Project **Insurance Contracts**

Topic **Risk adjustment**

Purpose of this paper

1. This memorandum discusses the risk adjustment included in the proposed measurement for insurance contracts. Specifically, this memorandum provides information about an objective for a risk adjustment under the proposed measurement and a brief analysis about the numerous methods that could be used to calculate a risk adjustment.

2. Some Board members raised concerns about the discipline and rigor surrounding the proposed insurance measurement (specifically the cohesiveness of the risk adjustment with the probability-weighted cash flows). Consequently, those Board members directed the staff to perform an analysis of the applicability of an option pricing model in the context of measuring an insurance contract. The staff has performed that analysis in Agenda Paper 6E (FASB Memorandum No. 41E) and that memorandum should be read in conjunction with this memorandum.

3. For discussion purposes, the term *risk adjustment* and *risk margin* are used interchangeably (most of the research papers on this topic use *risk margin*).

Summary of Staff recommendations

4. The staff recommends:

   (a) Not requiring a particular method for determining a risk adjustment.

   (b) Disclosures should be required similar to those in Statement 157 for fair value measurement with unobservable inputs.

(c) The risk adjustment should be the amount the insurer requires for bearing the uncertainty that arises from having to fulfil the net obligation arising from an insurance contract (a reaffirmation of the boards' previous decision at the January 2010 joint meeting).

Structure of the Paper

5. The rest of this paper is divided into the following sections:

   (a) Background (paragraphs 6 through 10)

   (b) Current practice (paragraphs 11 through 18)

   (c) Methodologies for calculating a risk adjustment (paragraphs 19 through 57)

   (d) Disclosure (paragraphs 58 through 63)

   (e) Objective for a risk adjustment (paragraphs 64 through 70)

Background

6. At their joint meeting in December, the Boards decided tentatively that the measurement approach should portray a current assessment of the insurer's obligation, using the following building blocks:

   (a) The unbiased, probability-weighted average of future cash flows expected to arise as the insurer fulfills the contract

   (b) The time value of money

   (c) A risk adjustment for the effects of uncertainty about the amount and timing of future cash flows

   (d) An amount that eliminates any gain at inception of the contract.

7. At the joint meeting in January, the staff provided an objective for the overall measurement approach. A working draft of that objective follows:

   [an entity's current estimate of] the present value of resources required to fulfil the net obligation created by the insurance contract.

8. A reporting entity would estimate that value using present value techniques that consider the four building blocks. To further clarify this objective and the use of

the building blocks, the boards could provide explanatory language which, for example, clarifies that:

(a) the measurement is from the entity's perspective, that is, resources reflect the entity's view of fulfilment of the contract.

(b) all available information should be used.

(c) financial market variables should be consistent with observable market information.

9. At that same meeting, the Boards decided tentatively that the risk adjustment should be the amount the insurer requires for bearing the uncertainty that arises from having to fulfill the net obligation arising from an insurance contract. The purpose (objective) of a risk adjustment is to convey useful information to users about the (remaining) uncertainty. This reflects the fact that a liability giving rise to future cash outflows with a fixed outcome of X is less onerous than a liability with an uncertain outcome that has an expected value of the same amount of X. In addition, as a more practical point, a risk adjustment would include in the measurement the fact that an insurer usually would not have all the information for determining an unbiased estimate of the expected value of the cash flows. Missing information is likely to lead to bias in one direction, usually an unfavourable direction – insurers do periodically suffer large surprises, but the large surprises usually result in losses, not gains.

10. However, some Board members were concerned about the application of this objective in practice—that is, would the objective be applied consistently or is the objective too vague to communicate the intentions of the boards. Consequently, the boards directed the staff to provide an analysis of the different methods that are available to calculate a risk adjustment.

Current practice

11. The staff believes that it is instructive to discuss current practice first to understand the purpose of a risk adjustment in the current proposed measurement. Under current practice, risk adjustments are used under generally accepted accounting principles, regulatory accounting, and voluntarily as part of supplemental information.

Generally accepted accounting principles

12. U.S. GAAP for long-duration insurance contracts includes a notion that is similar to a risk adjustment. In ASC Topic 944, paragraph 944-40-30-7, states that the assumptions used (mortality, morbidity, expected investment yields, terminations, expenses) to determine the liability for a long-duration insurance contract should include a *provision for the risk of adverse deviation* (PAD). The Master Glossary of the ASC defines the risk of adverse deviation as:

> A concept used by life insurance entities in estimating the liability for future policy benefits relating to long-duration contracts. The risk of adverse deviation allows for possible unfavorable deviations from assumptions, such as estimates of expected investment yields, mortality, morbidity, terminations, and expenses. The concept is referred to as risk load when used by property and liability insurance entities.

13. Paragraph 56 of the basis for conclusions of Statement 97 provides the following explanation of what the provision for the risk of adverse deviation represents:

> The provision for adverse deviation is a convention unique to the accounting for long-duration insurance contracts. Adverse deviation is fundamentally a notion of subjective conservatism and requires an increase in the reported liability for policy benefits beyond management's best estimate of the enterprise's ultimate obligation to policyholders. Companies other than life insurers are proscribed from making similar provisions by FASB Statement No. 5, Accounting for Contingencies.

14. There does not appear to be a sophisticated scientific method for calculating PADs. Actuaries generally use a percentage rate (5% to 10%) for changes in the different assumptions. Practice has developed such that the PADs applied to different assumptions generally fall into an acceptable range as determined through the negotiations between the preparers and their auditors. In addition, some assumptions (like expenses and mortality) are reasonably predictable and therefore the PAD may not be significant. Other assumptions (such as interest rates and morbidity) can include significant uncertainty and thus the PAD may be more significant.

15. Both Australia and Canada use provisions for the risk of adverse deviation. The Australian GAAP measurement of outstanding claims for a general insurance entity (also called non-life or property and casualty) includes the central estimate of the present value of expected future claims payments (including estimated claims handling costs) plus risk adjustment. A risk adjustment is added to the central estimate to achieve a desired probability of adequacy (confidence level). The Australian Prudential Regulation Authority (APRA) requires licensed Australian

insurers to have a minimum probability of adequacy of 75 percent. The expected future payments and risk adjustment are discounted using risk-free rates.

16. Canadian GAAP for life insurance companies requires use of the Canadian Asset Liability Method (CALM) for measuring insurance liabilities. Although CALM is specified in Canadian GAAP, many of the details of the method are spelled out in the Canadian Institute of Actuaries Standards and Practice. The basic notion is that the entity's insurance liabilities are measured by the carrying amount of owned assets that will generate cash inflows that will end with the last liability cash outflow. The insurance liabilities include margins for adverse deviation (risk adjustments) for each assumption used in measuring the insurance liability.

Regulatory reporting

17. Most insurance regulators use either explicit or implicit risk adjustments in determining solvency. For example, the insurance regulator in Switzerland uses a cost of capital approach to determining a risk adjustment. The risk adjustment under this regime is viewed as the amount a second insurer would be compensated for the risk of assuming the first insurer's assets and liabilities (essentially the additional costs for having to hold additional capital). The risk margin is the hypothetical cost of capital necessary to run-off all the insurance liabilities following financial distress of the entity. The risk adjustment is calculated as the discounted value of future costs of maintaining the target capital level if the insurance portfolio was being run-off by a third party. [Swiss Federal Office of Private Insurance November 2004]. The new regulatory framework that is being developed within the European Union, Solvency II, also uses the cost of capital approach.

Voluntarily as part of supplemental information

18. In an effort to standardize the reporting of the value of a life insurer, the CFO Forum issued guidelines for calculating European embedded value. Two forms of European embedded value exist—real world and market-consistent. Real world embedded value uses a risk discount rate and is attempting to determine a valuation that reflects the market's view of risk. Real world embedded value uses a top-down approach to determining the risk discount rate (comprised of the risk-free rate plus a risk-margin derived from the CAPM model). Market-consistent uses a bottom-up approach. For those risks that the financial markets provide inputs (hedgeable risks), the market price of risk is included in the liability measurement. To

determine the market price of risk, the insurer uses the prices of hedging instruments or other market consistent valuation techniques, for example, by calculating the liability based on a portfolio of replicating assets. For other risks (non-hedgeable risks), a separate risk adjustment is determined through a cost of capital approach. As a consequence, market-consistent embedded value uses a risk-free discount rate for discounting.

