Institute of Actuaries of Australia

Resilience Reserve Task Force Discussion Paper

6 August 2007

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1 INTRODUCTION

1.1 Scope

Late in 2006, the Institute of Actuaries of Australia established a task force ("RRTF") reporting to the Life Insurance and Wealth Management Practice Committee to review the basis for determining resilience reserves for life insurers under the Solvency and Capital Adequacy Standards, and to make recommendations for changes to the LIASB.

The terms of reference of the RRTF set out a number of objectives and deliverables. The initial work of the Task Force focussed on the first objective set out in the terms of reference:

> "Objective 1 is to determine principles and parameters that can inform:
>
> - the development of detailed criteria for the approval of internal models to assess resilience reserve requirements; and
> - the determination of an appropriate prescribed reserving basis to replace the Determination of Resilience Reserves under Actuarial Standards 2.04 (Solvency Standard) and 3.04 (Capital Adequacy Standard)."

In considering this objective, the Task Force has deliberately not focussed on practical implementation issues, but has simply focussed on what would be theoretically desirable. Further, we have not made any assumptions as to the underlying models or model structures that might be applied in setting up an internal model.

Subsequent work will address the development of an appropriate prescribed reserving basis (consistent with the principles and parameters referred to above), and the determination of detailed criteria for the approval of internal models to assess resilience reserve requirements. As part of this subsequent phase of work, practical implementation issues will need to be addressed; hence we would not necessarily expect the prescribed reserving basis to explicitly address every point of principle.

In relation to Objective 1, the terms of reference state that:

- "principles" refers to those broad issues identified in earlier resilience work which are relevant to an assessment of resilience requirements and which still need to be

considered (or re-considered) by the LIASB (e.g. mean reversion, diversification, tail dependence); and

- "parameters" refers to the derivation from analysis of historical experience of suitable stochastic distributions and their associated parameters which would underpin both an internal model and the prescribed basis.

It is worth highlighting a small number of key elements set out in the RRTF's terms of reference:

- the resilience reserving basis does not need to allow for a fund to be able to meet its resilience reserve subsequent to an adverse market movement;
- consideration should be given to a range of "economic shocks" (which we have interpreted as being the full range of "market-related risks");
- the overall level of security that the basis should target is coverage of market-related risk events at a 95% (Solvency) / 99% (Capital Adequacy) confidence level over one year, although the RRTF has also been asked to consider whether the one year time horizon is inappropriate for any particular risks.

The purpose of this report is to provide the preliminary views of the RRTF in respect of Objective 1 and to seek feedback from individual members of the IAAust and life companies, prior to finalising its views and making a recommendation to the LIASB.

1.2 Actuarial Standards

Resilience Reserves are a component of the broader capital requirements set out in AS2.04, AS3.04 and AS6.03. Consequently, in developing a basis for setting Resilience Reserves, the objectives of these current standards (and the definitions set out in AS7.02) have been considered.

1.2.1 Definition

Actuarial Standard 7.02 defines the Resilience Reserve to be:

> A component of the determination of the Solvency Requirement, Capital Adequacy Requirement and Management Capital Requirement, which reflects the capital requirements that need to be held before the happening of a prescribed set

> of changes in the economic environment, such that after the changes the company is able to meet the policy owner and other liabilities of the statutory fund, including the assessed liability risks in accordance with these standards.

The separate Standards provide further background on the purpose of the Resilience Reserve. The Overview of Section 2 of both the Solvency and Capital Adequacy Standards, in discussing the Resilience Reserve, states that:

> Mismatching of asset and liability exposures necessitates the provision of a reserve for adverse movements in the asset values to the extent they will not be matched by a corresponding movement in the liabilities.

In relation to the Resilience Reserve, both Standards refer to a general time frame of 12 months. They further state that:

> The reserve required at the end of the period in (b) [being the 12 month period] is able to be determined assuming that a matched asset and liability profile is achieved and that the [Solvency / Capital Adequacy] Requirement of this Standard is otherwise satisfied at, or after, that time.

