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Risk Margins – Have We Come Full Circle?

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Risk Margins - Have We Come Full Circle?

Abstract

The purpose of this paper is to provoke debate on the role of risk margins and their effectiveness in the management of risk for insurers. Considerable work and thinking has gone into this topic over the past decade, yet practitioners do not seem close to achieving consensus. We believe it is timely to take stock and stand back from the detail – are we continuing to make progress, and continuing to add value? Will greater efforts for more accurate determination of risk margins save insurers from another major GFC? Are we sufficiently advanced in our understanding of the uncertainties, the areas of reliance on judgment and the practical issues, to support a simpler approach? Have we now come full circle? This paper contemplates these questions and attempts to provoke discussion on whether we as a profession are best off re-directing our focus and efforts beyond risk margins to other ways of looking at and assessing risk.

Keywords: risk margins, uncertainty, frameworks, practical considerations, limitations, benchmarks, alternative approaches.

1 INTRODUCTION

Attempts at more accurate risk margin estimation have been the subject of considerable analysis and discussion by the actuarial profession over the past decade. Several papers have been written on this topic both in Australia and overseas, including a paper published by the Risk Margins Taskforce of the Institute of Actuaries of Australia in 2008 proposing a comprehensive framework for assessing risk margins.

Yet several years on, the profession seems no closer to common agreement and practice, and there remains a vast array of approaches being applied and a consequent range of outcomes. Why is this? In this paper, we explore some of the reasons, discuss whether the issues are surmountable and debate alternatives to the increasing effort to achieve the optimally accurate margin.

Our premise for putting forward this paper is that, given the lack of common practice after all this time, it may be timely for the profession to stand back and to look at a different way of thinking about risk. Instead of increasing complexity, a simpler approach is at least debatable. And whatever the reasons for the slow universal adoption of a consistent approach, our contention is that being stuck in the middle ground is no good for anyone, not for the profession and more importantly not for industry or society who put faith in our analyses and practical advice as a major part of policyholder security and insurer solvency.

Have we come full circle in our understanding of risk, the judgments and practical limitations involved in its measurement? Does our increased understanding, gained from practical (or impractical) application of the various approaches, enable us to more confidently develop universal benchmarks?

The paper looks at:

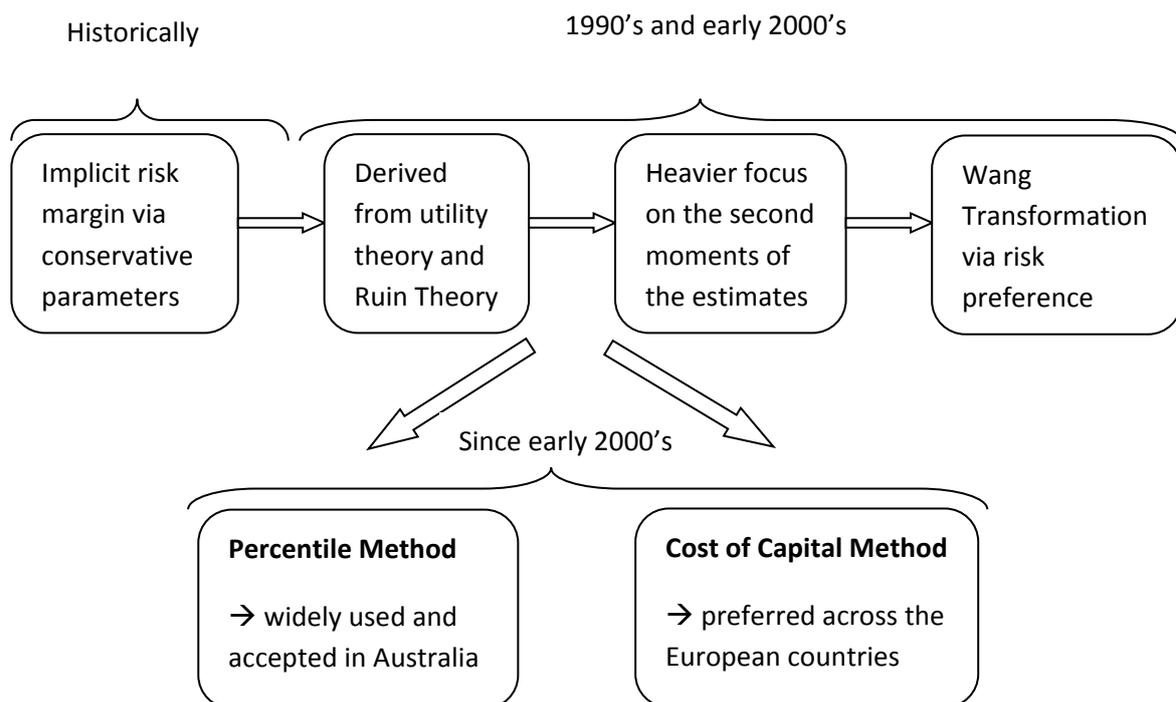
- A brief history of risk margins in Australia, to the current day
- A survey of current approaches in use
- Practical considerations, including hurdles to achieving consensus and a look at what's happening abroad
- An example demonstrating the impact of 'judgment' on outcomes
- Thinking ahead – a discussion of where to next?

2 A BRIEF HISTORY OF RISK MARGINS IN AUSTRALIA

2.1 Where it all began

Long before the introduction of the concept and requirement of an explicit risk margin in addition to the central estimate of liabilities, actuaries worldwide had traditionally allowed for implicit risk margins by applying conservative assumptions and parameters in determining insurance liabilities (Sandstrom A, 2010).