Methodologies for calculating a risk adjustment

19. There are currently a number of potential methodologies available for calculating a risk adjustment. In this section, the staff provides a brief overview of the potential methodologies. The staff points out that the topic of what would be the best methodology is controversial and generally based on an individual's preference since all of these methodologies are essentially trying to measure the immeasurable (that is, uncertainty). Accordingly, this analysis is designed to provide the boards with information about the numerous methodologies to assist the boards in moving forward on this project.

20. During the research of risk adjustments, the staff identified a recently issued paper that analyzes margins for uncertainty (risk adjustments) for life insurance and annuity products.[1] While this report focused on margins for uncertainty in the context of a principle-based framework for U.S. statutory financial reporting and focused on life insurance and annuity products, the staff found the analysis instructive in assessing the pros and cons of various risk adjustment methodologies. The staff has prepared a summarized table, derived from that paper, in **Appendix A** (along with an excerpt of the paper noting its limitations) that details the pros and cons of each methodology. Additionally, that full paper can be provided upon request.

21. The methods described in this paper can be grouped in different ways. Some of the methods only pertain to adjustments to individual assumptions while others are top-level adjustments. When applying risk adjustments at an individual-assumption level, it is more difficult to identify adjustments for diversification. However, risk

[1] The paper referred to is *Analysis of Methods for Determining Margins for Uncertainty under a Principle-Based Framework for Life Insurance and Annuity Products* dated March 31, 2009 prepared by PricewaterhouseCoopers for the Society of Actuaries.

adjustments applied at the individual-assumption level are easier to test and track. Methodologies that are consistent with applying risk adjustments to individual assumptions are factor-based and methodologies that use judgement based on experience (such as those used in US GAAP in Statement 60). Methodologies that are consistent with applying risk adjustments at a top-level are cost of capital (such as Swiss Solvency Test) and calibration to markets or insurance pricing. The other methodologies can be adapted for both individual-assumption application and top-level application.

22. The staff has grouped the risk adjustments into the following major types:

    (a) Explicit assumption methods

    (b) Quantile methods

    (c) Cost of capital methods

    (d) Discount rate methods

    (e) Other methods

    (f) Implicit (but unspecified) confidence level

Explicit assumption methods

23. Explicit assumption methods are the least complex of the methods researched. These methods can be best described as being based off of the actual assumptions. That is, the risk adjustment is the function of a percentage or limitation (for example, a minimum or maximum amount) of the assumption. One example is specifying a particular mortality table and then adjusting the mortality table by 5% to reflect the risk. Another example would be to assign a percentage by line of business; the riskier lines of business would have a higher percentage.

24. Examples of these types of methods are *factor-based methods* and *judgment based on experience studies*. *Factor based methods* are heavily reliant on the ability to select the appropriate factor and are not responsive to changing market conditions. In addition, it is difficult to determine when there is overlap of risk adjustments on assumptions (diversification) and therefore these could be construed as overly conservative. An example of a *factor based method* is found in U.S. GAAP and is referred to as provisions for the risk of adverse deviation (described earlier in this paper). Regulators find these methods appealing because of the ease of application and they are easily audited.

25. Methods based on *judgment based on experience studies* generally incorporate the historic experience of the entity. This is useful in making the risk adjustment more relevant than the *factor based methods* but is also its biggest weakness. The use of the entity's historical experience allows for significant subjectivity in its application. These methods are most commonly used in solvency and performance reporting in countries such as the U.S., U.K., Australia, and Canada.

Quantile methods

26. Quantile methods use statistical approaches to derive the risk adjustment. These methods can be further divided into the following:

    (a) Confidence intervals

    (b) Conditional Tail Expectation

    (c) Multiples of the second or higher moments of the risk distribution

Confidence intervals

27. *Confidence intervals* are the most widely used and understood of the quantile methods. Rather than using a single amount (such as a mean), a *confidence interval* uses an interval that will likely include the desired outcome to provide an indication of the reliability of an estimate. A *confidence level* provides the likelihood that the estimate will be included within the interval. The confidence level is sometimes referred to as Value at Risk (VaR). The IAA's paper *Measurement of Liabilities for Insurance Contracts: Current Estimates and Risk Margins* provides a clear description of the use of confidence intervals in determining a risk adjustment stating:

> Risk margin methods based on confidence levels express uncertainty in terms of the extra amount that must be added to the expected value so that the probability that the actual outcome will be less than the amount of the liability (including the risk margin) over the selected time period equals the target level of confidence.

28. The use of *confidence intervals* for determining a risk adjustment has the benefit of being easy to communicate to users and are relatively easy to calculate. However, the usefulness of confidence intervals diminishes when the distribution of losses is not normal (that is, the loss distribution is skewed which is often the case for insurance contracts). When the loss distribution is not normal (that is, the mean and median are not equal), the selection of the confidence interval must take into

account additional factors such as the skewness of the loss distribution. In addition, this method ignores outliers (extreme losses in the tail) in the loss distribution.

29. For example, suppose a confidence level of 95% is used and the following estimates are made for two contracts. For contract A, the 95% confidence level is CU1,000 and the remaining 5% of the distribution is evenly spread from CU1,001 to 1,010. For contract B, the 95% confidence level is CU1,000 and the remaining 5% of the distribution is evenly spread from CU1,001 to 2,000. At the 95% confidence level, these two contracts will have the same risk margin. On the other hand, at say the 97% confidence level, contract A will be measured at CU1,004 and contract B will be measured at CU1,400.

30. *Confidence intervals* are currently used in Australia for solvency reporting of general (non-life) insurance. Under that regime, the risk margin is equal to the 75th percent confidence level of the loss distribution less the 50th percent confidence level (the best estimate). In Canada, quantile methods are used to apply a risk adjustment to each assumption (for life insurance) or by portfolio (for non-life).

Conditional Tail Expectation

31. Conditional Tail Expectation (CTE) (also referred to a Tail Conditional Expectation and Tail value at risk) is an enhancement of value at risk. CTE provides a better reflection of the potentially extreme losses than value at risk by incorporating the expected value of those extreme losses in the measure of the risk adjustment. The Society of Actuaries' paper *Analysis of Methods for Determining Margins for Uncertainty under a Principle-Based Framework for Life Insurance and Annuity Products* provides the following description:

> The CTE method is a modified percentile approach that combines the percentile and mean values of different cases. It basically calculates the mean of losses within a certain band (or tail) of pre-defined percentiles. With the CTE method, the margin is calculated as the probability weighted average of all scenarios in the chosen tail of the distribution less the mean estimate (which may or may not be the median, i.e. the 50th percentile). The CTE method is an improvement over the percentile (VaR) method discussed above since it smoothes some extreme claims (or statistical outliers).
>
> The key advantage of the CTE is that since it applies fundamentally the same calculation technique as the mean estimate, it has the benefit of consistency and it also reflects the skew of the distribution in the risk margin. For example, the CTE over the 75% confidence level (often referred to as CTE(75)) of a claim distribution is the expected value of all claims that fall into in the highest 25%

> of the claim distribution. The margin in this case would be taken as CTE (75) less the mean (i.e. best estimate) of claims.

32. The main drawback of this approach is the need to determine the loss distribution. As noted previously, the loss distribution for most insurance contracts is skewed. A compounding effect is that CTE focuses on extreme losses occurring in the tail of the insurance contract. The ability to predict the loss distribution under these conditions is difficult at best and subjects the calculation to significant judgment.

