance paper *A Framework for Assessing Risk Margins* developed by the Risk Margins Taskforce of the Institute.[1] It presents a framework for setting life insurance risk margins which is similar to, but less complex than, the approach described in the general insurance paper.

The framework and examples presented in this Information Note are not exhaustive, and other valid approaches could be adopted by companies. It is anticipated that the level of sophistication applied in setting margins is commensurate with the scale, nature and complexity of a company's business and risk profile.

Feedback from Institute Members is encouraged and should be forwarded to the Life Insurance Risk Margins Task Force via Mr Rob Desoisa at rob.desoisa@au.ey.com

2.0 Background

2.1 Requirements of LPS 115

Under LPS 115 the Insurance Risk Charge is the reduction, if any, in the capital base that would occur if the adjusted policy liabilities were changed to stressed policy liabilities.

The stressed policy liabilities must be determined in the same way as the risk-free best estimate liability (RFBEL) or participating policy liability (PPL) but using stressed assumptions in respect of morbidity, longevity, lapses, servicing expenses and any other insurance risks.

The following stress margins are required to be applied to the best estimate assumptions when determining the stressed policy liabilities:

1 Available online at: http://www.actuaries.asn.au/Library/Framework%20for%20assessing%20risk%20margins.pdf

(a) mortality random stress;

(b) morbidity random stress;

(c) mortality future stress;

(d) morbidity future stress;

(e) event stress;

(f) lapse stress;

(g) longevity stress

(h) servicing expense stress and

(i) other insurance contingencies.

The stress margins, before adjustment for diversification, must be determined at a 99.5 per cent probability of sufficiency over a 12 month period. This means that, in the assessment of the Appointed Actuary, there is no more than a 0.5 per cent probability that the actual cost of claims will exceed the stressed estimate. The LPS 115 margins are in respect of liabilities net of outwards reinsurance. Gross of reinsurance margins may be required for the purpose of determining the Asset Concentration Risk Charge under LPS 117 Capital Adequacy: Asset Concentration Risk Charge (LPS 117).

The longevity stress margin and the servicing expense stress margin are specified by APRA and therefore will not be discussed further in this Information Note.

During 2013, an Institute taskforce raised a number of questions with APRA regarding the ways in which LPS 115 was being interpreted. APRA responded on 29 October 2013 by releasing a letter to life insurers on the interpretation of the capital adequacy standards.[2] This Information Note has had regard to the guidance in APRA's letter.

2.2 Framework

The following sections discuss considerations for determining stress margins under LPS 115 and sets out a framework which draws from the approaches used by general insurers. Other approaches, appropriate for the nature, scale and complexity of an insurer, may be equally valid.

2 Refer to the 29/10/2013 letter at this address http://www.apra.gov.au/lifs/Pages/other-information-for-life-insurance.aspx

3.0 Structure of this Information Note

The Information Note is structured as follows:

- Section 4 sets out a broad set of principles that underpin the framework for determining stress margins described in this Information Note.
- Section 5 discusses the typical methods that can be used to calculate random stress margins.
  - The strengths and limitations of each of the methods are discussed along with the Taskforce's observations of the circumstances in which each method might be appropriate.
  - Annexure A provides some illustrative examples to support those methods.
- Section 6 discusses the framework for determining future stress margins.
  - The strengths and limitations of the framework are discussed.
  - Annexure C provides a worked example of the application of the framework.
- Section 7 discusses considerations in assessing whether the event stress margin specified by APRA is adequate.
- Section 8 discusses the potential methods for determining the lapse stress margin.

4.0 Principles for determining stress margins

The approach for determining stress margins described in this Information Note employs the following set of principles:

- Risk margins reflect the risk profile of an organisation and are revised in accordance with changes in the organisation's risk profile.
- Consistency in the approach to setting margins across time periods and products.
- The approach to setting margins allows the Board to take ownership of stress margins by facilitating greater understanding of risk drivers (rather than technical elements).
- The level of sophistication applied in setting margins is commensurate with the scale, nature and complexity of a company's business and risk profile.

- Clear documentation of the framework employed – particularly any areas where judgment has been exercised.
- Insurers may choose to review the risk margins annually in line with the emerging experience. The framework could be reviewed at least every three years (or when there are material changes in the business), including active interactions with business unit management.

Various approaches to setting margins may be consistent with these principles. The methods suggested in the remainder of this Information Note adhere to these principles while providing practical and flexible structures within which to work.

5.0 Random stress margins

5.1 Background

Under LPS 115, the requirements relating to random stress margins include:

- application term: 12 months from the reporting date;
- purpose: to reflect uncertainty in insurance claim outcomes arising due to adverse fluctuations in experience, but excluding the impact of single events such as pandemics, terrorist attacks and natural catastrophes that could cause large numbers of claims; and
- considerations: the size of these margins will depend on factors such as (but not limited to) the expected volume of incidence (or termination) of claims, the distribution of sums insured, and the impact of existing reinsurance arrangements.

As portfolio size and characteristics vary between companies, the range of random stress margins across the industry may be quite wide. Thus benchmarking only has limited application when considering the magnitude of an individual company's random stress margins.

5.2 Approaches

The quantification of random stress margins is less subjective than setting future stress margins.

In general, the random stress margin is calculated as:

(99.5% Random Claim Amount - 50% Random Claim Amount) /
(50% Random Claim Amount)

where the 50% Random Claim Amount is in line with the Best Estimate Claim level.

The following are common approaches for determining the random claim amount (in a decreasing level of complexity):

(a) Full stochastic simulation method

Based on a stochastic simulation of outcomes at an individual benefit level for the portfolio.

(b) Simplified stochastic simulation method

Based on a stochastic simulation of outcomes for key sub-groups within the portfolio (that is, less granular than the full simulation method).

(c) Statistical method

Based on a statistical distribution with parameters calibrated to the portfolio.

Refer to Annexure A for detailed discussions of the respective approaches, including illustrative examples.

Although expected to produce a more accurate result, the more complex approaches will generally entail higher data and system requirements. Companies may assess the cost and benefits of these methods, including the materiality of stress impacts, to establish the most appropriate approach for their business.

However, it is not necessary to be limited to any single method. A blended approach could provide more flexibility in setting the stress margins. For example:

- a statistical method complemented by a simplified stochastic simulation approach to estimate the tail segments of the claims distribution; or
- a statistical approach combining suitable distributions – for example, a normal distribution for the non-tail portions with a Weibull distribution to estimate the claims risk in the tail.

5.3 Granularity of random stress margins

Typically, the determination of random stress margins is considered at various levels of granularity. These include, but are not limited to, the following.

5.3.1 Mortality and morbidity

Random margins must be set separately for morbidity and mortality. This is because diversification between morbidity and mortality is applied via the correlation matrix under paragraph 42 of LPS 115.

5.3.2 Product level

Ideally, the calculation of random stress margins should be at statutory fund level. Two margins would be calculated: one for mortality and one for morbidity. Calculating margins at a statutory fund level will implicitly allow for diversification across products and so generate the level of stressed liabilities anticipated by the standard. However, it may not be possible to do this as multiple approaches to calculating the stress margins for different products may be required due to data or other limitations on components of the portfolio.

Where it is not possible to perform the calculation at an aggregate level, diversification factors may be applied to the product level margins so as to approximate an aggregate stress margin for mortality or morbidity. The margins across products could be aggregated using the approach for aggregating future stress margins, which is discussed later in this Information Note.

It may also be desirable to calculate the random stress margin at a lower level and then aggregate in order to allocate capital between products. In this circumstance, the aggregate diversification benefit can be quantified as the difference between the stressed liabilities as calculated using individual margins and the stressed liabilities as calculated using aggregate margins. Companies can then consider how this diversification could be allocated across products.