Since the 1990's, the general insurance industry has seen numerous developments in the methodologies applied to the determination of explicit risk margins. The following chart outlines the main stages of this evolution (Deloitte AG, 2010).



2.2 Developments in regulatory and accounting requirements

The stakeholders, at least where a focus on regulatory requirements is concerned, in the risk margin determination include insurers, accountants, regulators and potentially with lesser influence, actuaries. The treatment of risk margins and any developments should ideally find agreement and buy-in from the various parties.

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The Percentile Method became entrenched in Australia when the Australian Prudential Regulation Authority ("APRA") prescribed minimum explicit risk margins to be included in insurance liability provisions in 2002. The required risk margin must be no less than the greater of:

- A value which provides an insurance liability provision with a 75% probability of sufficiency; and
- One-half of a standard deviation above the mean.

Since then, the Percentile approach has been widely adopted and well accepted in Australia, mainly because it fits better with the 75% minimum probability of sufficiency requirement.

In terms of accounting requirements, the financial reporting standard AASB 1023 for general insurance contracts was first issued in November 1996. At this issue, the outstanding claims liability was to be measured as the "present value of expected future payments", with no mention of risk margins. The standard was re-issued in July 2004 effective for reporting periods from 1 January 2005, for alignment with international reporting standards. This revision in 2004 was when the inclusion of an explicit risk margin in determining outstanding claims liabilities was first specified. The standard does not prescribe a fixed margin or the level of adequacy required, but states that risk margins adopted for regulatory purposes may be appropriate for the purposes of the standard, or as a starting point in determining such margins. Insurers must however disclose the probability of adequacy intended to be achieved by their adopted margin.

The Australian tax treatment of risk margins provides for tax deductibility on the risk margin by its inclusion in the outstanding claims liability. We note that this position presumably assisted with acceptance by the Australian insurance industry of the accounting and regulatory requirements for risk margins.

2.3 Evolution in actuarial thinking and practice over the past decade

Over the past decade or so, the profession has invested significant effort in trying to better understand uncertainties in relation to insurance estimation and to more accurately assess risk margins. During this time, we have made considerable progress in moving on from concentrating mainly on quantitative aspects to also considering the qualitative aspects, and recognizing areas where there is greater reliance on judgment as well as the practical applications and limitations.

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Numerous papers have been written and presentations given in previous conferences on this topic since the Tillinghast paper (Bateup R and Reed I, 2001) commissioned by the Institute of Actuaries of Australia ("Actuaries Institute") and the Trowbridge paper (Collings S and White G, 2001), both produced in 2001, providing benchmarks for risk margins. More than ten years on, these papers are still very much quoted and relied upon, particularly for smaller portfolios.

A risk margins taskforce was established by the Actuaries Institute in 2005 and their paper published in 2008 providing a framework for assessment of risk margins. During the process, there has been considerable engagement with stakeholders, including insurance executives, APRA and market analysts. Two of the stated key roles of the taskforce were to move the profession away from relying on benchmarks, and to encourage consistency of approach.

Fast forward to 2012 – what is happening in practice? Are we still making progress towards consistency and consensus? It seems to us that there are still a range of different opinions and practices, at one end simply applying benchmarks based purely on portfolio size and mix of classes, and at the other adopting sophisticated approaches that attempt to take account of and quantify all possible risks.

In the next section, we set out the outcomes of a survey of a cross-section of portfolios of different sizes and mixes of classes of business, to provide an indication of various approaches to risk margin estimation currently in use. We follow this up by assessing some of the hurdles to the profession finding common ground on this issue.

3 WHAT'S HAPPENING IN PRACTICE – A QUICK SURVEY

3.1 A Survey of Various Approaches to Risk Margin Estimation

Anecdotally and in discussions with our colleagues amongst the profession, we are aware of different opinions and varying practices in risk margin estimation. However, we thought it worthwhile to substantiate this via a survey of a cross section of portfolios with different characteristics. We were interested in investigating the various approaches in current use, and how these might differ by size of portfolio or nature of the business conducted.

As well, with a focus on risk margins as effectively forming part of capital, we were interested in looking at the relative significance of risk margins in relation to solvency capital, to put some context into the effort involved in its estimation.

We carried out the survey on 30 current portfolios, which include insurers and reinsurers as well as accident compensation authorities for which risk margins are applied. The table below outlines the breakdown of these 30 portfolios based on aggregate size and nature of business. Note that these are not intended to represent the practice of the industry as a whole, but simply to provide an indication of a range of approaches currently in use. Also note that for some questions, responses were either unavailable or not applicable for some portfolios.

Table 3-1: Mix of portfolios in the survey

	Size			Nature of Business		
	Small ¹	Medium ²	Large ³	Short-Tail	Long-Tail	Mix
Number	15	8	7	6	12	12

Notes:

1. Small portfolios defined as those with aggregate insurance liability (i.e. outstanding claims plus premium liability) central estimates lower than \$50M.
2. Medium portfolios defined as those with aggregate insurance liability central estimates between \$50M and \$200M.
3. Large portfolios defined as those with aggregate insurance liability central estimates greater than \$200M.

3.2 Main Techniques Adopted

As the responses indicate, the Tillinghast 2001 paper remains a main tool in estimating risk margins for 9 (or 39%) of the 23 small and medium-sized portfolios. The remaining 13 (or 57%) of such portfolios rely on a variety of other techniques such as bootstrapping, stochastic chain ladder, statistical analyses of historical loss ratios, and for one run-off portfolio, a simple scenario-based approach on outcome possibilities for outstanding matters.

All of the large portfolios surveyed apply bootstrapping or other stochastic analyses with some form of subjective adjustments to account for market and individual portfolio characteristics. Also mentioned were random walk simulations.