Multiples of the second or higher moments of the risk distribution

33. The term *moment* is used in mathematics to describe the nature of a distribution. The first moment is the mean of the probability distribution (in this project, that would be the first building block—the unbiased probability-weighted cash flows). Under a normal distribution, a bell-shaped curve generally represents the distribution. As noted previously, the loss distribution for insurance contracts is generally skewed. The second moment is the variance or standard deviation of the cash flows. This represents the degree of flatness of the distribution. The flatter the distribution, the higher the uncertainty (and the larger the standard deviation). The third and fourth moments are the skewness of the probability distribution and the kurtosis of the probability distribution, respectively. Skewness captures the lopsidedness of the distribution and kurtosis reflects the relative size of the tail of the probability distribution.

34. A risk adjustment based on multiples of the second or higher moments of the risk distribution can be used to achieve a selected confidence level. For example, the Society of Actuaries' paper *Analysis of Methods for Determining Margins for Uncertainty under a Principle-Based Framework for Life Insurance and Annuity Products* provides the following example:

> …a company could calculate the sample variance or the 3rd moments of sample mortality (or death benefits relative to death exposures). They could then add a percentage of variances to the mean assumption to derive the mortality parameter where the percentage multiplier is determined to target a certain level of confidence. For example, the mortality assumption could be set equal to the sample mean plus 0.1 times the sample variance. Similarly, if a risk parameter is known to be normally distributed, setting the assumption to equal the sample mean plus 0.675 times the sample standard deviation would result in risk margins calibrated to approximately the 75th percentile.

35. This method suffers from similar drawbacks as previously noted for this family of methodologies—specifically, there is significant judgment in determining the multiple when the loss distribution is skewed.

Cost of capital method

36. The cost of capital method attempts to reflect in the risk adjustment the cost of bearing risk. In its simplest form, the cost of capital is the cost of an entity's funds—that is, the estimated cost of holding the capital that is needed to give policyholders comfort that valid claims will be paid, and to comply with regulatory capital requirements, if any. The Society of Actuaries' paper *Analysis of Methods for Determining Margins for Uncertainty under a Principle-Based Framework for Life Insurance and Annuity Products* an example of an approach to determining a risk adjustment using a cost of capital method:

> Under the cost of capital (CoC) method, the margins for uncertainty are set equal to the required capital multiplied by the excess of the company's weighted average cost of capital over an appropriate risk free rate. The generic approach typically follows the steps outlined below:
>
> 1. Determine the required capital for a block of policies or product line based on the risks to which the company is exposed. The capital used may be based on regulatory capital, economic capital, rating agency capital or a mix of these (such as the highest of all three).
> 2. Project the future required capital over the lifetime of the liabilities relating to this business.
> 3. Calculate the company's weighted average cost of capital. There are various methods to determine the cost of capital, for example using the CAPM model to determine the cost of equity.
> 4. Calculate the present value of the product of required capital and cost of capital from time zero until all of the business has matured, discounting using an appropriate risk free rate.

37. A cost of capital method has the benefit of being potentially suitable for both general purpose financial reporting and for reporting to regulators. In addition, the cost of capital approach can be intuitive for those insurers who consider cost of capital in pricing decisions. It may also be understandable for users and may permit concise and informative disclosure.

38. The CRO Forum [of European insurers] suggested that an approach be developed that uses a 'replicating portfolio' of traded financial instruments to price the expected cash flows (and thereby also the risk adjustments associated with market variables), and a cost of capital approach to determine the risk adjustment associated with non-market variables.

39. However, the cost of capital method requires significant judgment to determine (a) what capital and (b) what cost (or required total return). The ability to compare risk adjustments across entities would be difficult and there

would be a lack of consistency. Further, the ability to attribute part of the cost of capital to a specific assumption would be arbitrary since the determination is done at an aggregate level (for example, how does the effect of diversification impact the risk adjustment on an individual assumption?).

Discount rate methods

40. Discount rate methods use adjustments to the discount rates to reflect the risk adjustment. In the case of a liability, the discount rate would be lowered creating a larger liability. The lowering of the discount rate implicitly creates the risk adjustment. However, there is no ability to apply these methods at the individual assumption level. Therefore, the risk adjustment cannot be quantified nor can the effect of changes be attributed to individual assumptions.

41. Examples of these methods include *risk adjusted returns* and *deflators*. Risk adjusted methods start with the risk-free rate and subtract a risk adjustment. There is significant judgement surrounding the amount of the risk adjustment and how that amount reflects other attributes such as the line of business. *Deflators* are much more sophisticated and more conceptually appealing than *risk adjusted returns*. *Deflators* are calculated through using a stochastic process to determine the discount rate. That is, a different *deflator* applies to each outcome and expresses for each outcome how much value market participants place on cash flows in that scenario. The attractiveness of *deflators* is the recognition in the method that risk-averse market participants place more weight on some outcomes than others. The drawback of this approach is the need for an efficient market to provide the necessary information. While markets may exist for certain guarantees and options within an insurance contract, generally no secondary market exists for insurance contracts and prices in the primary market may not be readily observable.

Other methods

42. The following are several other methods identified during the staff's research:

    (a) Stress/Sensitivity testing

    (b) Stochastic modelling

    (c) Calibration to the capital markets or insurance pricing

Stress/Sensitivity testing

43. As the name implies, this method is comprised of stressing the underlying assumptions and determining how the changes in the assumptions impact the expected claim payments or capital. These tests are well-suited for determining individual risk adjustments on individual assumptions, but at the same time taking into consideration the effects of diversification. However, these tests can also be time-consuming and subject to significant judgment. For example, what is the appropriate level of change in the assumption? If a desired result is a highly conservative risk adjustment, then the stress of the assumptions can be made to achieve this result.

Stochastic modeling

44. Stochastic modelling is a technique used to estimate probability distributions of potential outcomes by randomly varying one or more inputs over time. Generally historical information is used to derive the randomness of the outcomes and a large amount of simulations using the random variances is run. Because stochastic modelling focuses on varying individual inputs, this method can be applied at the individual assumption level which allows for tracking and useful disclosures. The Society of Actuaries' paper *Analysis of Methods for Determining Margins for Uncertainty under a Principle-Based Framework for Life Insurance and Annuity Products* provides the following example of an approach to using this method:

> Where stochastic modelling is used to help quantify the margins for non-hedgable risks, the approach applied typically involves the following steps:
>
> - Fit a probabilistic distribution to the risk factors being modelled (e.g. mortality or withdrawal rates). This can be based on historic experience, academic research and/or actuarial judgment.
> - Stochastically simulate liability results under thousands of different scenarios (each one sampling randomly from the risk factor distribution for the parameter of interest). The intrinsic risk factor volatilities can be measured based on the simulated results.
> - Quantify the required assumptions and margins by taking an appropriate percentile from the distribution of simulated results. Where required, the precise assumption for the parameter of interest can be determined based on the specific scenario that generated liabilities at the chosen percentile. The margin for uncertainty can then be set equal to the sampled parameter in this scenario less the best estimate assumption for the parameter.

45. Some of the drawbacks of a method that uses stochastic modelling is that the complexity increases as more variables are included in the modelling. In addition, this method can be very difficult to explain because the actual simulations are not

transparent. Stochastic models also can be difficult to control and audit because the output based on random variances of potential outcomes cannot be replicated for testing.

46. Stochastic models are most likely to be applied for:

    (a) contracts that involve complex guarantees, for example unit-linked contracts that include guarantees of minimum death benefits.

    (b) Portfolios exposed to catastrophic risk such as hurricane or earthquake.

Calibrate to the capital markets or insurance pricing

47. Calibrating to the capital markets or insurance (or reinsurance) pricing uses market information to derive a risk adjustment. In many instances, market participants are including in the pricing of risk the same uncertainty that a risk adjustment is attempting to include in the measurement of the insurance contract such as volatility of the cash flows and expectations of future cash flows. However, this method depends on the presence of a deep and liquid market. In addition, many market participants include in the pricing other components such as credit and liquidity that is not consistent with the purpose of the risk adjustment in this project. Therefore, this method appears to be better suited to benchmarking or testing other methods for determining a risk adjustment.