5.3.3 Components of liabilities

The impact of the random stress needs to encompass all constituents of the liabilities (that is, active lives reserves, Claims in course of payment (CICP) reserve, Incurred but not reported (IBNR) reserve and Reported but not accepted (RBNA) reserves, etc). As per Section 5.3.2, ideally the stress margin is calculated at an aggregate level as the combined 99.5% level of statistical fluctuation across all components of the liability.

In order to determine the combined stress scenario adjustment (as well as potentially allocate stress margins to products), it may be desirable to assign random stress margins to each component of the liabilities (claims incidence, terminations, emergence of IBNR and approval of RBNA). As per Section 5.3.2,, in this circumstance the aggregate diversification benefit can be quantified as the difference between the stressed liabilities calculated using individual margins and the stressed liabilities calculated using aggregate margins. Companies can then consider how this diversification could be allocated across the components of the liabilities.

5.4 Other considerations and complications

5.4.1 Frequency of review

As the risk profile or volume of business in a statutory fund changes, the random stress margins would be expected to change to reflect this. Insurers may choose to review random stress margins annually, with more frequent reviews in response to changes such as:

- business mix variations – for example, a large increase in the size of risk portfolios due to a statutory fund amalgamation, a business acquisition or the win or loss of a large group scheme;
- risk profile – for example, changes in reinsurance arrangement; and/or
- material revisions in best estimate actuarial assumptions.

5.5 Data limitations

Adopting the full simulation method described above requires the best estimate mortality or morbidity rates and sum assured at a detailed policyholder level. This level of granular information may not always be available (for example, the individual member details for Group insurance policies).

Possible approaches to address this include:

- approximate key characteristics of the data based on industry information (for example, from reinsurers);
- data groupings with similar risk characteristics; and/or
- use data for other parts of the business as a proxy, adjusted for the difference in number of policies and known differences in the demographics and/or insured risk profile.

5.5.1 Aggregation of margins

Subject to the granularity at which the random stress margins are set, companies may need to appropriately aggregate the individual stress margins to arrive at an adverse insurance outcome consistent with the 99.5% probability of sufficiency. This is discussed further in Section 5.3 of this Information Note.

5.5.2 Gross and net of reinsurance random stress margins

The random stress margins are to capture statistical variability to which the company is exposed. As such, a net of reinsurance margin is required in calculating the Insurance Risk Charge.

For the purpose of determining the Asset Concentration Risk Charge under LPS 117, a separate gross (or reinsurance) random stress margin may also need to be calculated. Materiality is a key consideration in determining if both gross and net margins are required. Companies would assess whether using only a net of reinsurance stress margin would produce a materially accurate result.

6.0 Future stress margins

6.1 Background

Under LPS 115, the requirements relating to future stress margins include:

- application term: applied from the reporting date for the remaining term of the liabilities;
- purpose: to reflect the risk with regards to potential adverse changes to best estimate assumptions over the 12 months following the reporting date, relating to:
  - mis-estimation of the central estimate – this relates to the adequacy of the investigations, the quality of data used and the risk of analysis error in determining the best estimate assumptions;
  - changes in future experience – this could be due to adverse trends, cyclicality, systemic changes, changes in claims management and underwriting practices;
- considerations:

  Mis-estimation of the central estimate may arise due to the best estimate assumptions being based on past experience that is itself subject to random variation. However, as indicated in APRA's 29 October 2013 letter to life insurers, it is not appropriate to set future stress margins simply by presuming the usual assumption setting process will continue to be applied but with 12 months of additional adverse experience data. At the 99.5 per cent confidence level, a range of other issues could affect the best estimate assumptions.

The changes in future experience can be considered to arise from the following:

- 'Internal factors' – that is, factors internal to and, to some degree, under the control of the insurer; and
- 'External factors' – that is, factors in the environment external to the insurer over which it has little direct control.

To determine an appropriate stress for future risk, each risk and the extent to which it can affect mis-estimation and trends in claim experience can be considered. Once this has occurred for each risk, the impact can be aggregated to form an overall future risk stress.

While the impact of risks may vary significantly by company, market segment and risk type, a consistent framework for identifying and determining stresses with regards to these risks can be used.

The following sections discuss: a possible framework; the sources of information that can be used to determine an appropriate stress margin for individual risks; as well as an approach to aggregate the risks together to form the future stress margin required under LPS 115.

6.2 Framework

This section discusses the suggested framework, which allows companies to systematically work through a number of steps and determine margins appropriate for their business. The framework aligns with the principles set out in Section 4.0 of this Information Note.

The approach is designed to establish a repeatable and understandable process around setting future stress margins. This enables business or environmental changes each year to be reflected through changes in the stress margins. It also helps to ensure consistency between products and enables interaction between departments in setting the margins (for example, underwriting, claims management, risk, pricing and capital management). Additionally, it is likely to improve the Board's understanding of the drivers behind changes in risk margins and lead to a better understanding of the company's risk profile.

While there will always be subjectivity regarding future trends in experience, the suggested approach is designed to facilitate the consistency of judgments made when setting the margins. Additionally, while parts of the approach remain subjective in nature, it is clearer with this approach where and how this subjectivity is applied.

The remainder of this section describes the steps of the framework set out in the table below. A worked example is included in Annexure C.

Step	Framework component	Steps	Section of Information Note
1	Portfolio preparation	Set valuation/ product classes	6.2.1
2	Sources of uncertainty/ risk analysis	Define risk categories based on: Internal risk analysis External risk analysis	6.2.2
3	Set risk factors	For each valuation class and risk category, assign a risk factor (for example, 1-5)	6.2.3
4	Assign stress margins	For each risk factor, assign a stress margin	6.2.4
5	Aggregate undiversified stress margins	For each valuation class, calculate an overall stress margin	6.2.5
6	Aggregation of margins	Determine what diversification benefits apply Assign correlation factors Calculate diversified stress margins	6.2.6 & 6.2.7
7	Additional analysis / validation of margins	Sensitivity testing or scenario testing Internal and external benchmarking Hindsight analysis	6.2.8

6.2.1 Portfolio preparation

Step 1: Set valuation/ product classes

Before commencing any analysis, the portfolio is split into appropriate valuation/ product classes. Future stress margins represent potential adverse changes to best estimate assumptions and would be set for each of these valuation classes.

The key considerations in setting a class are as follows.

- LPS 115 requirements: future stress margins must be set separately for mortality and morbidity because diversification between mortality and morbidity is applied via the correlation matrix under paragraph 42 of LPS 115;
- the level at which best estimate assumptions are set – consider the level of granularity at which assumptions are determined and whether it is significant enough to perform meaningful analysis; and

- the nature of the risk within the valuation class (aiming for homogeneous risk groupings while containing sufficient data to remain credible).

  While valuation classes would differ across companies, the typical valuation/ product categories might consist of:

  - Individual Death / TPD / Trauma
  - Individual DI Incidence / DI terminations
  - Group Lump sum
  - Group salary continuance (GSC) Incidence/GSC terminations

  Consideration should be given to having separate groups for active lives, CICP, RBNA and IBNR (especially in the case of group business).

  Other considerations include:

  - potentially splitting classes by distribution channel if the risks are considered to vary materially by channel; and
  - splitting classes between Statutory Funds to ensure that diversification benefits are not determined across Statutory Funds.

6.2.2 Sources of uncertainty / Risk analysis

Step 2: Define risk categories

Consideration should now be given as to what risks to future claims experience the valuation classes/products are exposed. In deciding upon the number of risks, there is a trade-off between:

- a high number of risk categories, which will make it easy to reflect changes in risk profile over time and differences in risk profile between valuation classes/products; and
- a low number of risk categories which will make the framework easier to understand and lead to a simpler process of assigning value to the risks.

The Taskforce considered it desirable to group risks where possible. For example, data quality might be a specified risk which would include quality of data in the underlying systems, quality of data cleansing processes, access to data, etc.

One approach to identifying the appropriate risk categories is to separate risks into ‘internal’ and ‘external’ risks.