Several of the bootstrap and other statistical methods were combined with judgment/subjective allowances for the model specification error. At least 3 (or 10%) of portfolios use the balanced scorecard method specifically to evaluate internal systemic risks although responses do state that the assumptions chosen are relatively crude.

In addition, even when more sophisticated statistical techniques are applied to larger-sized portfolios, the role of the Tillinghast 2001 paper remains important. It is frequently used as a tool for external benchmarking and any material difference is investigated further. Some practitioners also make comparisons to the papers on risk margins published by APRA, the latest of which was issued in November 2008, to establish whether their risk margin estimates appear broadly comparable with the margins adopted by APRA-regulated insurers and reinsurers.

3.3 Risk Margin on Outstanding Claims Liabilities (OCL)

Averaging across all responses, the 75% sufficiency risk margin on OCL equals 18% of the central estimate. Breaking down this result into the various portfolio groupings:

- The results for *small portfolios* average 24%, and for *large portfolios* average 11%. This is unsurprising since large portfolios are generally able to enjoy higher diversification benefits and lower independent risks, both of which serve to reduce the percentage required margins.
- The average for *short-tailed portfolios* is 14%, against a 23% average for *long-tailed portfolios*. This accords with the greater inherent uncertainty in long-tailed portfolios with regard to claims development and economic factors such as inflation.

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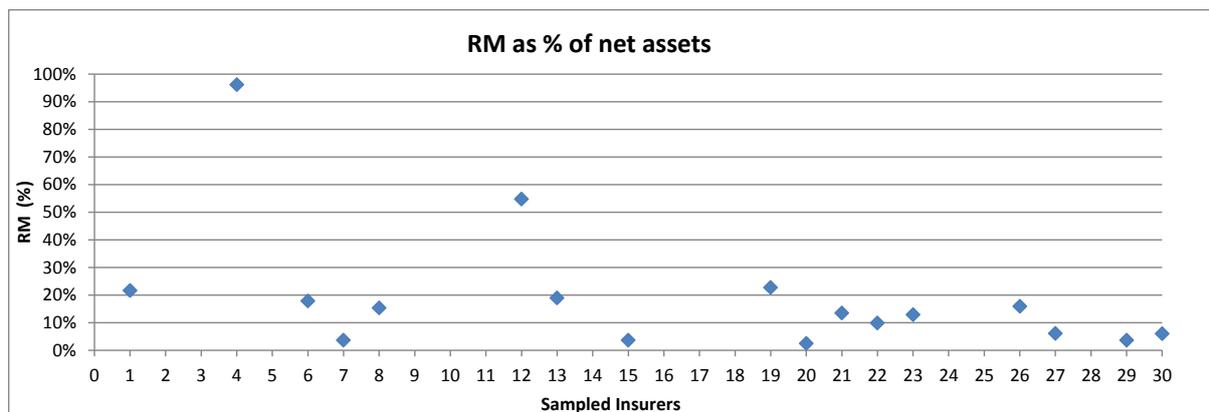
- Finally, the average for all portfolios predominantly adopting the *Tillinghast benchmarks* is 24%, compared to 16% for the ones using *other statistical methods*. One reason for this may be that the portfolios relying on Tillinghast benchmarks tend to be the smaller portfolios.

3.4 Risk Margin on Premium Liabilities (PL)

In terms of risk margins on PL, the findings are very similar to risk margins on OCL in terms of the comparison between portfolio size, nature of business and the main technique adopted. However, the PL risk margins are generally higher than their OCL counterparties, averaging 22%, reflecting the greater uncertainty associated with PL central estimates.

3.5 Aggregate Risk Margin as a Percentage of Net Assets or Eligible Capital

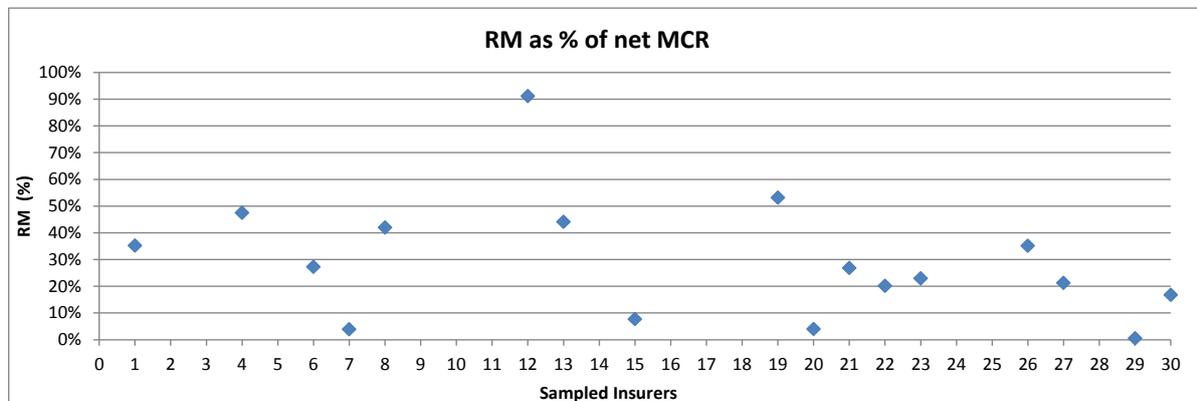
Figure 3-1: The proportion of risk margins to net assets, by portfolio



We note the wide range in the relative significance of the risk margin against eligible capital, from 1% to at the extreme 96%, of net assets. On average, of the 17 responses received, the aggregate risk margin represents around 19% of net assets. If we exclude the outlier (of 96% for one of the small portfolios), the average reduces to 14%. In general, the percentages tend to be lower for small and short-tailed portfolios as well as those not purely adopting the Tillinghast benchmarks. It is worth noting that for 7 out of 17 insurers (41%), the risk margin accounts for less than 10% of their net assets.