Implicit (but unspecified) confidence level

48. An implicit (but unspecified) risk adjustment can be described as the use of conservative assumptions that aim to give reasonable assurance at an implicit confidence level that ultimate cash payments will not exceed the recognised liability. Terms sometimes used in this context are *sufficiency* (for example, a high probability that amounts paid will not exceed the reported liability), *provision for risk of adverse deviation*, and *prudence*. The staff has not provided any analysis on the use of an implicit (but unspecified) confidence level because these methods are deemed to not meet the requirements of the third building block (that is, an explicit risk adjustment).

Staff analysis

49. Based on the research performed, the staff has the following general observations about risk adjustments:

(a) Risk adjustments are complex. Any mention of "easy" should be taken in the context of the subject matter. However, insurance is complex as well. The idea that some simplistic notion can be used to explain something as complex as insurance is not realistic.

(b) The number of existing and developing methods is growing rapidly.

(c) The inputs within a given method can vary. In addition, often times elements of one method can be incorporated as part of another method (for example, confidence levels could be used in deriving a factor-based risk adjustment or in a cost of capital method).

(d) The viability of a particular method is based on the facts and circumstances of the situation and the desired information expected to be derived from the risk adjustment.

(e) Significant judgement is needed not only in selecting the inputs but also in applying the methodologies. The only defense is good disclosure.

(f) Risk adjustments are subject to manipulation. Inherently any highly judgmental estimate with the possibility of significant variances has this weakness. Robust disclosure and the use of specialists subject to a rigorous set of principles may help to mitigate this weakness.

(g) Risk adjustments are attempting to convey, among other things, the uncertainty in highly uncertain cash flows. Inherently, similar to the estimate of claims amounts, the estimate (like the risk adjustment) will always be subject to questions about accuracy. Additionally, risk adjustments are designed to reflect "normal" adverse activity and while most methods take into account extreme events, no method will fully capture the occurrence of a rare, extreme event (otherwise insurance contracts would not be affordable).

(h) To the extent a risk adjustment methodology is new or not currently part of an entity's reporting (that is, required under existing accounting guidance, regulatory, or voluntary), implementation of a new methodology will be costly.

(i) If one method covered all types of insurance contracts, the regulators would have identified and used the methodology consistently across jurisdictions.

50. The staff notes that even the experts in this field cannot provide a consensus view on the appropriate methods mainly because the answers are based on the particular circumstances. The ad hoc Risk Margin Working Group of the International Actuarial Association published a paper dates April 15, 2009, *Measurement of Liabilities for Insurance Contracts: Current Estimates and Risk Margins*, based on a request from the Solvency and Actuarial Issues Subcommittee and the Insurance Contracts Subcommittee of the International Association of Insurance Supervisors. The findings as outlined in the executive summary are as follows:

    While no method can currently be tested for market-consistency for insurance risks (given that there is no current market for insurance liabilities), we have evaluated each of these four main risk margin approaches and arrived at the following conclusions:

    - The cost of capital method (without simplification) is the most risk sensitive and is the method most closely related to pricing risk in other industries. However, in part as a result, it is also more challenging to implement than the other methods.
    - Within the quantile family of methods, CTE approaches are conceptually more sound than confidence level approaches, with the differences being significant for products with more skewed risk distributions. To the extent that confidence levels are specified for risk margins or capital measurement in the cost of capital method, these can better represent appropriate capital levels for this purpose. Regulatory oversight or actuarial practice would apply higher levels for products whose risk distributions are more highly skewed.
    - Explicit assumptions and discount approaches could be used as approximations for other methods. However, consistency among insurance products and between insurance and other industries is not practical using a purely explicit assumption or discount approach.

51. Some Board members have expressed a concern that some of the methods for determining a risk adjustment may not be linked to the actual liability. Therefore, these Board members suggested an option pricing model that would implicitly include the risk adjustment (see Agenda Paper 6E/FASB Memorandum No. 41E). In the approaches that are considered bottom-up, the linkage to the liability is established through the impact on the individual assumptions. The individual assumptions are then used to calculate the liability. In the approaches that are applied at a top down, such as cost of capital, the linkage is more difficult to explain.

52. For example, as discussed in paragraph 36, cost of capital is the estimated cost of holding the capital that is needed to give policyholders comfort that valid claims will be paid, and to comply with regulatory capital requirements, if any. The

objective behind this method is more focused on solvency and a particular return on capital than the measurement of the liability. In fact, the cost of capital method appears more adept to regulating an insurance entity as opposed to general purpose financial reporting to shareholders and other stakeholders. That is, because there are a number of inputs that can be used for capital and a number of inputs that can be used for the required return on capital, consistency can only be achieve through stipulating what capital and required return are used. That said, because this method is more adept to regulating an insurance entity, a benefit would be that an insurance entity may be able use the cost of capital method for both general purpose financial reporting and regulatory reporting (with the regulator stipulating the inputs to be used and whether there are limits). However, the staff believe that the goal of general purpose financial reporting is not solvency (focused on worse case scenarios) but the profitability of an entity. Accordingly, the boards should be cognizant of the requirements under regulatory accounting but this should not be the sole determinant for a particular method for determining a risk adjustment.

53. The staff reviewed numerous papers on the different methods. From an accounting standpoint, the staff believes there are some critical considerations (cost-benefit, ability to communicate to investors, etc.) in determining the optimal method or methods to be used for determining the risk adjustment. The following provides a table by method of these critical considerations:

Methods for determining a risk adjustment	**Ease of implementing**	**Ease of benchmarking**	**Understandable**	**Simple disclosures**	**Conceptually appealing**
Explicit assumption methods:					
Factor-based	Yes	Maybe	Yes	Yes	No
Judgement based on experience studies	Maybe	No	Yes	Maybe	Maybe
Quantile methods:					
Confidence intervals	Maybe	Maybe	Yes	Yes	No
Conditional Tail Expectation	Maybe	Maybe	Maybe	Yes	Yes
Mutliples of the second or higher moment	Maybe	Maybe	Maybe	No	Maybe
Cost of capital	Maybe	No	Maybe	No	Maybe
Discount rate methods:					
Risk adjusted returns	No	No	Yes	No	Maybe

Methods for determining a risk adjustment	**Ease of implementing**	**Ease of benchmarking**	**Understandable**	**Simple disclosures**	**Conceptually appealing**
Deflators	No	No	No	No	Yes
Other methods:					
Stress/Sensitivity testing	Yes	Yes	Yes	Yes	Maybe
Stochastic modelling	No	No	No	Maybe	Yes
Calibration to the capital markets or insurance pricing	No	No	Maybe	No	Yes

54. While a factor-based method appears to contain some of the desired attributes for accounting, it is not appealing from a conceptual standpoint. In addition, it would require the boards to determine the factor(s). That is, the boards would need to stipulate what amount(s) or percentage(s) should be added to each individual assumption. This is not consistent with a principles-based approach and presumably the factor would need to be updated on a regular basis to reflect changes in the industry and the economy. Further, consideration would need to be provided for different products and for different geographical locations as sovereign laws and courts differ significantly around the world.

55. Another method that appears promising is the use of sensitivity analysis and stress testing. However, a method using these tools would be very costly and time consuming. Many medium-sized and small insurance entities would have difficulty complying because of lack of resources and the need to pass along the cost to its customers (thus potentially putting these entities at a competitive disadvantage with larger insurance entities).

56. The quantile methods also have some appeal, specifically the CTE method. As noted previously, the CTE method is more refined than value at risk because it partially reflects the effects of extreme events that may occur in the tail. However, while this approach provides useful information for those contracts with a tail, for contracts without a tail (such as life insurance) it may result in a less useful risk adjustment. For example, because of the long term nature of many life insurance contracts, changes in experience assumptions or trends may not be adequately reflected. These methods are also subject to considerable judgment and the ability to estimate a meaningful distribution for a contract that has a skewed distribution.

57. Because no one method for determining a risk adjustment appears to be superior in all instances, the staff believes it is imperative to consider the potential disclosures that could be required.