Internal risks

Internal risks factors are those internal to and, to some degree, under the control of the insurer.

The following list outlines some of the broad risk categories that could be used but is by no means an exhaustive list. Annexure B provides some more detail to assist in thinking through what may be included in these risk categories.

- data quality: Product Administration System (PAS) and Claims Administration System (CAS) quality, PAS and CAS stability, data cleansing, reconciliations;
- experience investigations, assumptions and modelling process: quality of rating factors, stability of experience investigations, materiality of assumptions, known errors, allowance for trends not incorporated in the best estimate assumptions, extent to which models are representative of the underlying insurance process;
- product- and company-specific factors: distribution risk, underwriting risk, ageing of the portfolio; and
- claims management risk: claims team resourcing levels, claims management processes and systems quality (linked to data quality above), capability of claims team.

External risks

External systemic risk analysis: this is a systemic approach for the risks that have not emerged in past experience but may arise in future experience due to factors in the environment external to the insurer over which it has little direct control. Risks that form part of event stress (for example, pandemics) should not be included here.

The following list outlines some examples of broad categories of external risks. Further descriptive detail can be found in Annexure B.

- medical risk: new diseases, new diagnostic tools;
- competition and reputation risk: expanding benefit definitions, increases in automatic acceptance levels, increased customer awareness/financial education, distribution channel quality/reputation;

- economic and social (general environment outside of life industry) risks: unemployment/economic downturn, lifestyle changes/trends, social media, globalisation; and
- legislative and legal risk: emerging trends of legal activity, legislative changes.

Once the valuation classes/products and risk categories have been identified, a matrix is formed as set out below:

Valuation classes/ products	Risk categories				
	Risk 1	Risk 2	Risk 3	...	Risk r
Product 1					
Product 2					
...					
Product p					

6.2.3 Set risk factors

Step 3: assign risk factors to capture the relative impact of a 1 in 200 year stress on the future claim cost of a valuation class/product

Once the matrix of valuation classes/risk categories has been established, a risk factor is assigned to each risk category for each valuation/product class.

For example, a risk factor from 1 to 5 can be assigned.

The risk factor represents the relative impact of a 1 in 200 year stress on the future claims cost for each product. A risk which would have a minimal financial impact even in a 1 in 200 year stress would be rated as 1. A risk which would have a catastrophic financial impact in a 1 in 200 year stress would be rated as 5.

Considerations in setting risk factors include:

- The views of experts in the area – for example, the actuaries involved in setting best estimate assumptions (for assumption setting process risk) and the claims management team leader (for claims management risk).
- Past experience/data available for particular risks – for example, sources of information could include:

Internal sources

- the history of experience investigations;
- valuation and assumption reports; and
- internal risk monitoring.

External sources

- APRA industry statistics;
- industry mortality and morbidity investigations;
- statistics from the Australian Bureau of Statistics;
- health databases; and
- other regulatory regimes (for example, Solvency II).

- Consistency with other risk assessments performed (for example, as part of the risk management framework implemented by the risk function).
- High level reasonableness checks, such as considering consistency of the risk factors between products and risks.

6.2.4 Assign stress margins

Step 4: determine a scale of stress margins which corresponds to the risk factor scale

The risk factors must now be converted into stress margins. Stress margins are set for each risk factor – for example, 1 to 5 could correspond to stress margins from 5% to 200%.

The stress margins would not be expected to increase linearly as risk factors increase. The financial impact of a risk rated with a risk factor of 5 would be expected to be well in excess of 5 times a risk rated with a risk factor of 1.

Quantification of the stress margins will likely be a progressive exercise, involving a high degree of subjectivity at first, but with the potential to become more objective over time as experience emerges. Certain examples have been provided below to demonstrate this.

Setting the stress margins would require:

- judgment and calibration to current margins/other benchmarks;
- use of data where possible to anchor some stress margins to objective measures; and
- engagement of risk and subject matter experts.

Examples

Example 1 – data quality

Consider Company A, a large well diversified insurer with a portfolio of retail and group business.

Company A manages the data for its retail business on a number of different administration systems. Appropriate data cleansing and reconciliation processes are in place for retail data. In the past 5 years, the errors in relation to retail data have been able to be identified quickly and have not had a material impact on results (4 errors in the last 5 years with a BEL impact of <$200K each).

For group business, Company A has a number of different sources of data and the quality of the data varies by scheme. For certain schemes, there is a significant amount of work involved in data cleansing and understanding the data on a regular basis. The checking processes around the data processes are not well documented and appropriate controls are not in place to identify data errors in a timely manner. In the past 3 years, there have been 12 incidences relating to data errors. These errors have led to an adverse impact of approximately $20m in the last year and $10m each in previous years.

In the above scenario, it is appropriate for Company A to choose a higher risk factor (data quality) for group business in comparison to retail business. In choosing the risk factor for group business, Company A should consider the magnitude of the losses in the past few years.

For example, if Company A considers that a 100% margin (Risk factor: 4) on group business is sufficient to cover a $30m loss (a 1 in 200 loss based on extrapolating available historical loss data), then a risk factor of 4 in this case might be appropriate.

Example 2 – assumption process

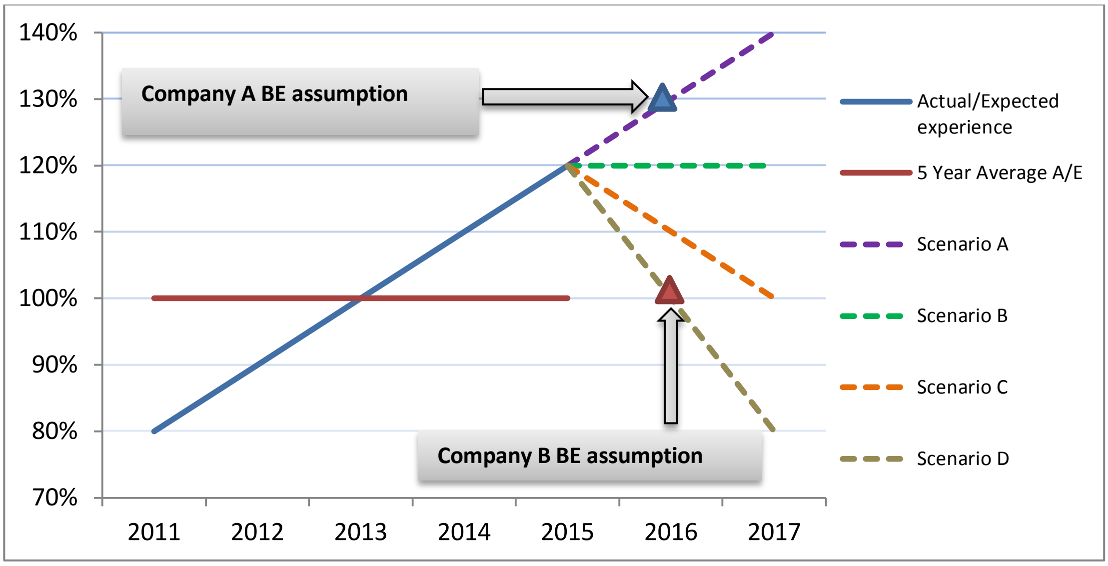
Consider two medium-sized companies, Company A and Company B, selling retail lump sum and disability income business in the Australian market.

For this example it has been assumed that both Companies A and B have similar portfolios of business and are similar in respect to their claims management and underwriting approach. Further, both companies have faced similar claims incidence experience for disability business in the past 5 years relative to their assumptions (denoted by solid blue line in the figure below).

Company A has considered the worsening in the disability incidence trend in the past two years and chosen to set its best estimate assumption by giving additional weighting to the more recent experience (that is, at a 30% level above its 5 year average (130% A/E level)).