3.6 Aggregate Risk Margin as a Percentage of the Minimum Capital Requirement (MCR)

Figure 3-2: The proportion of risk margins to MCR, by portfolio



Again, we note the wide range in the significance of the risk margin in relation to the minimum regulatory capital required, from 1% to at the extreme 91%, of MCR. On average, of the 17 responses received, the aggregate risk margin represents around 29% of MCR. Again, if we exclude the 91% outlier, the overall average reduces to 26%. Similar to the prior section, the percentages tend to be lower for small and short-tailed portfolios as well as those not purely adopting the Tillinghast benchmarks. For 4 out of 17 insurers (24%), the risk margin accounts for less than 10% of MCR.

3.7 Timeframe to Determine Risk Margins

On average, around 2 days are spent to determine risk margins, with those purely applying the Tillinghast benchmarks needing less than a day and the larger portfolios requiring up to 7 days.

3.8 Revision Frequency

15 of 25 responses (or 60%) revise their risk margins annually, with 6 (or 24%) doing so biennially and 4 (or 16%) doing so once every three years or less frequently. For those actuaries who provided a comment on their current practices compared to the past, all indicated that their current revision frequency for risk margins has been consistent with their practices in the past.

3.9 Concluding observations

We make the following observations:

- There is still a **heavy reliance on benchmarks**, particularly for smaller portfolios.
- Also, at face value, it seems there is **limited consensus of practice**. This would indicate that two of the key roles of the risk margins taskforce, of moving the profession away from relying on benchmarks and to encourage consistency of approach, have at this point in time at least, seemingly not been achieved. Our discussions indicate little intent expressed for major change in various practitioners' approaches in the immediate future.
- Even where more sophisticated statistical methods are in use, and scorecards applied for internal and external systemic risks, practitioners admit scorecard selections to be crude, with **heavy reliance on judgment and subjective allowances**, particularly for external systemic risks.
- Risk margins form **a reasonably significant part of capital** (14% of net assets, 26% of MCR on average, excluding one outlier) **although the range is large** between portfolios. This is not true across all portfolios, some of which have a ratio of risk margins to net assets and MCR of less than 10%.
- The use of benchmarks requires minimal effort and time, which perhaps explains their continued wide use, against other approaches. For smaller to medium sized portfolios at least, our discussions indicate some reasons include **a lack of data for analysis, plus the considerable uncertainty still existing in more sophisticated approaches** did not provide sufficient justification and added value for their adoption.

In the next section, we look at some of the hurdles to moving away from benchmarks and towards a more sophisticated consensus approach.

4 PRACTICAL CONSIDERATIONS

4.1 Hurdles in risk margin estimation

We start by referencing the paper prepared by the Risk Margins Taskforce of the Actuaries Institute in 2008 (Marshall, Collings, Hodson and O'Dowd, 2008) that set out a new general framework for assessing risk margins. The paper provides comprehensive categorisation of the sources of uncertainty and introduces a structured approach to assessing risk margins, including combining qualitative considerations with the results of any available quantitative analysis, and practical advice on its implementation.

The paper was supplemented by a survey in 2006 of the actuarial approaches to determining risk margins in Australia. The survey indicated little disagreement regarding the Percentile calculation method itself, which can be summarised in three main steps:

- Coefficients of variation (CoVs) are determined for individual valuation portfolios, separately for outstanding claim liabilities (OCL) and premium liabilities (PL);
- A correlation matrix to account for the diversification benefit is populated based on the expected correlations between valuation groups, again separately for OCL and PL; and
- A selected statistical distribution is then combined with the adopted CoVs and correlation coefficients in determination of the aggregate risk margin at the required probability of sufficiency.

However, the survey revealed considerable differences in the analysis and investigations conducted to parameterise the Percentile method, i.e. determining coefficients of variation (CoVs), assessing contributions to correlations from each key risk, selection of the appropriate distribution, the common use of a *bolt-on* approach (that is, central estimate and risk margin determined separately, which can be theoretically flawed where internal consistency between the two methods is overlooked), and the pervasiveness of judgment in the assessment process.

The new framework was developed taking into consideration the concerns with the wide range of approaches then adopted in practice and consequent significant inconsistencies in the final outcomes. The proposed framework aimed to take a methodical and rigorous approach to examining each of the key sources of uncertainty and provide a practical platform to help actuaries determine appropriate and justifiable risk margins.

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Yet four years on from the introduction of the new framework by the risk margins taskforce, six years since the survey indicating the issues with risk margin estimation, and over a decade since the Tillinghast paper providing benchmarks for risk margins, it would seem that most of the practical issues highlighted in the survey are still present, the benchmarks from 2001 are still in use despite the fact that they were intended as general guidelines only, and we are not markedly closer to consensus in practice. Why?

Some of the answers are provided in the Risk Margin Taskforce's paper itself. There is no doubt that the paper helped to clearly set out and categorise, for many actuaries, the various sources of risk and the significant number of judgmental elements involved in each step of its estimation. The paper however notes that a full application of each step of the framework is a substantial and comprehensive undertaking, and also recognises the substantial amount of actuarial judgement in its application. In particular, judgement is required in all aspects of the analysis, irrespective of whether quantitative or qualitative methods have been used to assess the volatility associated with a particular source of uncertainty. In many situations such considerations dominate the risk margin assessment.