Further:

> Allowance for management corrective action to achieve a matched asset and liability profile during the period in (b) is considered to be limited to highly reliable actions only, with conservative response time allowances.

1.2.2 Differences across the Actuarial Standards

There are certain overarching points of difference between the Solvency Standard and Capital Adequacy Standard that are of relevance. In particular, the Solvency Standard contemplates the fund being closed to new business, and states[1]:

> The prescribed requirements set out within this Standard are designed to allow the obligations of the fund to be reliably met under circumstances where a judicial manager would most expeditiously seek for them to be secured.

[1] See Section 2.2 of the Solvency Standard.

As noted in the introduction to the Standards, the Solvency Standard favours a "primarily prescriptive approach" in order to "facilitate comparability across the industry", while the Capital Adequacy Standard "adopts a less prescriptive approach". Under the Management Capital Standard, the Resilience Reserve forms part of the Solvency Requirement and is calculated on the same basis as is applied under the Solvency Standard.

In practice, the Resilience Reserve bases under both the Solvency Standard and the Capital Adequacy Standard are both largely prescriptive. Apart from the overall level of security targeted by each basis[2] (a once in 20 year event for Solvency and a once in 100 year event for Capital Adequacy), the key differences between the two bases are as follows:

- hypothecation is not permitted under the Solvency Standard, but is permitted under the Capital Adequacy Standard[3], although there is a partial allowance for hypothecation under the Solvency Standard to the extent that policy owner liabilities "move in harmony with the assets supporting them"[4]; and
- the yield shocks are basically fixed (in basis points) under the Solvency Standard, whereas they comprise a fixed component and a proportion of current yield component under the Capital Adequacy Standard;
- the yield and credit shocks are generally lower under the Solvency Standard than the Capital Adequacy Standard; and
- under the Solvency Standard, tax benefits may only be taken into account if they would be realised "on the company ceasing business"[5].

1.2.3 Summary of Purpose of Resilience Reserves

In summary, therefore, the current Actuarial Standards seek to reserve against the impact of market movements on the net position of the fund (where the measurement of liabilities is that taken from the Standards prior to the inclusion of the Resilience Reserve) over a one year time horizon at either a 1 in 20 or 1 in 100 level of confidence. It is assumed that the assets and liabilities of the Company could be moved into a matched position by the

[2] See Section 5.2.5(a) of each Standard.
[3] See Section 11.3 of each Standard.
[4] See Section 11.5.2 of the Solvency Standard.
[5] See Section 11.8.2 of the Solvency Standard.

end of this period, at which time no further Resilience Reserve would be required. While the Standards generally consider a 12-month time period, they do contemplate a situation under which management corrective actions can be taken in the intervening time.

The Task Force has assumed that the basic structure of the Resilience Reserve (effectively a type of value at risk calculation) is given and has not considered the merits of alternative structures such as applying Conditional Tail Expectation measures.

In relation to differences between the Solvency and Capital Adequacy bases, the only mandatory difference in respect of the calculation of Resilience Reserves appears to be that the Capital Adequacy shocks should be more extreme than those under Solvency.

1.3 Rationale for Allowing Internal Models

While not strictly relevant to the Task Force's current objective, we have considered different rationales for allowing (or promoting) the use of internal models. The underlying rationale will have a significant influence on subsequent phases of work undertaken by the Task Force, and so discussion on this topic has been included in Appendix D.

1.4 Work of Prior Resilience Reserve Task Force

The Life Insurance Practice Committee of the Institute of Actuaries of Australia (LIPC) established a Resilience Reserve Task Force (2005) to provide a tenth anniversary review of the basis for determining the Resilience Reserves used in the determination of statutory solvency and capital adequacy requirements of life insurance companies in Australia. These had been based on the work of an earlier working group.

The 2005 RRTF recommended various changes to the size of the resilience shocks, the addition of a provision for credit risks, changes to the formula that required changes to the diversification factor and the introduction of a provision for mean reversion. Time pressures made it impossible to resolve various issues related to changes to the formula. Consequently, this recommendation and a broader consideration of the concept of mean reversion were deferred for later investigation.

These issues are therefore taken up in the terms of reference of this Task Force.