Company B has chosen to set its best estimate assumption at the 5 year average level (100% A/E level) in line with its assumption setting philosophy. The assumptions are set equal to the '5 year average' experience (100% A/E level) with no additional weighting given to the adverse upward trends in the experience in the past 2 years.

This is illustrated in the graph below. The 'scenarios' illustrated by the dashed lines show a range of possible outcomes for future experience.



It is appropriate for Company B to choose a higher risk factor in comparison to Company A, given that Company B has not given additional weighting to the upward trend of the experience in the past 2 years in setting its best estimate assumption.

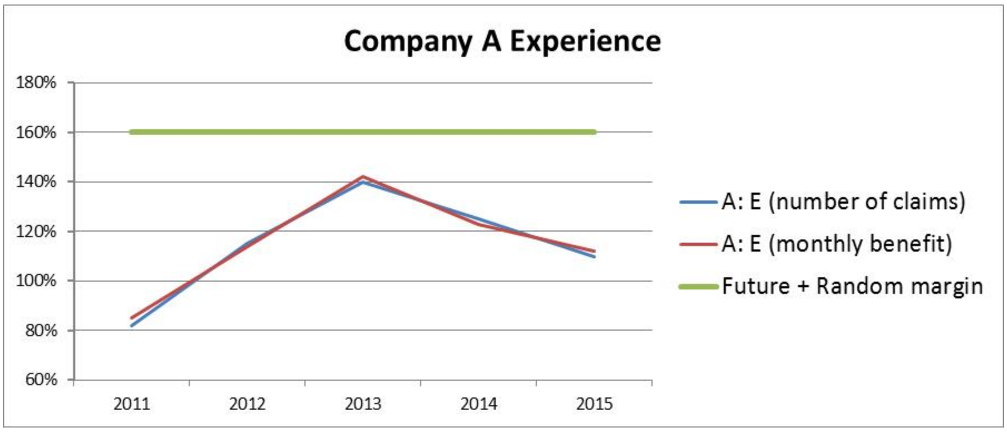
Example 3 – hindsight analysis (evolution from subjective to objective approach to setting margins)

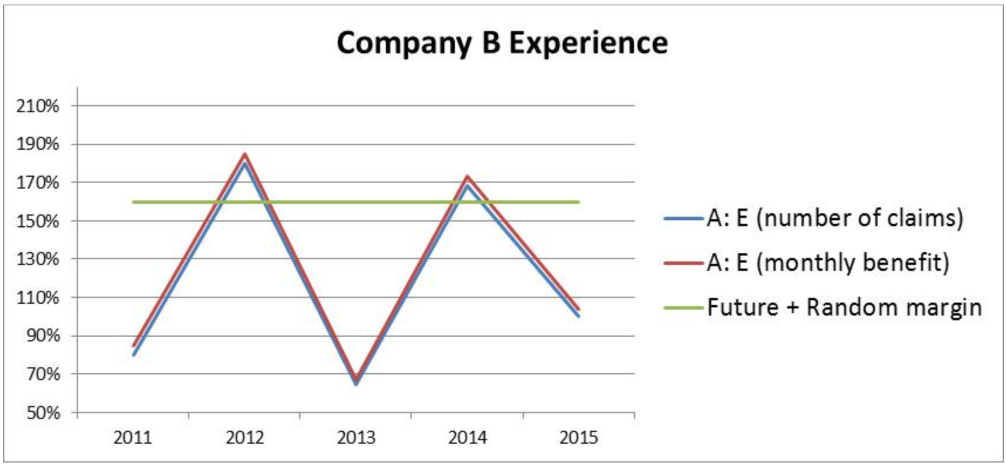
This example illustrates an approach for companies to back-test the sufficiency of their margins against historical experience.

Consider Companies A and B who choose to set their future (52%) and random margins (30%) at the same level.

The following charts show the stress margins compared with variances in Company A and Company B's recent experience. Because the experience includes fluctuations due to both future risks and random statistical fluctuations, the experience is compared to the sum of the future and random stress margins.

The analysis shows that, for Company A, the stress margins (combined random and future stress margins) are sufficient to cover observed adverse experience relative to best estimate assumptions over the five year time horizon in the experience investigations. However, for Company B, the stress margins are not likely to be sufficient to cover the respective volatility, given that in two of the past five years, the experience observed has been worse than the 160% level (stresses combined using square root of $x^2 + y^2$). For company B, the example highlights the importance of further work to understand the drivers of the volatility in experience, which will then guide in setting the stress margins.





6.2.5 Aggregate undiversified stress margins

Step 5: determine an undiversified stress margin for each valuation class

An overall stress margin for each product/valuation class is determined by aggregating the risk factors across risk categories.

A number of approaches could be used here with varying degrees of sophistication. The approach presented in this Information Note is simple and is done in two steps:

- for each risk factor in the valuation class/risk matrix, the corresponding stress margin (set in Section 6.2.4 above) is assigned; and
- the initial undiversified stress margin is determined by averaging these converted risk factors across all risk categories for each valuation class.

Note that the stress margins corresponding to risk margins are averaged rather than the risk factors being averaged. This is to:

- allow for the likely non-linear shape of the stress margins; and
- more appropriately capture the impact if additional risk factors are added in the future.

The approach presented is simple, but companies could potentially increase the sophistication over time.

6.2.6 Aggregation of margins

Step 6: allow for diversification in the margins that have been set for each valuation class

A process of aggregation must be considered to allow for diversification benefits between different margins to ensure an overall probability of sufficiency of 99.5% at the statutory fund level. This can be achieved through the use of correlation matrices. Once these matrices have been established, they can be applied to the undiversified stress margin impacts to determine the diversified margins.

Considerations for diversification

Under LPS 115, there is explicit allowance for the diversification benefits between:

- random and future margins; and
- morbidity and mortality margins.

However, LPS 115 does not explicitly allow for any diversification benefits between:

- different types of morbidity margins (that is, diversification benefits between TPD, trauma, and disability);
- margins applied on different reserves (that is, diversification benefits between morbidity/mortality, IBNR and RBNA);
- different business units (that is, group risk, retail risk, direct channel and other risk products); and
- different causes of adverse experience (if allowed for, this should be incorporated into aggregating the undiversified stress margin).

A simple approach to allow for diversification is to consider correlations between wider, or grouped, valuation classes, rather than attempting to assign correlation coefficients between each individual valuation class. Natural valuation class groupings to consider as to whether diversification may exist include:

- TPD, Trauma and Disability income insurance;
- Retail and Group risk;
- different distribution channels (for example adviser and direct); and
- Reserves (IBNR, RBNA, CICP) and incidence.

In setting up the correlation matrices, allowance could be made for diversification between valuation classes impacted by mortality or morbidity by using two matrices: one for mortality and one for morbidity. The Taskforce considered the benefits of applying smaller sequential correlation matrices (for example, a matrix for distribution channel correlation, a matrix for product correlation, etc). However, the Taskforce's view was that small sequential correlation matrices populated using high level correlations were susceptible to over estimating diversification benefits.

No allowance should be made for diversification between mortality and morbidity as this diversification benefit is explicitly set out in LPS 115.

In determining the magnitude of correlation, a simple approach can once again be adopted. Each set of two items can be considered to have no correlation, low correlation, medium correlation, high correlation or full correlation. Correlation matrices can be assigned using correlation coefficients chosen from a pre-determined range. For example: no correlation: 0, low correlation: 0.25, medium correlation: 0.5, high correlation: 0.75 and fully correlated: 1.

The setting of correlation coefficients can often be subjective. By setting a discrete range of coefficients, it limits the subjectivity. Possible considerations when choosing correlation coefficients may include but are not limited to:

- the impact of risk categories when determining future margins. For example, TPD and disability margins are both highly impacted by economic and social risks, therefore it can be argued that they are more correlated to each other compared to trauma margins;
- the setup of a company's claims process. For example, is the claims management process separated by business unit or is it centrally operated?;
- any crossover of medical conditions between different policy designs/benefits;
- the valuation class/product category – for example, IBNR margins represent possible delays in reporting as well as additional claims being reported. However, RBNA margins do not need to take into account delay factors. Therefore, it can be argued that IBNR and RBNA have low correlation; and
- high level reasonableness checks to ensure that the correlation matrix is internally consistent.