Indeed, phrases appearing in the proposed framework such as "significant amount of subjective judgement", "qualitative judgement", "substantial amount of judgement" and "a large degree of judgement" provide a flavour for the significant uncertainties and practical difficulties involved, even in a well set-out methodical approach. Indeed a word count indicates the words 'judgment', 'subjective' or 'art' (as in an "art in itself" or "blend of art and science") appearing over 40 times in the paper.

The reality is that risk margin estimation is not an easy task and there is not an easy, or indeed even a difficult, theoretical statistical solution. Quantitative modelling techniques such as bootstrapping, Mack method and stochastic chain ladder are backward-looking, hence only focus on sources of independent risk and past external systemic risk. In order to capture the internal systemic risks as well as the future external systemic risks, supplementary analyses are put forward which are detailed in application and involve multiple sources of subjectivity.

Correlation effects present another challenge. It is noted that the paper does not consider or discuss any quantitative methods to assessing correlation effects, for a variety of reasons. These include that the techniques tend to be technically complex and require substantial amounts of data, it is difficult if not impossible to separate the past correlation effects between independent risk and systemic risk, and even if modelling of correlation effects were practical, they would be unlikely to yield results that could be aligned to the outcomes of the framework in relation to

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independent risk, internal systemic risk and external systemic risk. The proposed framework can however be extended to correlation effects, and requires that these effects be considered in the context of each source of uncertainty or risk category. Even then, the process is largely subjective, in particular in relation to the determination of the partial correlations of the external systemic risk categories either within or between valuation classes, the aggregation of correlated risk categories into broader bands and the allocation of correlation coefficients to these bands.

In circumstances where high probabilities of sufficiency are sought e.g. 99%, such as for portfolio transfers or capital repatriations, recent studies (Embrechts P, 2012) have shown that outcomes are extremely unreliable. Even for data sets that are well-behaved (where most aren't), the confidence interval on the 99% quantile can be so immense as to raise questions as to the value of such estimates.

We would say that most actuaries are not afraid of complexity and in fact by our very nature and training are drawn to complex problem solving. So why the continued reliance on benchmarks and slow take up of a more sophisticated consensus approach? The reasons we can draw, some from our own experiences and some from discussions with other actuaries, include:

- **Weighing up of cost and effort.** The practical difficulties and the unavoidable need for substantial actuarial judgement reinforce the idea that the cost in terms of time and resource involved in thorough quantitative and qualitative analyses in the determination of the risk margin may well outweigh the potential increase in accuracy. In addition, some entities see little value in the work and consider a detailed actuarial analysis of risk margins as more likely to result in disruption to the continuity of financial reporting than to add value to management of the business.
- **No marked improvement in transparency.** The actuary is encouraged to deploy their judgement in a robust and transparent manner in following the steps in the proposed framework. In practice, the complexity and many subjective elements in implementation even where fully documented may not be immediately identifiable and could well obscure the big picture, and provide a greater sense of accuracy than may well be the case.
- **Significance of the margin, in capital terms.** We refer back to Section 4 earlier which showed up some portfolios where risk margins represent a small proportion (less than 10%) of eligible capital, and also of MCR. In these cases, it is harder to justify significant efforts for the risk margin determination.
- **Limited availability of internal data.** This is particularly the case for smaller insurers with limited and volatile internal data where relying on benchmarks may be more cost-effective than putting effort into a detailed estimation process.
- **Substantial amount of actuarial judgement.** As outlined above, each step of the process involves substantial judgment, irrespective of whether quantitative or

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qualitative methods have been used to assess the volatility associated with a particular source of uncertainty, and in many cases, can dominate the risk margin assessment.

- **Magnification of issues for run-off portfolios and situations requiring high quantiles.** When faced with requirements for extreme probabilities of adequacy, e.g. 99.5% for run-off portfolios, there are added complexities; for example, in the selection of appropriate statistical distributions that are representative of the underlying distribution of insurance liabilities, and also the dependency structures for the various correlation effects. These issues can render the outcomes extremely unreliable, and hence of limited value, from a technical standpoint.

Other concerns cited with risk margins are that when economic conditions start to deteriorate, which is inevitable given the economic cycle, CoVs and correlation coefficients (under extreme conditions) would both increase. This would therefore impose higher risk margins on companies that already suffer financial difficulties. From this perspective, would risk margins really be able to save the world (fulfilling its intended role as "shock absorber"), or would it simply be countercyclical and only add additional or un-necessary pressure at unfavourable times?

4.2 Looking Wider Afield - Risk Margins outside Australia, and in particular Europe

We consider this paper would be incomplete if we did not look beyond our borders to see what our colleagues overseas are doing, particularly in Europe where considerable work has gone into Solvency II and with its imminent launch. Have our European cousins overcome the types of issues with risk margins that we are still battling with here? We do not however intend to go into great detail or discussion on Solvency II, other than to provide international context for the types of issues faced in risk margin determination in Australia.

Similar to Australia, implicit risk margins were historically applied across the US and Europe, through the use of conservative assumptions such as applying partial allowance for discounting (Gutterman, Bell and Nyce, 2009 and Miccolis and Heppen, 2010). Since the mid-1980's, actuarial committees started to explore the idea of discounting insurance liabilities with an explicit risk margin (Meyers, 2008).

Currently risk margin requirements differ significantly in countries outside Australia, ranging from highly prescriptive to no clear requirements at all. The International Accounting Standards Board (IASB) has encouraged a more consistent framework to be applied in the determination of insurance liabilities and risk margins across different countries through the development of International Financial Reporting Standards (IFRS) 4 and 5.