1.5 Task Force Membership

The members of the RRTF are:

- Anthony Asher;
- Tony Bofinger;
- Anton Kapel (Convenor);
- Eunice Mok; and
- Colm Vincent.

1.6 Timetable

In relation to Objective 1, this paper represents the first key deliverable.

TABLE 1

Key Deliverables

Step 1	Release of paper for exposure to IAAust membership
Step 2	Deadline for feedback from membership
Step 3	Finalisation of deliverables for approval by LIWMPC and IAAust Council
Step 4	Final recommendations to LIASB

The final deliverable will represent the RRTF's recommendations to the LIASB in relation to the principles and parameters, supported by a detailed paper incorporating member and industry feedback.

If the recommendations are accepted by the LIASB, work on Objectives 2 and 3 will then be able to commence.

2 SUMMARY OF RECOMMENDATIONS

Set out below is a summary of the key recommendations of the RRTF. In limited cases which are particularly subjective, more than one option has been put forward in relation to a particular issue, as the Task Force feels that it cannot recommend one option over another without receiving broader feedback. Each recommendation is discussed in more detail in the body of the report, and the relevant section reference is included with each recommendation.

- The resilience test should continue to consider interest rate risk, other asset price risks (e.g. equity or property), currency risk and credit risk. [§4]
  - A specific requirement should be added in relation to the parameters that influence derivative prices (particularly volatility). [§4.4]
  - Additional reserves (through greater shocks) should apply if an individual asset class is not "fully diversified". [§4.11]
  - A specific inflation shock (representing future inflation) should be specified that would apply to both assets and liabilities, but only to the extent that there is a direct effect of inflation on these values. [§4.12]
- Tax effects should be included, although credit for tax benefits should only be taken to the extent that such benefits would be realisable in the scenario under consideration. [§10.1]
- A fixed time horizon of one year should be applied. Where an internal model is used, it would be reasonable to effectively consider a shorter time period, but only to the extent that there was appropriate support to demonstrate that processes are in place to allow the company to move to a matched position within that shorter time period in the event of an adverse movement in markets. [§5.2]
- For simplicity, the shocks should continue to be applied instantaneously under the prescribed basis. However, it would be expected that an internal model would apply a continuous test (projected over multiple time periods within the year), with allowance for investment earnings during the period. [§5.5]

- The asset mix adopted should reflect the actual mix at the calculation date. Under an internal model projection, changes to that mix that reflect the scenario under consideration would be allowed, but only to the extent that:

  — the modelled actions are considered to be highly reliable; and

  — the modelled response times are appropriate given the scenario under consideration.

  The cost of making such changes (e.g. the assumed buy/sell spread) should be allowed for on a basis that is consistent with the scenario under consideration. [§10.4]

- Diversification effects should be incorporated on a basis that responds reasonably to the assumed correlations between asset classes.

  — The correlations adopted should reflect those expected given the “extreme” market movements envisioned by the Actuarial Standards. Therefore it will be necessary to be mindful of potential differences in correlations between “normal” and “extreme” market movements.

  — An allowance for the correlation between assets and liabilities should be incorporated in a manner consistent with the allowance for diversification between asset classes (e.g. as negative assets). [§7.4]

- No "artificial" minimum level of reserve should be set. It should be possible that a perfectly matched portfolio would generate a zero Resilience Reserve. [§10.2]

- A single prescribed basis should apply to the entire company, without any product-specific approaches. However, while a company's internal model should be based on a single consistent framework, there should be no constraint against applying different detailed modelling approaches to different product types if the nature of the underlying risks warrant it. [§10.3]

- While there are good arguments to allow for mean reversion, the majority of the Task Force members consider that the additional complexity could not be justified in the case of the prescribed basis. However, companies should form their own view on mean reversion in respect of their internal model. [§9]