Disclosures

58. The staff believes that a discussion about an area as complex as risk adjustments necessitates a discussion about the potential disclosures surrounding these adjustments. Admittedly, one of the ways to deal with the variety and complexity of the methods described in this paper is through detailed disclosures. The staff

first performed a review of a sample of SEC Form 10-K disclosures on PADs (a list of the disclosures sampled can be provided to the boards upon request). The disclosures appear for the most part boilerplate and uninformative as to the specifics and significance of the PAD in measuring these uncertain liabilities (most disclosures merely acknowledge the presence of this factor). Based on the review of 10-Ks, some entities explained that they:

(a) include a provision for adverse deviation from estimated early policy surrender behavior

(b) include a provision for adverse deviation from expected claim levels, due to changes in underlying assumptions,

(c) include a provision for adverse deviation, meaning they allow for some uncertainty in making our assumptions,

(d) include a provision for adverse deviation, which is intended to accommodate adverse fluctuations in actual experience.

59. The staff then determined that a similar situation exists for Level 3 measurements in Statement 157—that is, the lack of a market to derive observable inputs. Accordingly, the staff suggest the following disclosures (in part based on the disclosures required under Statement 157) by line of business or similar logical groupings of insurance contracts:

(a) The amount of the risk adjustment at the reporting date. This could be achieved through a comparison of the probability-weighted cash flows with and without a risk adjustment.

(b) The type of approach (that is, top-down or bottom-up) and methodology chosen to determine the risk adjustment (that is, top-down or bottom-up) and the reasons for choosing that methodology.

(c) If differences exist in the methodologies used to determine the risk adjustment within a line of business or similar logical grouping, the reason for those differences.

(d) If a methodology is changed during a period, a description of why that methodology was changed and the impact of that change on the amount of the risk adjustment.

(e) With regard to the inputs used in the methodology:

(i) A description of the inputs. Description of the inputs may be easy for models that use few inputs and difficult for models that rely on more inputs. Ease of communication of the model and inputs is one factor the staff think an insurer should consider in selecting approaches.

(ii) The information used to determine the inputs

(iii) A sensitivity analysis surrounding the inputs that may significantly impact the measurement

(iv) Explanation of how the sensitivity analysis is performed and why the chosen analysis is appropriate and representative

(f) A rollforward of the beginning balance of the risk adjustment to the ending balance, including the following items:

(i) Risk adjustments related to new business

(ii) Risk adjustments related to expired/terminate business

(iii) Changes in the risk adjustment (a detailed description of why this amount changed during the period)

60. The staff believes that these disclosures, while detailed, will provide the necessary information to users to not only compare what methodologies are applied to a line of business but also track the effects of changes in the risk adjustment (and compare those adjustments between entities that are purporting to use the same adjustment).

Staff recommendation

61. The staff recommends not requiring a particular method for determining a risk adjustment. The staff believes that the wide range of insurance contracts necessitates flexibility in selecting the best approach for determining a risk adjustment. Further, no one method appears to be superior for all insurance contracts. Additionally, the rapid pace of development and the continued advances in techniques for estimating uncertainty makes it imperative not to select just one method that may become obsolete (and require further standard setting to change the method required). The staff also points out that in some instances one method is used as part of or in support of another method. Requiring a single method may preclude the use of a supporting method and in effect negate the effectiveness of the

required single method.

62. The staff points out that the difficulty in selecting a methodology for determining a risk adjustment is not a result of a deficiency or lack of clarity in the measurement objective. The staff also believes its recommendation is consistent with the approach taken for measuring fair value under Statement 157. That Statement defines fair value but does not prescribe how to calculate fair value. Liabilities that fall within Level 3 (use of unobservable inputs) would presumably be using the same methodologies as discussed in this paper. Statement 157 does discuss the inputs used to determine fair value. In the instance of determining a risk adjustment, the method chosen may not be as important as the inputs used. Therefore, it may be more important to determine the contract boundaries and what is used to determine the overall measurement (including the risk adjustment).

63. In its research performed on PADs used under U.S. GAAP, the staff believes two key points are relevant to the discussion in this paper. First, U.S. GAAP does not provide a specific objective for the PAD, nor does it provide a specific method by which to calculate the PAD or any parameters around the inputs used for the PAD. Practice has developed through discussions among actuaries, accountants, and auditors to dictate how the PAD is applied. Second, while practice has led to consistencies in how to apply the PAD, disclosure surrounding the PAD is not generally robust. The staff believes that risk adjustments are an area that must be further developed by the experts and the accountants. The staff also believes that the appropriate disclosures must be made to communicate information about risk adjustments. Accordingly, the staff recommends that the disclosures discussed in paragraphs 58 through 60 should be included in the exposure draft.

Question for the boards
Do the boards agree with the staff recommendation?

Objective for a risk adjustment

64. In paragraph 6 of this memorandum, the staff provided a working draft of the objective for the overall measurement for insurance contracts. The objective is:

> **[an entity's current estimate of] the present value of resources required to fulfil the net obligation created by the insurance contract.**

65. The fulfilment of the net obligation (that is, the net of the cash inflows [premium] and cash outflows [claims payments]) is subject to significant uncertainty. Insurers (and investors in insurers) demand compensation for bearing uncertainty – an insurer is concerned about unfavorable deviations from its assumptions (uncertainty in its assumptions). That uncertainty arises from the fortuitous nature of insurance—the insurance entity does not know if or when it may be required to pay for insured events. Uncertainty is included in the price of the insurance contract (the customer consideration) in the form of a profit (that is, what the insurance entity demands to take on the risk of the policyholder). However, profit can emerge from two sources.

66. The most common source is through receiving customer consideration that exceeds the performance obligation of the contract. The difference between these two amounts is profit (if no variability exists in either amount). The other source is a reduction in the expected costs to perform under the contract. This second source is what is being captured by the risk adjustment. The profit embedded in the customer consideration pertains to the protection being provided by the insurance entity to the policyholder. Arguably, that profit should be recognized over the period in which the protection is being provided. However, most insurance contracts contain significant uncertainty surrounding when a payment will be made and the amount of that payment. Recognizing all of the profit in the customer consideration during the period in which protection is being provided would not represent the obligation under the insurance contract. Accordingly, the risk adjustment provides the means by which that *profit* can be incorporated in the insurance liability. The risk adjustment represents both an indication of the uncertainty of an insurance contract and a deferred profit. If the insurance contract suffers claims higher than expected, the risk adjustment is a reflection of that adverse development. If the claims under the insurance contract equal expectations, then the risk adjustment represents a deferred profit.

67. In addition, depending on the decisions reached on the treatment of a residual margin, that decision may necessitate a risk adjustment. That is, the decision to recognize the residual margin over the coverage period (and presumably revenue would be recognized over that same period) does not allow for any profit recognition over the claims settlement period. Accordingly, the risk adjustment is needed to reflect the fact that the insurance entity (a) must perform during the claims settlement period and (b) is subject to potentially significant uncertainty in the ultimate timing and amount of the payout.

68. At the January 2010 joint meeting, the boards decided tentatively that the risk adjustment should be **the amount the insurer requires for bearing the uncertainty that arises from having to fulfil the net obligation arising from an insurance contract**. This objective achieves two goals: it links back to the measurement objective and it is broad enough to accommodate multiple methods for determining the risk adjustment. That said, the objective has been criticized for being too broad. Consequently, the staff believes that there are several possible avenues:

    (a) If the boards choose a specific method for determining the risk adjustment, elements of that method should be incorporated in the objective. For example, if the boards chose a conditional tail expectation method at the 90th percentile, the objective could read as follows:

        the amount the insurer requires to achieve the expected value of all outcomes beyond the 90th percentile for bearing the uncertainty that arises from having to fulfil the net obligation arising from an insurance contract

    (b) If the boards choose a type or family of methods for determining the risk adjustment, commonalities among the methods should be incorporated in the objective. For example, if the boards chose methods that use confidence intervals, the objective could read as follows:

        the amount the insurer requires <u>at a high level of confidence</u> for bearing the uncertainty that arises from having to fulfil the net obligation arising from an insurance contract

    (c) The boards could focus on the common attractive attributes of acceptable methods and derive the objective from those attributes. For

example, the boards may decide that methods that reflect the effects of diversification are superior. The objective could state:

the amount the insurer requires for bearing the uncertainty that arises from having to fulfil the net obligation arising from an insurance contract reflecting the effects of diversification.