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The proposed capital regime for European Union insurers, Solvency II rules, has been some ten years in the making and was originally scheduled to be applicable from 1 November 2012. This was subsequently delayed to 1 January 2013 and later on to 1 January 2014. There is however mounting speculation that this could be put back further to 2016 or later to give governments time to iron out their differences.

There are a large number of stakeholders involved in Solvency II, including insurers, accountants, regulators, and actuaries possibly lower down the pecking order, all working to find common agreement. Many organizations have been analysing and commenting on Solvency II including CEA (Comité Européen des Assurances, the European Insurance Federation), CEIOPS (Committee of European Insurance and Occupational Pensions Supervisors), Groupe Consultatif (comprising the actuarial associations in the European Union), the CRO and CFO Forums, the Joint Forum, the IAA (International Actuarial Association), IAIS (International Association of Insurance Supervisors) and IASB (International Accounting Standards Board).

Under this regime, insurers are subject to a Solvency Capital Requirement (SCR) on top of assets backing liabilities to safeguard policyholders and promote confidence in the financial stability of the insurance sector. Unlike the Percentile method used across Australia, Solvency II applies a market-consistent Cost of Capital (CoC) approach to determine risk margins. This CoC approach was first adopted in Switzerland in 2003 and subsequently more widely adopted across Europe since 2005 (Deloitte AG, 2010). The risk margin under this approach is designed to ensure that the value of technical provisions is sufficient for another insurer to take over and meet the insurance obligations. It is calculated by determining the cost of providing an amount of eligible own funds equal to the SCR at each future year end necessary to support the obligations over their lifetime (Meyers, 2008 and England, 2011) and involves:

- Calculating SCR at each year-end
- Multiplying by the cost of capital less the risk-free rate
- Discounting at the risk free rate and summing.

The standard formula is (England, 2011):

$$RM = COC \times \sum_{t=0}^{\infty} \frac{SCR_t}{(1 + r_{t+1})^{t+1}}$$

where:

RM = risk margin for the whole business

COC = cost of capital rate i.e. the additional rate above the risk-free rate

SCR_t = the SCR for year t

r = risk-free rate for maturity t .

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One major advantage of the CoC method is that it is relatively straightforward and transparent, therefore more understandable to clients, regulators and other stakeholders (Bulmer, 2010). It also links more closely to the IFRS requirements and recent international accounting developments (Tang, 2008). It is also considered to more strongly (than the Percentile method) exhibit one of the key desirable characteristics of risk margins indicated by the International Actuarial Association (IAA) and International Association of Insurance Supervisors (IAIS), namely that “for similar risks, contracts that persist over a longer time frame will have higher risk margins than those of shorter duration” (Meyers, 2008).

Despite these advantages, the CoC method does suffer similar technical difficulties to the Percentile method. Some of the issues are as follows:

- The major one is the need to derive an appropriate cost of capital rate that reflects the uncertainties surrounding the insurance liabilities (Lockerman, 2012). Projecting the long-term average of this stochastic quantity involves carefully examining historical returns and the market prices for risk (Gutterman, Bell and Nyce, 2009). It is practically difficult, highly judgemental and any small shift could lead to a major change in the resulting risk margin.
- Moreover, to satisfy the requirements attached to this method, the opening solvency capital and the subsequent amount required at each future year end need to be calculated. This can only be accurately estimated with simulation on simulation, which is impractical without some form of approximations and/or simplifications (Bulmer, 2010). Such modifications will be subject to the approval of regulators, imposing further uncertainty at the current stage.
- Additionally, it is challenging to allocate the overall risk margin to individual lines of business in a robust manner, due to the complexity involved in the estimation of correlations between risk factors for individual lines of business (England, 2011).
- Market analysts have also cited concerns that the rules, which were drawn up amid benign economic circumstances a decade ago, are too sensitive to the violent financial market swings seen since the GFC in 2007 and could impose excessive capital strain on insurers.

To sum up, although a different approach has been proposed by Solvency II compared to the Percentile approach adopted in Australia, there are nevertheless extensive technical difficulties involved in the CoC approach and the role of actuarial judgement remains significant as several aspects are heavily subjective. For the purpose of this paper we will continue to focus on the Australian context which remains the core of our discussion.

5 AN EXAMPLE ILLUSTRATING THE IMPACT OF JUDGMENT ON OUTCOMES

As discussed earlier, a full-scale risk margin determination will involve a significant amount of subjective judgment at various stages in the process. This is particularly so for the systemic risks, and diversification effects, where very different views could easily be taken that would be considered reasonable, because of little knowledge or lack of an evidence basis for the selections.

In this section, we present a simple example that demonstrates what impact subjectivity in just one aspect can have on the outcomes. We have selected the role of diversification effects for this illustration. For simplicity, we have not attempted to split the liability into outstanding claims and premium liability components, or internal/external systemic risks, for which further assumptions yet would be required in relation to correlation effects between each source of uncertainty, risk category, valuation portfolio and outstanding claim/premium liability combination.

The example focuses on a multinational insurer ABC with main operational functions located in two separate countries, namely Australia and the United States. This insurer participates in three lines of business (i.e., motor property damage, public liability and workers' compensation) which are marketed and managed by two sub-brands (i.e., brand A and brand B) under the main corporate umbrella. Therefore, its variance correlation matrix for the overall portfolio needs to incorporate multiple layers of diversification benefits including geographical, business line and structural aspects.

The assumed net central estimates and coefficients of variation (CoVs) for all individual lines of business split by country and sub-group are summarised in Table 5-1 and Table 5-2 below.