- Hypothecation should be allowed under all capital standards. The level of admissible assets to be hypothecated should be the sum of:
  - the capital requirement immediately prior to the addition of the Inadmissible Asset Reserve; and
  - the Resilience Reserve. [§8]
- Given the time-frames and confidence levels being considered, sufficient relevant historical data is simply not available. Consequently some element of judgement is necessary in setting the parameters for a prescribed basis or any internal model. Correlations of variables for extreme market movements are particularly difficult to set based on historical experience. [§11.1]
  - History sets used to guide the choice of parameters should generally contain between 20 and 100 years of data.
  - Shorter time periods should only be considered if they result in a higher reserve.
  - Particular care is required for variables which have less than a 20-year history.
  - History sets should not be applied blindly. Consideration needs to be given to the relevance of the history set, given any known changes in the economic environment.
  - Market-based estimates of future experience (e.g. implied equity volatility) should not be applied blindly, although they may be used as a guide to "average" (or perhaps biased average) future experience.

3 OVERVIEW

In the following sections, we discuss a number of topics which are relevant to an assessment of resilience requirements. For each topic, we have provided some background discussion on the issue and have recommended an approach. The key issues that we have considered, in the order that they are presented, are as follows:

- the range of market-related risk types to specifically include;
- various time horizon issues such as whether the test should represent a continuous test over the full time horizon, or be as at the end of the period only and whether there should be an allowance for the expected return over the period;
- the classes into which assets should be grouped;
- diversification, both across asset classes and between assets and liabilities, including tail dependence;
- hypothecation;
- the extent to which the basis should be "adaptive" (i.e. soften as markets fall, strengthen as markets rise), which may incorporate an allowance for mean reversion;
- a number of other miscellaneous issues such as taxation; and
- considerations in setting the parameters underlying the Resilience Reserve calculation.

4 MARKET-RELATED RISKS

4.1 Introduction

It is necessary to define the various market-related risks which are to be allowed for in the Resilience Reserve prior to developing a basis. The final form of a "prescribed basis" may not explicitly address every risk, however, as allowances for certain risks may be implicit in the application of prescribed factors.

A clearly articulated range of market-related risks would also be vital to guide the development and approval of an internal model approach to setting Resilience Reserves (each risk should either be explicitly modelled, or justification provided as to why an explicit allowance is unnecessary).

Market risk is generally defined as the risk of losses arising from movements in market rates. A broad definition of market risks to be included in the Resilience Reserve should in theory provide for any risk that causes a mismatch between assets and liabilities.

In this section, where we refer to practice in other markets, we have considered the capital standards for life insurers in the USA, Canada, UK, South Africa and Singapore; for general insurers in Australia; and also for banks in general.

4.2 Interest rate risk

Interest rate risk refers to the exposure to losses from fluctuations in the level of interest rates. Interest rate risk is perhaps the most fundamental underlying risk arising from asset-liability mismatching.

The current standards prescribe parallel shift in yields which are applied to all securities in the interest bearing sector and to the valuation of liabilities.

The Task Force recommends retaining the current approach – that is, an element of the basis should be shocks to the level of interest rates.

4.3 Other asset price risks

Other asset price risks refer to the exposure to losses from fluctuations in the market values of asset classes other than simple interest bearing securities (such as equities,

property, infrastructure, and other asset classes). Derivatives are addressed in the following section and so are not considered here.

Price risk from equities and property is another fundamental source of risk included in all standards. Other asset classes are typically not specifically addressed, although some banking standards do consider commodities as a specific asset class.

Under the current Actuarial Standards, prescribed yield changes are applied to "growth assets" (equity and property).

The RRTF recommends that allowance continue to be made for other asset class risks. Further discussion of the asset classes to be considered is provided in Section 6.

4.4 Derivative pricing risks

Derivatives have been considered separately from other asset classes due to the fact that their value depends not only on the price of the underlying asset but also on other variables. While some simple derivatives may present essentially the same risk exposure as the underlying asset (for example, exchange traded equity index futures), other more complex derivatives (e.g. exotic options) can be impacted by a wider range of risks.

The pricing formula for a derivative will provide one view of the risks to which a particular derivative may be exposed. For example, the price of the underlying asset, interest rates, volatility and time to expiry are common inputs to option pricing formulas. However, pricing models, particularly for more complex derivatives, are often not complete and rely on a number of approximations. Consequently, factors which do not appear in the pricing formula may influence the price of these instruments.