(d) The boards could focus on common attributes among the methods the boards do not want to allow. For example, the boards may decide that a discount rate method is not acceptable because it cannot be applied at the individual assumption level. The objective could state:

the amount the insurer requires for bearing the uncertainty that arises from having to fulfil the net obligation arising from an insurance contract calculated at the individual assumption level.

69. In summary, the proposed objective for a risk adjustment can be further tailored to accommodate the decisions of the boards. The staff has provided a list of factors for determining a risk adjustment in **Appendix B** that can be included in the exposure draft to assist in determining the appropriate methods for a risk adjustment. In addition, the staff makes the following observations:

    (a) It will be difficult to satisfy everyone's notion of the role and characteristics of a risk adjustment

    (b) If the boards decide on a specific method or type or family of methods, the task of drafting the objective is made easier

    (c) If the boards decide that an entity should choose the best method based on the facts and circumstances, the objective must be broad enough to allow flexibility in selecting a method and the disclosures must be robust

70. Accordingly, the staff recommends that the boards reaffirm their decision at the January 2010 joint meeting—that is, the risk adjustment should be the amount the insurer requires for bearing the uncertainty that arises from having to fulfil the net obligation arising from an insurance contract. Based on the decision about a methodology for determining a risk adjustment, the staff will tailor the objective and description of the risk adjustment.

Question for the boards
Do the boards agree with the staff recommendation?

Appendix A

A1. This appendix includes two tables that are summarizations of data from *Analysis of Methods for Determining Margins for Uncertainty under a Principle-Based Framework for Life Insurance and Annuity Products*. As the paper indicates, it is focused on life and annuity insurance contracts. Further, the paper was written in the context of determining margins for uncertainty for a statutory framework (that is, a framework that focuses on solvency) and is based on the generally accepted **actuarial** principles and individual company experience. Section 2.4 of the paper provides the limitations of the research conducted the most significant being that the research is intended to be educational and not draw any conclusions or quantify differences in methodologies.

A2. The first table provides an overview of the margins by the level of aggregation (that is, at an individual assumption level or across all risk types and assumptions). The second table is a summarization of the available methods for determining a risk adjustment, the pros and cons of those risk adjustments, and examples of the practical applications.

A3. The following terms are used in the table and require additional clarification:

Best estimate liabilities: The most likely "estimation" of an insurer's future obligations.

Required capital: Capital that is intended to act as a buffer for extreme "tail events." This generally refers to the capital requirements as set forth by a regulator focusing on solvency.

Hedgeable assumptions: Assumptions that can be diversified (interest rate risk and equity market performance).

Non-hedgeable assumptions: Assumptions that cannot be diversified (mortality, morbidity, withdrawals, other policyholder behaviors, expenses, etc.).

Margin approach by level of aggregation	Characteristics	Pros & Cons	Examples of methodologies under this approach
Bottom-up	Quantify the overall margins by adding margins on each individual assumption. North America has traditionally utilized bottom-up approaches in the design of solvency and performance measurement frameworks. In general, bottom-up approaches are typically more consistent with setting margins on individual assumptions.	☑ Providing explicit feedback loops by assumption, which allow management, auditors and regulators to monitor the appropriateness of reserving in light of emerging experience. ☑ Since the margins are broken-down at the individual assumption level, it is easy to review and monitor the degree of uncertainties assumed by actuaries and the variation of actual experiences from expected assumptions as the business matures. ✘ **Whether and how to take into account the diversification effects between risks.** For individual risks that are not independent of each other, the diversification effects could (in theory) be identified and allowance made for them as an adjustment to the overall insurance liabilities. Otherwise applying margins to each assumption independently might result in redundancy in the overall margins and hence overly conservative final reserves. However, quantifying the diversification effects is sometimes extremely difficult due to the complex path-dependent nature of the "payoffs" of future cash flows. For example, the utilization of variable annuity guarantees is clearly correlated with the withdrawal assumptions. However quantifying the correlation, if possible, is time-consuming and onerous. Also history has shown that correlations tend to break down in extreme market conditions.	Judgement based on experience studies or factor-based methodologies. Methods such as sensitivity testing, stress testing, quantile, and stochastic could also be applied at this level of aggregation.
Top-down	Determine the margins on an aggregate basis across all risk types and assumptions, relative to best estimate liabilities or required capital. The European Union is tending towards use of top-down approaches. However, top-down approaches can often be applied to help calibrate and test the overall level of margins determined using a bottom-up approach.	☑ Implicitly address the diversification issue. ☑ Might implicitly consider various risks that are not considered in many bottom-up approaches. For example, the market-consistent cost of capital method (also called market value margin) adopted by Swiss Solvency Testing uses the company's required capital in the calculation of risk margins. The required capital has often incorporated different types of asset risks (such as credit risks, liquidity risks, etc), liability risks (such as mortality risks, longevity risk), asset-liability mismatch risks (such as interest rate risks, duration mismatch risks) and operational risks (such as frauds, malpractice, reputation, etc). ✘ However, unlike the bottom-up approaches, **top-down approaches do not provide such clear and transparent feedback**	Cost of capital method; calibration to capital markets or insurance pricing. Methods such as sensitivity testing, stress testing, and stochastic could also be applied for multiple inputs.

		loops to monitor the deviation of actual experience from expected.	

Margin approach (by group of methodologies)	Characteristics	Pros & Cons	Examples of practical application
Factor Based Approaches	This method refers to the application of factors that actuaries incorporate in the reserving process. Insurance companies may be required to apply factors prescribed by regulators, or they may determine the factors themselves based on regulatory guidance and company policies. Appropriate for setting margins on individual risk factors such as mortality, expenses, expense inflation, default costs (assets-related), policyholder behavior.	☑ Relative ease of calculation and stability across different reporting periods. ☑ Not overly reliant on the credibility of historic data or company experience. ☑ Suitable for both large and small firms. ☑ Appropriate for application to all risk factors; ✘ **The factors result in unspecified conservativeness** (established at an implicit confidence level) being embedded in the assumptions or reserving methods. This leads to higher possibility of manipulations; ✘ **Does not allow for monitoring the variation between expected and actual experience** as the latter is not referred to in the measurement.	The existing US GAAP reporting framework is a typical example of a factor-based method, where factors (known as provisions for adverse deviation or PADs) are applied to the reserving assumptions to make prudent allowance for risks such as mortality.
Discount related methods	These methods involve creating margins implicitly by modifying the discount rates used in calculating the insurance liabilities. The modification can be either addition or subtraction to the base discount rates. Mainly suitable for a top-down approach. Not suitable to determine risk margins on individual risk factors.	✘ Difficult to quantify margins. ✘ Margins generated are implicit and not transparent. ✘ Risk margins vary with variations in interest rates which have little to do with insurance risk. ✘ Difficult to apply to individual risk factors.	Net asset returns minus/plus a margin; Risk adjusted returns; Stochastic discount factors. Risk adjusted returns effectively used under regulatory reporting of general insurance in the US.
Judgment Based on Experience Studies	Under this approach, margins determined based on experience studies are applied to best estimate assumptions to generate a prudent liability. This approach may be used to adjust the base mortality, withdrawal, expense, or other non-financial assumptions by a factor that is based on experience studies (e.g. adjustments derived from actual-to expected ratios) to increase the insurance liabilities.	☑ Certain degree of transparency. ☑ Clear reference to historic company experiences. ☑ Explicitly covers individual risk factors. ☑ Typically easy to communicate to management, auditors and regulators. ☑ Provides a very natural mechanism to track the variation of actual versus expected experience for individual risk factors. ✘ Overly reliant on historical data and requires credibility of the data to be taken into account. ✘ It requires frequent experience studies	Canadian GAAP, US GAAP (FAS 60), UK Individual Capital Assessment Standards (ICAS), and Australian Margin on Service (MoS) have all published