Table 5-1 – Assumed net central estimates for all individual lines of business (\$m)

	Mtr_AUS_A	Mtr_AUS_B	Mtr_USA_A	Mtr_USA_B	PL_AUS_A	PL_AUS_B	PL_USA_A	PL_USA_B	WC_AUS_A	WC_AUS_B	WC_USA_A	WC_USA_B
Net CE	30	30	20	20	50	40	30	30	40	40	40	50

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Table 5-2 – Assumed CoVs for all individual lines of business (%)

	Mtr_AUS_A	Mtr_AUS_B	Mtr_USA_A	Mtr_USA_B	PL_AUS_A	PL_AUS_B	PL_USA_A	PL_USA_B	WC_AUS_A	WC_AUS_B	WC_USA_A	WC_USA_B
Aggregate CoV	20	15	25	20	35	30	35	35	30	40	35	45

For simplicity, we assume that the distribution of uncertainty for each of the three lines of business split by country and sub-brand combine to form a multivariate normal distribution. The resulting undiversified risk margins calculated for each individual line are summarised in the Table 5-3 below:

Table 5-3 – The undiversified risk margins for all individual lines of business (expressed as % of the net central estimates)

	Mtr_AUS_A	Mtr_AUS_B	Mtr_USA_A	Mtr_USA_B	PL_AUS_A	PL_AUS_B	PL_USA_A	PL_USA_B	WC_AUS_A	WC_AUS_B	WC_USA_A	WC_USA_B
Undiversified Risk Margin	13	10	17	13	24	20	24	24	20	27	24	30

Note: The CDF of the unit normal distribution equals 75% when evaluated at a value of 0.674. Therefore, the undiversified risk margin for individual line *i* can be calculated as $0.674 \times \text{aggregate CoV}_i$.

The overall *undiversified risk margin* is calculated to be 22%, (simply the weighted average of the undiversified risk margins shown in Table 5-3).

To estimate the overall *diversified risk margin*, we divided the aggregate variances into independent and systemic components based on a 30%/70% split. We also derived the systemic variance correlation matrix between lines of business taking into account the spread across two different countries and sub-brands. The resulting assumed systemic variance correlation matrix is shown in Table 5-4 below. A heavy element of judgment was involved in this derivation, which includes the actuary's perception of the veracity of his/her own common reserving method imposed across the group. We assigned a zero coefficient of correlation between pairs of independent variations because they are by definition uncorrelated.

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Table 5-4 – Assumed systemic variance correlation matrix between lines of business (%)

Correlation	Mtr_AUS_A	Mtr_AUS_B	Mtr_USA_A	Mtr_USA_B	PL_AUS_A	PL_AUS_B	PL_USA_A	PL_USA_B	WC_AUS_A	WC_AUS_B	WC_USA_A	WC_USA_B
Mtr_AUS_A	100	50	40	30	20	15	15	10	20	10	15	10
Mtr_AUS_B	50	100	30	40	15	20	10	15	15	15	10	15
Mtr_USA_A	40	30	100	50	15	10	20	15	15	10	20	15
Mtr_USA_B	30	40	50	100	10	15	15	20	10	10	15	20
PL_AUS_A	20	15	15	10	100	50	40	30	30	15	20	10
PL_AUS_B	15	20	10	15	50	100	30	40	20	20	10	20
PL_USA_A	15	10	20	15	40	30	100	50	20	10	30	20
PL_USA_B	10	15	15	20	30	40	50	100	10	20	20	30
WC_AUS_A	20	15	15	10	30	20	20	10	100	50	40	30
WC_AUS_B	10	15	10	10	15	20	10	20	50	100	30	40
WC_USA_A	15	10	20	15	20	10	30	20	40	30	100	50
WC_USA_B	10	15	15	20	10	20	20	30	30	40	50	100

The combined variance for an insurer's aggregate portfolio taking account of all lines of business is (Bateup and Reed, 2001):

$$Var(Y) = \sum_{i=1}^N Var(X_i) + 2 \sum_{i<j} \rho_{ij} \sigma_{X_i} \sigma_{X_j}$$

where:

X_i = the i^{th} line of business (further split by county and sub – brand here)

$Var(X_i)$ = variance of net central estimate for the i^{th} line

ρ_{ij} = systemic correlation between net central estimates for the i^{th} and j^{th} line

σ_{X_i} = standard error in the net central estimate for the i^{th} line

= net central estimate for the i^{th} line * systemic CoV for the i^{th} line

Based on the above assumptions, we calculated the variance of insurer ABC's aggregate portfolio to be 4645 and therefore, the combined CoV to be 16%

$$\left(= \frac{\sqrt{Var(Y)}}{\sum_{i=1}^N CE_i} \right).$$

This resulted in a diversified total risk margin of **11%** (= 0.674 x 16%), a significant reduction on the undiversified risk margin of **22%**.

As illustrated by the above example, in spite of the significant subjectivity involved in the estimation of the correlation matrix, it can have a considerable effect on the

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calculated risk margin. The practical difficulty in accurately deriving an overall correlation matrix magnifies rapidly for insurers with multiple lines of business, operations across different geographical areas and/or a complex corporate structure comprising various sub-brands. Indeed the overall group margin can almost be 'correlated away' by assumptions of more diversification effects, most of which may be largely subjectively derived, between all the sources of uncertainty, risk categories and valuation portfolios. Having said this, for the provisions for prudential regulatory purposes, the regulator in each jurisdiction might require that the diversification effect be allowed for only for liabilities in that jurisdiction.