6.2.7 Rounding

6.2.8 Additional analysis / validation of margins

Once an initial set of margins has been determined, it is important to carry out reasonableness checks – particularly when the framework is used for the first time.

There are a number of areas of additional analysis that can be conducted to provide further comfort regarding the outcomes from the deployment of the framework. These include sensitivity analysis, scenario testing, internal and external benchmarking and hindsight analysis.

Some questions for the actuary to consider are:

- Are the final margins reasonable based on the ratings given? It is likely that the actuary will have an idea of the margins expected based on the discussions held to determine the ratings. At this stage stepping back and looking across the product classes it will be clear whether the margins reflect this expectation. For example, it would be expected that products given a rating of ‘5’ in any of the risk categories would have a higher final margin than those with only 1s and 2s. If not in line with expectations, it is possible that either: (i) the means by which the ratings across the risk categories are combined is not working; and/or (ii) there is not enough differentiation between the points on the margin/rating curve; and/or (iii) the risk categories are not of sufficient granularity or are too granular.

- Are the margins and/or risk ratings consistent with the risk ratings carried out as part of risk management framework or ICAAP? The two should be consistent as far as possible, if not linked to one another in some way.

- How does it compare to the margins determined under the existing process? A natural step would be to compare to the company’s existing future margins and possibly even to calibrate any new outcomes to the existing position (although, if this framework leads to significantly different outcomes, it will be important to identify the reasons). If the difference is due to an improved understanding of the underlying risk, then it could be appropriate to reflect this.

- Consistency of margins across product lines. It is likely that the actuary will have views regarding the relative level of stress margins by product. The outcome of applying the framework can be assessed against these broad expectations. It is, however, possible that following the process could equally change or shape expectations about the relative riskiness of products as well.

- Back-testing of margins and correlation assumptions against historical experience. In particular, the overall stress margin can be assessed for reasonableness compared to past changes made to best estimate assumptions. For example, if the outcome of this framework is a 5% stress margin for a particular product line, but the overall mortality/morbidity assumption for that product line has increased or decreased by, say, 10% every 2 or 3 years as part of the assumption review process, it is likely that the stress margin is too low. In such a case, perhaps certain risks have not been considered, the risk factor levels have been set too low, the stress margins associated with risk factors have been set too low or diversification benefits have been over-estimated.

- How do the capital outcomes compare to other measures of insurance risk available? Existing process, such as Economic Capital, may also be a source of information for comparison.

- How do the final stress margins compare to the margins used by others in the industry and are they reasonable based on the nature of the company? Industry benchmarking provides an alternative source of information. Industry benchmarking results should be interpreted with care, as portfolio size and characteristics vary between companies and this can result in a wide range of stress margins across the industry.

6.3 Additional considerations

- Approach to transition to suggested framework – the initial set up of the suggested framework is likely to be resource intensive, both in terms of time and data/information required. This would need to be considered when adopting the framework.

- Calculation of margin gross/net of reinsurance – technically, margins are needed on both a net and gross basis. However materiality should be considered here. For most companies, using gross margins to determine concentration risk would not materially impact the capital position.

- Experience for following 12 months vs change in best estimate assumptions – consideration should be given to how assumptions would change at the end of 12 months, which may be different to the stress experienced within the next 12 months. Given assumption setting processes often look at experience over a number of years, the full stress may not be taken up in the assumptions immediately or, if the actuary setting the assumption takes the view that recent experience is the beginning of an emerging trend, assumptions could change by more than the stress experienced in the 12 months. This is again a very subjective area where many different views can be taken.

- Disability business – The margins determined should reflect the increase in the cost of claims. Consideration should be paid to both incidence (active lives driving the cost of claims) and terminations (open claims driving the cost of claims).

6.4 Strengths and limitations of the approach

6.4.1 Strengths

Aids understanding and communication

The setting of capital margins under the Life and General Insurance Capital (LAGIC) framework is still a relatively new task requiring input from many teams across the business. It is likely that the company will already have an established communication process around the setting of best estimate assumptions.

The straightforward nature of this framework will allow a similar communication process to be established for LAGIC Capital Margins, as it is relatively easy to understand and does not require the use of 'actuarial jargon'. There may already be an existing risk rating process in place which can be leveraged.

A communication process could be established to cover both the selection of risk categories and the ratings of products with respect to these categories. The distinct independent risk categories will allow discussion with different SMEs across the entire business – distribution, underwriting, claims, product, risk etc.

While a 1 in 200 event can be hard for people to conceptualise, by focusing on specific risks the suggested framework can help the business to think through each category in turn and articulate what a severe outcome could really mean for claim costs.

The suggested approach is designed to improve the Board's understanding of the drivers behind any changes in risk margins and lead to a better understanding of changes in the company's risk profile.

To some extent, the suggested framework also removes the need to explain or 'defend' subjective margins, as the final margins are an outworking of the ratings process.

Encourages ownership of outcomes

There is increasing onus on boards and management to have more involvement in setting both best estimate assumptions and regulatory capital risk margins. A clear robust framework which can be communicated clearly and be widely understood, will increase engagement and therefore the ability to take accountability for the final outcomes.

Facilitates embedding

Once established the suggested framework will allow companies to fully embed capital and risk into all business decisions, assisting companies in achieving their best practice for ICAAP.

For example, the risk rating matrix could be:

- used dynamically in business discussions (for example, what does it mean for our margins/capital if we take on this particularly risk?); or

- built into dashboards and scorecards to embed risk and capital awareness across all layers of employees (for example, scorecards or dashboards could include KPIs for actions taken to reduce risk ratings, or actions taken to collect information used in ratings).

Encourages consistency

The framework presented encourages consistency across a number of areas:

- the holistic approach enables margins to be set consistently across products. This is particularly beneficial for companies that may have a large suite of products that sit within different business units but are part of the same statutory fund;

- Once established, the framework can be maintained to allow consistent comparison from year to year. Ratings can be easily reviewed and only those that have changed need to be revised. Such changes in margins can be clearly linked to changes in the business over the year.

- This framework draws heavily from the framework proposed for general insurance companies in the paper "A Framework for Setting Risk Margins".[3] Given APRA's intention to standardise the approach to regulatory capital across the life and general insurance industries, this framework is a further step in improving consistency. Using a consistent framework could enable cross-collaboration across the actuarial profession across the life and general insurance industries.

Improved risk management

The framework presented in this Information Note encourages discussion about the specific nature of the risks that a company faces. It requires agreement about what risk

3 Available online at: http://www.actuaries.asn.au/Library/Framework%20for%20assessing%20risk%20margins.pdf

factors to assign. A natural part of the process of assigning risk factors for each risk category would likely be to compare the characteristics of, for example, a risk factor of 3 and a risk factor of 2. This comparison can give insights into what changes could be made to reduce/better manage risk.

To facilitate the implementation of any improvements identified, it is likely to be important that the risk management function is closely involved in the roll out and use of the suggested framework.

6.4.2 Limitations

Level of subjectivity/judgment

Despite being reasonably straightforward in approach, there are still a number of areas requiring judgment, including: determining the risk categories, assigning the risk factors, assigning margins to each of the risk ratings, and determining where correlations are required and what those correlations might be.

To address this, consider:

- a central team or person co-ordinating the process; and
- leveraging the approach used to undertake similar risk rating or ranking exercises as part of the risk management framework.

The framework does, however, bring the level of subjectivity in setting future stress margins to light.