Margin approach (by group of methodologies)	Characteristics	Pros & Cons	Examples of practical application
	This approach can be classified as a bottom-up one. Its application is appropriate to determine margins on the following risk factors: mortality, expenses, policyholder behavior	to support the quantification process, thus it does not result in stability of calculations between reporting cycles. ✘ It is also difficult to take account of diversification effects between different risk factors on an aggregate basis. ✘ The method is highly subject to the interpretation and judgment of actuaries and senior management. ✘ Requires the credibility of the experience data to be taken into account. ✘ Practical consistency would be difficult to achieve among different companies, especially when considering variations such as the sophistication of experience data between different sized companies. Therefore, this approach can be subject to manipulation.	guidelines around using historic experience studies to determine the risk margins for non-financial assumptions in the reserving of insurance contracts.
Sensitivity testing	This approach consists of determining how changes in key assumptions affect the amount of reserves of capital required. The actuary would typically need to be able to support why an additional margin should not be added. Sensitivity testing can be used in conjunction with stress testing to determine margins for uncertainties for individual risks or assumptions. Appropriate for setting margins on individual risk factors such as mortality, expenses, expense inflation, default costs, policyholder behavior.	☑ It can be performed at different levels of aggregation (i.e. across multiple products and/or risk factors) to help test the appropriateness of overall margins to also evaluate diversification effects. ☑ The theoretical approach and results are generally easy to communicate to management. ☑ Reasonably transparent. ☑ It can generally be implemented relatively easily within both large and small companies. ☑ It can be applied explicitly to both individual risk factors (assumptions) and multiple assumptions simultaneously in order to facilitate consideration of diversification effects. ✘ Sometimes the sensitivity modeling process can be complex and time-consuming. ✘ It relies heavily on actuarial judgment and might be subject to manipulation. ✘ It only tests a limited number of "future possibilities" on a deterministic basis and therefore may be questioned in relation to their accuracy. ✘ Difficulty in calibrating the chosen scenarios to appropriately reflect the desired level of confidence. This calibration is typically left to the judgment of the actuary performing the testing.	An example of a sensitivity test is the resiliency testing done in the U.K. and Australia.
Stress testing	Typically, stress testing involves varying multiple assumptions	☑ It can be performed at a different levels of aggregation (i.e. across	US statutory Cash Flow

Margin approach (by group of methodologies)	Characteristics	Pros & Cons	Examples of practical application
	simultaneously in a consistent manner. As such it is generally more useful to set or test the level of aggregate margins across multiple risks. In particular, stress testing can be useful to help determine whether the sum of individual risk margins (for individual assumptions) makes an appropriate allowance for any diversification benefit arising across the risk factors. Generally, deterministic scenarios will be developed to "shock" the future expected cash flows (and hence the insurance liability determined as the present value of future cash flows). The margins could be considered appropriate when the best estimate liability plus the margins would allow the company to survive under the desired severity of adverse scenarios. Appropriate for setting margins on individual risk factors such as mortality, expenses, expense inflation, default costs, policyholder behavior.	multiple products and/or risk factors) to help test the appropriateness of overall margins to also evaluate diversification effects. ☑ The calculations are typically relatively easy. ☑ The theoretical approach and results are generally easy to communicate to management. ☑ Reasonably transparent. ☑ It can generally be implemented relatively easily within both large and small companies. ☑ It can be applied explicitly to both individual risk factors (assumptions) and multiple assumptions simultaneously in order to facilitate consideration of diversification effects. ✘ Difficulty in calibrating the chosen scenarios to appropriately reflect the desired level of confidence. This calibration is typically left to the judgment of the actuary performing the testing. ✘ It relies heavily on actuarial judgment and might be subject to manipulation. ✘ It only tests a limited number of "future possibilities" on a deterministic basis and therefore may be questioned in relation to their accuracy.	Testing.
"Quantile" and Distribution Methods	The "quantile" and distribution methods refer to certain statistical approaches to determine the margins, which could include: 1. Confidence interval or percentile levels of risk factors (or Value at Risk – VaR); 2. Conditional Tail Expectation (CTE) (also called Tail Value at Risk or TVaR) measurement of risk factors; 3. Multiples of the second (variance or standard deviation) or higher moments (skewness of the probability distribution) of the risk distribution. 1. VaR aims to determine the extra amount required in addition to the expected value of losses such that the actual losses will be less than the amount of the established liability with the chosen level of confidence over a pre-defined time horizon. 2. The CTE method is a modified percentile approach that	☑ These methods benefit from relative transparency and ease of communication. ☑ Generally easy to calculate and can be used to determine margins for individual risk factors. ☑ They often make reference to historical data and relevant company experience. ✘ It can be difficult to justify the accuracy of the calculations when the risk factors being considered do not follow clearly defined probabilistic distributions. ✘ They may result in an over-reliance on historical data and may be highly dependent on the availability and credibility of that data. ✘ Easier to implement within larger companies that have greater volumes of historic experience data. ✘ These methods are more complex when actuaries are trying to determine a distribution to "fit" the risk factor directly than when relying on historical data.	VaR was prescribed by the Australian Regulator (APRA) in the "Prudential Standard GPS 210 – Liability Valuation for General Insurers".

Margin approach (by group of methodologies)	Characteristics	Pros & Cons	Examples of practical application
	combines the percentile and mean values of different cases. It basically calculates the mean of the losses within a certain band (or tail) of pre-defined percentiles. With the CTE method, the margin is calculated as the probability weighted average of all scenarios in the chosen tail of the distribution less the mean estimate (which may or may not be the median, i.e. the 50th percentile). Compared to VaR, the CTE method represents an improved method since it reflects extreme claims (or statistical outliers). 3. Margins for uncertainty can be set to equal a multiple of the second or higher moment of the risk distribution. These approaches are more appropriate to describe the following risk assumptions: mortality, default costs and policyholder behavior.	✘ This approach may not adequately establish margins for changes in experience assumptions or trends.	
Stochastic Modeling	Stochastic approaches may be used to help determine the margins for uncertainties required for non-hedgeable assumptions such as mortality, expenses and policyholder behaviors. In particular, the random fluctuation of risk factors could be modeled stochastically. For example, stochastic models of mortality and lapse rates have been used in some companies to develop their mortality and lapse assumptions. Where stochastic modeling is used to help quantify the margins for non-hedgable risks, the approach applied typically involves the following steps: □ Fit a probabilistic distribution to the risk factors being modeled (e.g. mortality or withdrawal rates). This can be based on historic experience, academic research and/or actuarial judgment. □ Stochastically simulate liability results under thousands of different scenarios (each one sampling randomly from the risk factor distribution for the parameter of interest). The intrinsic risk factor volatilities can	☑ It provides a mechanism to reference past experience (e.g. where this is used to calibrate the model parameters) without being overly-reliant on historical data. ☑ It can be used to determine margins for individual risk factors, but can often also be adapted to consider multiple risk factors simultaneously. ☑ It can be used to consider the diversification effects across different risk factors. ☑ The complexity of the approach, its widely documented theoretical underpinnings and the fact that the results can be analyzed for each individual scenario (including those at the percentiles representing the selected confidence levels) can reduce the scope for manipulation compared with deterministic approaches. ☑ The academic research conducted to support stochastic modeling for certain risk factors (e.g. mortality) can result in the approach being considered "accurate" in the sense that it responds appropriately to changes in the environment and underlying data. ✘ Complexity increases with the increase in the number of variables to	Examples only of stochastic models applied only to hedgeable risks (such as the Canadian Asset Liability Method – CALM).