Whilst the example is somewhat simplistic and perhaps a little extreme, it serves to illustrate the impact uncertain judgmental elements can have on the outcome. We have selected correlation effects but it is equally possible to have looked at systemic risk, where again very different views could be taken but still be considered "reasonable" or "not unreasonable", because of no reliable reference points and little knowledge of the true values. It is easy to see how the impact of the multitude of subjective judgments made along the process, and their contribution to the overall level of uncertainty in the outcome, can quickly become obscured and not readily transparent.

6 THINKING AHEAD – WHERE TO NEXT?

6.1 To sum up...

Actuaries have over the past decade or so put in considerable effort into gaining better understanding of the uncertainties related to insurance estimation and to more accurately assess risk margins. In Australia, we have made considerable progress moving on from mainly quantitative analyses to consideration of qualitative aspects, and in better understanding the practical considerations and judgments involved in the determination of risk margins.

However, despite the various studies, including a comprehensive framework for risk margin determination put forward by the risk margins taskforce of the Actuaries Institute in 2008, the profession seems no closer to common agreement and practice. The research that we have done for this paper indicates a number of reasons for this, a key one being the view that the practical difficulties and unavoidable need for substantial actuarial judgement mean the cost and effort of more thorough analyses may well outweigh any potential increase in accuracy. Risk margins are in some danger of being seen as purely a compliance process, rather than as adding real value to security and management of the business.

So, if increasing complexity is not the solution to achieving consensus on risk margins, where to next? Have we come full circle in our understanding of the uncertainties, judgments involved and practical issues, to support a simpler approach? And if we agree with this, where should we redirect our efforts?

6.2 Looking ahead – where to next?

To answer this, we consider that it may be timely for the profession to take stock, stand back from the detail, and perhaps reflect again on what purposes risk margins are meant to serve.

Given we have been poking holes, it's fair that we make an attempt at a possible alternative solution. Risk margins are currently required in Australia for regulatory purposes and for financial reporting. We start on the principle that risk margins are really a part of capital – most actuaries accept this, and so indeed do academic

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accountants who initially proposed that balance sheet provision should be central estimates, although this was resisted by the practitioner accountants.

In Australia we have a comprehensive framework for capital requirements, which is being continually improved to better reflect differences in risk profile. By imposing the minimum capital requirement, APRA is aiming to achieve a 99.5% level of sufficiency across the industry over any one-year period. On this basis, is the risk margin really that useful on its own or should it instead be considered as part of the aggregate capital required? If we were building up a capital regime from the beginning, would it be preferable to pick up all the risk in the calculation of capital requirements, rather than place risk margins separately within the balance sheet provision? One could argue that the split into risk margin and below the line capital is spurious.

However, we are aware we don't live an ideal world so this is very unlikely to happen. Moreover, tax deduction on the risk margin is attractive to insurers in financial reporting and to do away with it for regulatory reporting might be going too far. Having said this, we do already have different risk margins, so maybe ...?

The point we are making is that we should potentially re-direct our efforts from increasing sophistication in the risk margin determination, to:

- Setting appropriate total capital – this is really the focus of APRA's requirements of us, and of the industry; and
- Carving out a notional amount to be included in the risk margin – recognising that's all it is, a carve-out.

In theory this should be acceptable to the prudential regulator, but we would need to also consider implications for financial reporting. AASB 1023 requires a risk margin, and looking at this at a practical level, we cannot expect the accountants to change their minds. Having said this, AASB 1023 allows much more flexibility – so if the APRA carve-out is specified at the existing 75% probability of sufficiency, then it could potentially be readily adjusted for other sufficiency levels.

In terms of determining the carve-out, given the issues we have been highlighting on achieving accurate and transparent entity-specific determinations, we will start by suggesting an unfashionable proposition... How about industry benchmarks? We know that a lot of people use them anyway. Yes, they aren't insurer specific but the amount of subjectivity involved in "specific margins" renders them in many instances as somewhat spurious. On the assumption that explicit risk margins are retained, we could perhaps develop a set of industry benchmarks and update those periodically using inputs from all participants across the industry. For a large proportion of smaller

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insurers in particular, who already rely on benchmarks developed a decade ago, we consider this would be a welcome improvement.

Obviously there will be issues with this proposition, for further debate and discussion. As was the case for the Bateup-Reed in 2001, the margins should vary by size of liability, but what else? Some issues include:

- How one might incorporate diversification – this would be insurer specific and we have not at this point proposed any solutions to correlation effects.
- Allowing for reinsurance – once again this would be insurer specific. Benchmarks would need to relate to gross margins since different reinsurance structures mean that they may not be applicable across all net margins.

To conclude then, on the basis of our proposition, it is not a problem for prudential regulatory reporting for which the objective is to have the right capital – which really is the nub of what we need to concern ourselves with. It seems to serve little purpose to then jump through hoops to calculate a risk margin for financial reporting. If it is only used for tax deduction and is not supposed to be used for smoothing results, and the APRA risk margin would satisfy AASB 1023, then why not use it?

As for requirements to estimate risk margins at very high intended probabilities of sufficiency, e.g. at 99.5% in run-off situations, studies have shown that attempts to quantify entity-specific risk margins are mostly unreliable. If we acknowledge this uncomfortable reality, one solution discussed at the recent ASTIN conference in October may be to apply prescribed scaling-up multipliers to provisions estimated at lower probabilities of sufficiency, at which estimation difficulties still exist but are less acute.

We expect people to poke holes in our arguments and proposition, even to propose different solutions. If this starts a good debate on moving us off being entrenched on middle ground, then we have achieved what we set out to do with this paper.

APPENDIX A BIBLIOGRAPHY

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APPENDIX B RESPONSIBILITY FOR OPINIONS IN PAPER

The opinions expressed in this paper are those of the authors, and do not necessarily reflect the opinions of their respective employers.