7.0 Event stress

7.1 Background

LPS 115 requirements

Under LPS 115, the requirements relating to the event stress margin include:

- application term: not explicitly identified, but the APRA pandemic scenario implies that it should be 12-24 months;
- purpose: to reflect the impact of a single event which could cause multiple claims (mortality and/or morbidity). Examples given include: pandemics, terrorist attacks and natural catastrophes;

- considerations: the size of these margins will depend on factors such as the number of expected claims, the distribution of sums insured, and the impact of existing reinsurance arrangements; and
- prescribed minimum: APRA has set a pandemic scenario which represents the floor for the event stress margin.

7.2 Approach

An assessment (qualitative or quantitative) should be performed to confirm that the APRA-prescribed minimum scenario is sufficient to cover non-pandemic risks (for example, concentration risk exposures associated with group schemes) as well to confirm that the APRA-specified margins are appropriate.

Qualitative assessment

- Consider the key single event risks particular to the company that could cause a large number of claims:
  - disease-related (pandemics);
  - natural catastrophe-related (earthquakes or tsunami events);
  - location-related (building fire, sick building syndrome, mine collapse);
  - terrorism-related; and
  - other.

  The key single event risks considered should be consistent with the key risks considered in the risk management framework (RMF) and the ICAAP.

- Based on a qualitative assessment, map the key risks in an impact likelihood chart. The financial impact will depend on the specific exposure and portfolio characteristics of the company.

  The impact of single events will be influenced by the concentration risk of the portfolio, in particular the geographic location. For example, if a tsunami event were to be considered, then consideration needs to be paid to the number of low lying areas.

  For a pandemic event, the age-gender mix will influence the risk exposure, as pandemics can impact different parts of the population in a different way.

Quantitative assessment

- There are two elements to the quantitative assessment:
  - a simple assessment of the impact using risk exposure metrics such as sum-at-risk / maximum loss net of reinsurance/ probability of loss. The stress and scenario testing results (particular to event risks) considered in the ICAAP can also be used to assess this; and
  - a more sophisticated modelling approach if the above assessment indicates the risk is expected to result in a material financial impact. This will depend on the number of aspects (for example: severity of the event; expected claims; distribution of sum insured (risk exposure); existing reinsurance arrangements; time horizon of the event; secondary effects; effectiveness of countermeasures etc.
- It should be noted that parameterisation risk generally increases with model complexity (for example, when a model tries to incorporate increasing levels of forward-looking forecasting of unprecedented events.
- Perform a test to check if the APRA-prescribed minimum scenario is sufficient to cover the non-pandemic risks as well as the company-specific pandemic scenario. Adopt the scenario with the maximum estimated claims cost.

7.3 Key considerations

The key considerations for different product lines are set out below:

- Group schemes: companies that write group business need to consider the concentration risk exposures associated with large group schemes;
- catastrophe reinsurance cover: companies need to pay consideration to any catastrophe reinsurance cover that may be in place to mitigate significant concentration exposures;
- annuity business: significant mortality improvement as a result of technological advance or breakthrough (for example, a cure for cancer); and
- policy terms and conditions /reinsurance treaty terms: in considering the key event risks, policy terms/reinsurance treaty terms should be assessed. For example: (1) an insurer might exclude war-related claims in which case this risk would not need to be considered; and (2) pandemic exclusion.

8.0 Lapse stress

8.1 Background

Under LPS 115, the requirements relating to lapse stress margins include:

- application term: not explicitly identified, but the APRA interpretations letter to industry noted that:

  > "Paragraph 46 [of LPS 115] does not state whether the margin should apply for 12 months or a longer period. There could be a change in lapse rates for the next 12 months only (i.e. a random stress), a change that applies for the remaining term of the liabilities (i.e. a future stress affecting best estimate assumptions), or some combination of the two. The over-riding requirement is that the margin be set so as to satisfy the required probability of sufficiency."

- purpose: to reflect the nature of the company's lapse risk; and

- considerations:

  — the lapse stress margin should be calculated to provide a 99.5% sufficiency for the insurance risk charge;

  — unlike interactions between mortality and morbidity stresses, there is no explicit correlation for the interaction between lapse stress risk and the stresses applied to other decrements. APRA states that these correlations may be considered when determining the lapse stress;

  — a decision as to whether to increase or reduce lapse rates must be made for each "type of policy" depending on whether an increase or reduction would increase the stressed policy liabilities;

  — the level of aggregation for the "type of policy" is not explicitly defined. Paragraph 31 of LPS 115 in relation to stress margins generally states: "different margins may be applied to different types of policies. For example, there may be different morbidity random stresses for lump sum policies and disability income insurance policies." Related product group level could be considered for the level of aggregation when making the decision as to whether an increase or reduction in lapse rate should apply; and

  — APRA's guidance in its letter dated 29 October 2013 provides some further insight on the application to group risk stating: "For group business, 'lapses' can refer to policy termination and to individual members leaving or joining the scheme. In some circumstances, an increase in membership can be the adverse scenario."

8.2 Approaches

Unlike mortality and morbidity stresses, a random, future and event stress are not explicitly required to be considered.

APRA's guidance indicates that it is up to each company to consider whether to apply a future stress or a random stress component or both a random and a future stress.

Companies could consider adopting an approach for lapse margins which is similar to the framework suggested for future stress margins and random stress margins.

It is noted that the magnitude of lapse stress margin may not always have a material impact on the capital requirements. The level of sophistication of the approach to determining lapse margins should consider the level of the materiality on the capital requirements.

8.3 Key considerations

Some considerations in determining the lapse margins include:

- Has there been a recent event, or is there likely to be an event in the next year, such that a lapse stress is more likely (for example, negative press, increased premium rates)?
- Does the 12 month termination value dominate, such that the extent to which lapse rates will vary over the next 12 months (either through random or future stress) should be the focus?
- If a management action of repricing is assumed to occur in 12 months or more time to restore profitability, some consideration should be given to the impact of the price increase on lapses.
- Considerations on determining the correlations with other insurance stresses:
  - lapses and future claims experience (future stress) may be positively correlated as:
    - higher lapses can result in higher future claims due to selective lapsation; and

  - an economic stress situation (for example, higher unemployment rates) might result in higher claims (morbidity) and higher lapses; and

- lapses and future claims experience (event stress) may be negatively correlated as a pandemic might result in reduced lapses as insured lives place higher value on their cover.

Annexure A – Random stress margin approaches and worked example

Full stochastic simulation method

The full stochastic simulation approach generates claim simulation amounts at an individual benefit level. The data requirements for each benefit are the best estimate probability of claim (morbidity and mortality) and claim size. In addition, system capabilities to run a significant number of simulated outcomes are needed.

This method involves modelling each policy as either making a claim or not by using a random number generator. The random number generator would follow a uniform (0,1) distribution. For each policy, a claim is incurred if the random number is equal to or less than the best estimate probability of claim. The total claims cost across all policies is summed to generate a total claims cost for the coming year. This simulation is performed sufficient times to produce a reliable distribution of total claims cost. The 99.5% worst simulated result (relative to the best estimate claims cost) is used to determine the random stress margin.

For disability income insurance, modelling the claims cost involves using 2 random numbers – one to determine if a claim is incurred (as for Lump Sum) and a second to determine if a claim terminates before the end of the year. This will give a dollar amount of claims cost for the year, but this needs to be converted carefully to incidence and termination stresses.

Another approach for disability income insurance is to first set the termination and incidence margins separately to the 99.5% confidence level by applying the stochastic modelling approach with 1 random number, representing either incidence or termination. These stressed incidence and termination rates can then be combined by using explicit correlation assumptions. The impact of the correlation factor should be such that the total claims cost with the combined incidence and termination stresses is the same as the overall increase in claims cost when simulating the cost using 2 random numbers as described in the preceding paragraph.

Simplified stochastic simulation method

Where it is not feasible to run the claims simulation at an individual policy level, a simplified stochastic simulation approach may be used. Compared to the full stochastic simulation method, this approach requires less granular data and is less onerous on system requirements.