Margin approach (by group of methodologies)	Characteristics	Pros & Cons	Examples of practical application
	be measured based on the simulated results. □ Quantify the required assumptions and margins by taking an appropriate percentile from the distribution of simulated results. Where required, the precise assumption for the parameter of interest can be determined based on the specific scenario that generated liabilities at the chosen percentile. The margin for uncertainty can then be set equal to the sampled parameter in this scenario less the best estimate assumption for the parameter. This approach is appropriate to set risk margins on the following individual risk factors: mortality, expense inflation, default costs, policyholder behavior.	be modeled. ✘ It can be very difficult and costly to implement. ✘ It might not be practical for small companies. ✘ It is usually necessary to re-run the stochastic model at each reporting cycle. ✘ It is often difficult to explain the process and results to senior management.	
Cost of capital	Under this methodology, based on the required capital for a block of policies or product line, according to the risks to which the company is exposed, the future required capital over the lifetime of the liabilities relating to this business is projected. The entity then calculates its weighted average cost of capital and determines the present value of the product of required capital and cost of capital from time zero until all of the business has matured, discounted using an appropriate risk-free rate. This approach is appropriate to set individual risk margin on mortality risk factor.	☑ It is directly related to the required capital therefore it implicitly takes account of diversification effects when using economic capital as the definition of required capital (assuming the economic capital itself has allowed for diversification benefits). ☑ It is relatively easy to implement and calculate assuming insurers have already built their economic capital models or use regulatory capital as the definition of required capital. ☑ It also provides for stability of calculations across reporting cycles and largely does not suffer from over-reliance on historical data. ☑ In addition, it is consistent with how investors may view the business. ✘ It is not always possible to explicitly consider individual risk factors using this method. Where required capital can be isolated for an individual risk factor, the advantage of implicitly incorporating diversification effects will no longer be applicable. ✘ The method is also subject to a certain degree of manipulation when calculating the Weighted Average Cost of Capital (WACC). ✘ The approach has limited transparency and can be difficult to explain conceptually to senior management, particularly when a market-consistent approach is adopted.	Swiss Solvency Test (SST).

Margin approach (by group of methodologies)	Characteristics	Pros & Cons	Examples of practical application
		✘ The method may be less cost effective for smaller companies, particularly where economic capital is used as the definition of required capital and they do not already have an appropriate model in place. ✘ The overall accuracy of margins produced using this approach would depend on the appropriateness of the chosen WACC applied in the calculation. ✘ There are different notions of required capital: regulatory capital, economic capital, rating agency capital or a mix of these, as the projected capital required to support the liabilities. Even within these different definitions, there are various methodologies that can be applied to develop the capital calculations. If there is no standard definition of required capital, the comparability of this method between companies (or even within the same company between different lines of business) may be reduced. ✘ There is also a circularity issue as, under this approach, risk margins are dependent on the required capital which is typically defined to be the excess capital required above the insurance liability (which is the best estimate liability plus the margins for uncertainty).	
Calibration to the Capital Markets or Insurance Pricing	These are both top-down approaches and so they are potentially most useful in testing the calibration of overall margins allowing for diversification between different risk factors. Appropriate to set individual risk margin on mortality risk factor.	☑ Reasonable degree of transparency as they reflect capital market inputs or company pricing practices. ☑ They often implicitly take account of the diversification effects between risk factors. ☑ They do not extensively rely on a company's historical data. ☑ Relatively easily explained (conceptually at least) to senior management. ☑ In theory, these approaches should also minimize the risk of manipulation. However, this advantage will only be fully realized when there are deep, liquid and fully efficient markets for trading insurance liabilities. ✘ Indeed the methods themselves are only really practical when there is a deep and liquid market to provide stable, easy to obtain, accurate and unbiased inputs. ✘ They do not explicitly consider individual risk factors since the market pricing usually incorporates	(The Wang Transform falls in this category).

Margin approach (by group of methodologies)	Characteristics	Pros & Cons	Examples of practical application
		many risk categories. ✘ The market pricing often also makes allowance for risks that would be considered "outside" those covered by margins on insurance liabilities, such as catastrophes and "black swan" events. These risks are typically covered within required capital. ✘ The accuracy of the approach may sometimes be reduced through the use of out of date or biased market information to calibrate the margins. This issue is exacerbated since the approaches typically make limited reference to historic experience data to validate the calculated margins.	

Appendix B

Factors for determining a risk adjustment

B1. The objective of including a risk adjustment in the measurement of an insurance contract is to convey useful information to users about the uncertainty associated with the contract. To achieve that objective the estimate of the risk adjustment should consider the effects of uncertainty about the amount and timing of future cash flows.

B2. To convey useful information about future cash flows, the characteristics of that risk adjustment are likely to include the following:

(a) The less that is known about the current estimate and its trend, the higher the risk adjustment should be.

(b) Risks with low frequency and high severity will have higher risk adjustments than risks with high frequency and low severity.

(c) For similar risks, long duration contracts will have higher risk adjustments than those of shorter duration.

(d) Risks with a wide probability distribution will have higher risk adjustments than those risks with a narrower distribution.

B3. Furthermore, an insurer should select an approach for determining risk adjustments that considers the following factors:

(e) Numerous techniques exist for determining the risk adjustment. The selection of the appropriate method may vary between types of insurance contracts and different entities. Judgment must be applied in determining the appropriate method for each type of insurance contract. Various techniques are available and the use of the methods may vary by product (see Appendix C [not reproduced]). For example, one potential method could focus on a particular confidence level, such as the quantile method. Another method is based on cost of capital, acknowledging that an insurer's ability to sell new business to policyholders depends on holding sufficient capital to enable it to cope with adverse events.

(f) Risk adjustments should be explicit, not implicit. That is an important change from many existing practices that rely on estimates incorporating an implicit (and often unstated) degree of conservatism or prudence. Separating explicit estimates of future cash flows from explicit risk adjustments would improve the quality of estimates and enhance transparency.

(g) The risk adjustment for an insurance liability should reflect all risks associated with the liability.

(h) The risk adjustment for an insurance liability should not reflect risks that do not arise from the liability, such as investment risk (except when investment risk affects the amount of payouts to policyholders), asset-liability mismatch risk, or general operational risk relating to future transactions.

(i) The approach should be implementable at a reasonable cost and in a reasonable time, and be auditable.

(j) The approach should not ignore the tail risk in contracts with very skewed pay-offs, such as contracts that contain embedded options (eg the interest guarantees and other financial guarantees embedded in many life insurance products) or that cover low-frequency high-severity risks (such as earthquake), or portfolios that contain significant concentrations of risk. For example, if a large portfolio of insurance contracts is subject to significant earthquake risk but the insurer estimates that the probability of an earthquake is only 1 per cent, the approach should not ignore that risk.[2] Option-pricing methods or stochastic modelling may be needed to provide effective estimates of the risk adjustments associated with these items.

(k) The approach should make it easy to provide concise and informative disclosure, and for users to benchmark the insurer's performance against the performance of other insurers.

(l) If more than one approach is compatible with the above criteria, it is preferable to select an approach that builds on models that insurers use (or are developing) to run their business. For example, an insurer may be able to build on an economic capital model, an embedded value model or a model developed for solvency, if the resulting approach is compatible with the above criteria.

(m) The approach should not overlook model risk (the risk that a model is not a good description of the underlying process) or parameter risk (the risk that a model uses estimates of parameters that differ from the true parameters, or that the parameters may change over time).

B4. Although the DP described the risk adjustment as conceptually separate from the other building blocks (expected cash flows, discount rate), the staff believes that the IASB did not intend to preclude 'replicating portfolio' approaches. A replicating portfolio is a portfolio of assets whose cash flows **exactly** match those contractual cash flows in amount, timing and uncertainty. If a replicating asset exists for all (or, more likely, some) of the cash flows, the insurer can include the fair value of these assets in the measurement of the insurance contract, instead of estimating the expected present value of those cash flows and determining an explicit risk adjustment for those cash flows. To avoid double counting, the risk adjustment does not include any risk that is captured in the replicating portfolio.

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[2] The tail risk affects both (1) the expected cash flows and (2) the risk adjustment required for possible variations from the expected cash flows. Estimates of expected cash flows need to capture the effect that tail risk has on (1). The risk adjustment needs to capture the effect of tail risk on (2).