This approach combines lives into homogenous groups based on sum insured, and morbidity and mortality rate bands. Lives that are in the same morbidity/mortality bands are considered to be in the same sub-group. The number of claims in a sub-group can be stochastically simulated through a binomial distribution, where n is the number of lives per sub-group and p is the morbidity/mortality rate for that particular band. In addition, the cost of each claim can be simulated through a uniform (0,1) distribution based on the cumulative distribution of that particular sub-group. The claim cost per sub-group is the sum of each claim.

For each sub-group, simulations are performed. The 50% and 99.5% worst result is used to determine the random stress margin.

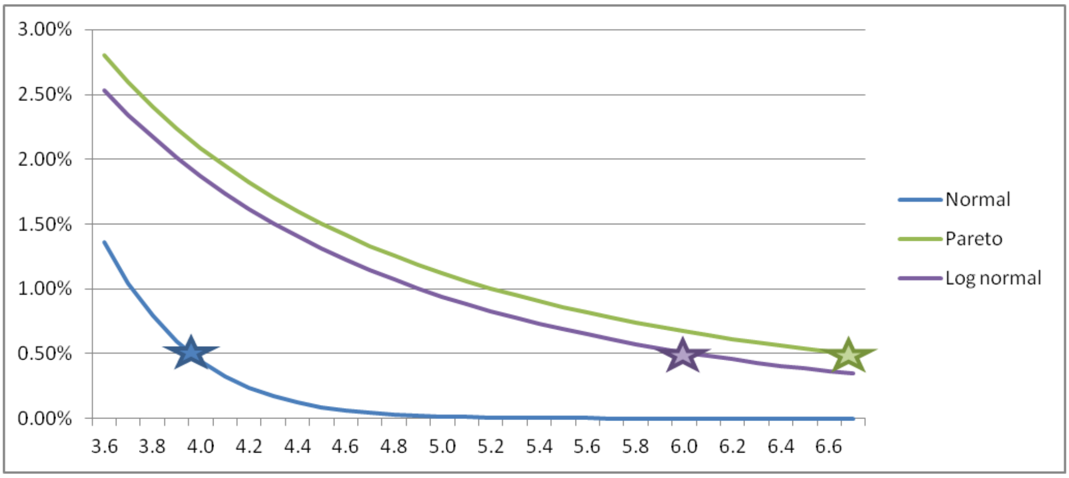
Statistical method

Where the simulation methods cannot be used, an alternative is to determine the random stress margins using a statistical approach.

Key considerations in adopting this method are the choice of the statistical distribution and the calibration of the distribution parameters.

The potential distributions that could be used and a brief description of the characteristics of each are described. It should be noted that this is not an exhaustive list or a description of methodology.

The tail of a normal, Pareto and lognormal are graphed below for comparison. The chart represents a normal distribution with a mean of 1 and standard deviation of 1, with the Pareto[4] and Lognormal charted for equivalent parameters. The stars mark the 99.5% point.



4 Assuming the 90th percentile of the Pareto distribution is the same as the 90th percentile of the normal distribution.

The normal distribution

Claims costs could be approximated using a normal distribution if the range of sums insured is relatively small. However, significant variability in sums assured may necessitate the use of more skewed distributions with fatter tails.

If annual claims costs are assumed to follow a normal distribution, the random risk margin can be determined as 2.576 standard deviations above the mean result (the 99.5% confidence interval of a normal distribution).

The standard deviation can be approximated from past years' experience, though this is not a good approximation if the size and/or profile of the book is not stable.

The log-normal distribution

The log-normal distribution, which is the exponential of the normal distribution, has a fatter tail.

It is quite easy to convert from a normal to lognormal distribution. For a normal distribution with mean 'a' and standard deviation 'b', the mean of the equivalent lognormal is given by ln[a * (1 + a2/b2)-(1/2)]. The standard deviation of the equivalent lognormal is given by √[ln(1 + a2/b2)].

Using this mean and standard deviation, the claims outcome at the 99.5% probability of sufficiency can be determined using the cumulative distribution function of the lognormal distribution, or simply by using the LOGINV function in Excel.

The Pareto distribution

The simple Pareto distribution has a fatter tail than the normal distribution.

Illustrative example

The choice of approach for random stress margins can give noticeably different results depending on the profile of the insurance portfolios. Particular care must be taken when assuming normality of the random claims costs.

As an example: consider two term life portfolios with identical 5,000 policies and policyholders' age varying between 16 and 55.[5] Without any reinsurance in place, the only difference is the mix of gross claims sum insured. For simplicity, the following composition of sums insured were assumed:

5 Mortality rates generated using an exponential distribution.

Portfolio A	Portfolio B
$1,000,000 (100%)	$500,000 (45%)
	$1,375,000 (35%)
	$1,500,000 (20%)

The following table compares the results of the 99.5% random stress margin between the simplified stochastic simulation approach (10,000 simulations) and the statistical method (assuming normal distribution).

Approach	Probability of Sufficiency (%)	Portfolio A (%)	Portfolio B (%)
Simplified stochastic simulations	99.5	69	82
	95	44	49
Statistical	99.5	64	70
	95	41	45

From the above, for portfolio A the statistical method produces a good reasonable estimate for random stress margins compared to the simulation approach. This is expected as the risks are quite homogeneous with identical sum insured.

However, for portfolio B where there is greater variation in sum insured, the statistical method only provides an acceptable estimate for at the lower 95% sufficiency level. For the higher 99.5% level, the statistical estimate is significantly lower than from the simulated approach. In this case, the normal distribution assumed under the statistical approach does not adequately draw out the tail risk of the claims cost.

Annexure B – Risk categories

The second step of the future margin process requires the categorisation of risks. This annexure provides some further descriptive detail for each of the risk categories suggested in Section 6.2.2 of this Information Note. The risk categories and considerations included here are not intended to be a full description of all possible risks and may need to be tailored to specific companies.

Internal risks

Internal risks factors are those internal to and, to some degree, under the control of the insurer. One aspect of this is 'internal systemic risk' which refers to the uncertainty arising from the actuarial valuation models used being an imperfect representation of the insurance process as it pertains to insurance liabilities. Model structure and adequacy, model parameterisation and data accuracy are all aspects of internal systemic risk.

The key sources of internal systemic risk include:

- specification error – inability to build a model that is fully representative of the underlying insurance process;
- parameter selection error – the error that can arise because the model is unable to adequately measure all predictors of claim cost outcomes or trends in these predictors; and
- data error – the error that can arise due to poor data or unavailability of data required to conduct a credible valuation.

Risk categories and examples or considerations in each category (these broad risks would be classified as low/med/high or 1 to 5).

(a) Data quality

- Product Administration System (PAS) and Claims Administration System (CAS) quality: consider the number of systems used to administer the business, the reliability of the data, reconciliation to other sources, internal processes to maximise data quality and any known shortcomings or errors
- PAS and CAS stability: consider how long the systems have been used and any recent changes which could affect claims and inforce data
- data cleansing: consider the reliability and timeliness of the process to identify and correct errors in the claim and inforce data

- reconciliations: consider the reconciliations in place to ensure the accuracy of the data

(b) Modelling process

- quality of rating factors: consider how well the rating factors used to model claims explain the underlying experience (for example, has sufficient information been captured to model the experience?)

- stability of investigations: consider how long experience investigations have been performed, whether the process used has been stable and the history of recent errors in the investigations

- materiality of assumptions: consider the dependency of the results on any assumptions that are used (for example, how much do the IBNR and RBNA assumptions affect the results?)

- known errors: consider any known errors or shortcomings within the experience investigations

- trends: consider the suitability of any trends that are built into the best estimate assumptions

(c) Product and company factors

- distribution risk: consider any changes in the method of distribution that may affect the profile of the insured lives and underlying experience

- underwriting risk: consider changes to underwriting requirements and procedures, stability of staff, caseloads and resourcing of the underwriting staff

(d) Claims management risk

- claims team under-resourced: consider number of staff, staff turnover and experience of staff

- claims management processes and systems quality (linked to data quality above)

- engagement score of claims staff

- increasing pressure to pay claims (for example, for reputational reasons)

External risks

External systemic risk analysis: this is a systemic approach for the risks that have not emerged in past experience but may arise in future experience due to factors in the environment external to the insurer over which it has little direct control. Single events that could commence in the 12 months following the reporting date and cause multiple claims are considered as part of the Event stress so should not be included here.

Risk categories and examples or considerations in each category (these broad risks would be classified as low/med/high or 1 to 5).

(a) Medical risk

- consider new diseases emerging, or unknown claims from a long time ago emerging now (like asbestos)
- new diagnostic tools – earlier/more trauma/TPD claims. Including government-sponsored
- biological warfare
- new biological testing becomes available and leads to anti-selection

(b) Competition and reputation risk

- expanding trauma, TPD & IP definitions (both internal and external risk)
- automatic acceptance levels increasing or underwriting reducing in general
- increased customer awareness/financial education leading to pressure to pay claims
- distribution channel quality/reputation (both internal and external risk)

(c) Economic and social (general environment outside of life industry) risks

- unemployment/economic downturn impact on disability claims
- lifestyle changes/trends
- social media – more awareness of insurance, cultural change, demographic change
- globalisation and cheaper travel – contagion risk, especially for global organisations

(d) Legislative and legal risk

- emerging trends of legal activity (lawyers getting involved at claim time, possibly with big delay)
- legislative change, like anti-discrimination laws preventing sex-based pricing or the legalisation of certain drugs
- any impacts from recent changes – FoFA etc

Annexure C – Worked example of future risk margin

Steps 1 [Set valuation classes] and 2 [Define risk categories]

Set up a matrix, with valuation / product class as rows and sources of uncertain / risks as columns. As this is a worked example, valuation / product classes are classed as 'class A1', 'class B2', class A2, class B2, etc.

	Internal company risks					External risks			
Risk categories (Step2) **Valuation class (Step1)**	Data quality	Modelling Process	Product & Company Factors	Claims management risk	Competition & reputation risk	Medical risk	Competition & reputation risk	Economic & social risk	Legislative & legal risk
Class A1									
Class B1									
Class C1									
Class D1									
Class A2									
Class B2									
Class C2									

Step 3 [Assign risk factors]

For each valuation class and risk, assign a risk factor. This example assumes 5 categories of risk factors, example from 1 to 5. The risk factors represent the relative impact of a 1 in 200 year stress on the future cost of claims for each valuation class, with 1 being the lowest impact and 5 being the highest impact.

Assign risk factors (Step3)	**Internal company risks**					**External risks**			
Risk categories (Step2) **Valuation class (Step1)**	Data quality	Modelling Process	Product & Company Factors	Claims management risk	Competition & reputation risk	Medical risk	Competition & reputation risk	Economic & social risk	Legislative & legal risk
Class A1	1	2	1	1	2	3	2	1	1
Class B1	3	4	3	2	1	2	3	5	2
Class C1	3	3	2	4	1	3	3	5	3
Class D1	2	2	2	2	3	2	5	2	2
Class A2	2	2	2	3	3	1	2	1	1
Class B2	5	5	3	2	2	2	4	5	4
Class C2	3	2	2	4	2	2	2	5	3

Step 4 [Assign stress margins to risk factors]

For each risk factor, assign a corresponding stress margin. In this worked example, the following is assigned:

Assign stress margin to risk factors (Step4)	
Risk Factor	Stress margin
1	5%
2	20%
3	40%
4	100%
5	200%

Step 5 [Calculate undiversified stress margins]

Based on the corresponding risk margin, convert the risk factors into risk margins. In this worked example, the undiversified stress margins are simply the arithmetic average of the stress margins for each valuation class. Using a correlation matrix would provide a more precise result, but given the broad nature of the estimates it was not felt that this precision was warranted. It is expected that, over time, the process for determining the estimates would be refined and increased sophistication introduced.

Convert to stress margins (step 5a)	**Internal company risks**					**External risks**				**Ave. Stress Margin, pre DF (Step 5b)**
Risk categories (Step2) Valuation class (Step1)	Data quality	Modelling Process	Product & Company Factors	Claims management risk	Competition & reputation risk	Medical risk	Competition & reputation risk	Economic & social risk	Legislative & legal risk	
Class A1	5%	20%	5%	5%	20%	40%	20%	5%	5%	14%
Class B1	40%	100%	40%	20%	5%	20%	40%	200%	20%	54%
Class C1	40%	40%	20%	100%	5%	40%	40%	200%	40%	58%
Class D1	20%	20%	20%	20%	40%	20%	200%	20%	20%	42%
Class A2	20%	20%	20%	40%	40%	5%	20%	5%	5%	19%
Class B2	200%	200%	40%	20%	20%	20%	100%	200%	100%	100%
Class C2	40%	20%	20%	100%	20%	20%	20%	200%	40%	53%

Step 6 [Aggregation of margins]

Step 6a) - set up the correlation matrices

Two correlations matrices need to be set, one for mortality and another for morbidity. This worked example assumes class A relates to mortality products and the remaining classes relate to morbidity products.

Mortality	Class A1	Class A2
Class A1		
Class A2		

Morbidity	Class B1	Class C1	Class D1	Class B2	Class C2
Class B1					
Class C1					
Class D1					
Class B2					
Class C2					

Step 6b) - assign correlation coefficients

The correlation coefficients for random margins are assumed to be independent. Hence correlation coefficients are either 0 or 1.

The correlation coefficients for future margins can be determined from a pre-set range. This example assumes No correlation: 0, low correlation: 0.25, medium correlation: 0.5, high correlation: 0.75 and fully correlated: 1.

Mortality	Class A1	Class A2
Class A1	1	0.25
Class A2	0.25	1

Morbidity	Class B1	Class C1	Class D1	Class B2	Class C2
Class B1	1	0.75	0.5	0.25	0.25
Class C1	0.75	1	0.5	0.25	0.25
Class D1	0.5	0.5	1	0.25	0.25
Class B2	0.25	0.25	0.25	1	0.25
Class C2	0.25	0.25	0.25	0.25	1

Step 6c) - application of correlation matrices

Firstly determine the diversification factor as follows:

Mortality	Class A1	Class A2	$ claim impact of undiversified margins on PV future claims	Comments
Class A1	1	0.25	500	
Class A2	0.25	1	300	
Total [A]			800	Simple addition
Correlated total [B]			644	Application of correlation formula
Diversification factor [C] = [B]/[A]			**81%**	

Morbidity	Class B1	Class C1	Class D1	Class B2	Class C2	$ claim impact of undiversified margins on PV future claims	Comments
Class B1	1	0.75	0.5	0.25	0.25	650	
Class C1	0.75	1	0.5	0.25	0.25	400	
Class D1	0.5	0.5	1	0.25	0.25	250	
Class B2	0.25	0.25	0.25	1	0.25	300	
Class C2	0.25	0.25	0.25	0.25	1	100	
Total [A]						1,700	Simple addition
Correlated total [B]						1,293	Application of correlation formula
Diversification factor [C] = [B]/[A]						**76%**	

Then apply the diversification factor to the undiversified stressed margins:

Valuation class	Stress Margin, pre DF (Step 5b)	Diversification factor	Stress Margin, post DF (Step 6c)
Class A1	14%	81%	**11%**
Class B1	54%	76%	**41%**
Class C1	58%	76%	**44%**
Class D1	42%	76%	**32%**
Class A2	19%	81%	**16%**
Class B2	100%	76%	**76%**
Class C2	53%	76%	**41%**

END OF INFORMATION NOTE