Further, a company that adopts a specific asset strategy that relies on purchasing derivatives in future is faced not only with the price risk associated with its existing portfolio of derivatives, but also the risk that the cost of purchasing derivatives in future will increase. This may apply where long term liability contracts are hedged with a rolling portfolio of derivatives. It should be noted that derivative markets cannot necessarily be relied upon to provide efficient hedging instruments. As noted in by Taylor[6]:

[6] Taylor M P (1995) The Economics of Exchange Rates Journal of Economic Literature 3.1 13-47

> "A discernible trend in the efficiency literature since the 1970s has been toward the increasing econometric sophistication. Thus, early tests of efficiency, which involved simple tests for a random walk in the spot rate, were supplanted by basic linear regression analyses of uncovered interest parity, which were in turn supplanted by application of the use of sophisticated rational expectations estimators which allowed the use of data sampled more finely that the term of the forward contract involved. By and large, this increasing sophistication has generated increasingly strong evidence against the simple, no-risk-premium speculative efficiency hypothesis."

We also note that life companies can be exposed to derivatives not only through direct investment in such instruments, but also through holdings of other asset classes (e.g. hedge funds).

For options, volatility is usually a key valuation parameter. Studies have shown that both volatility and implied volatility change significantly over fairly short periods.

While the discussion above on derivatives has focussed on derivative investments, similar considerations apply to liability options and guarantees. The fair value depends not only on market yields but also on implied volatilities in the market. For long term options, the market in derivatives is unlikely to be sufficiently deep to calibrate values with the market. In such cases, shocks should be set with regard to the historical volatility of volatility.

Currently, there is no explicit consideration of derivatives price risks under the Actuarial Standards. The RRTF recommends that an explicit consideration of derivatives price risk be included, and that parameters be specified for volatility. If relevant, the volatility shocks should also be applied to the liability valuation.

If an existing hedge requires rolling within the 12-month horizon, a reserve should be required for the risk of the cost rising if credit is to be taken for the hedge being rolled.

4.5 Yield curve risk

Yield curve risk is an extension of interest rate risk that relates to the effects of changes in the shape / slope of the yield curve where assets and liabilities are not cash flow matched.

This risk is typically not explicitly addressed in the capital requirements of other markets, with the exception of banking where modelling of yield curve scenarios is required before an internal model will be approved. In the current Actuarial Standards, consideration of changes in yield curve shapes is required if material but nothing is prescribed.

The RRTF recommends retaining the current approach in respect of the prescribed basis, on the basis that for most typical life insurance companies the bulk of interest rate risk would be captured by parallel shifts and hence it would be difficult to justify the additional complexity of having to model the yield curve. For a company seeking to use an internal model, however, we would expect that non-parallel yield curve movements would be incorporated if interest rate risk was significant.

4.6 Currency risk

Currency risk relates to the risk of adverse changes in the values of assets or liabilities due to movements in foreign currency values.

Currency risk is currently included in the Actuarial Standards by applying a discount factor if liabilities are backed by assets in a different currency. In other markets, there is also typically a requirement related to currency risk.

The RRTF recommends retaining an explicit allowance for currency risk.

4.7 Credit risk

Credit risk relates to the risks of a "counterparty" (meaning the issuer of a security or the counterparty to a derivative contract) not fully performing its obligations, including the impact of:

- potential defaults;
- potential transition of assets from one credit rating to a lower rating; and
- potential adverse variation in overall market credit spread levels.

This is a fundamental risk category and is included in all standards. The difference in treatment among regimes relates to different emphasis on the less direct forms of credit risk, i.e. transition and spread risks. The current Actuarial Standards include all three types above via parameters on the probability of default and yield shifts, although there is

no explicit methodology in respect of derivatives counterparty risk. In other markets, the allowances for credit risk vary in sophistication from simple factor based allowances to advanced modelling where "credit risk" is expressed in terms of probability of default, loss given default and exposure at default, and spread risk is incorporated as an element of market risk.

The RRTF recommends retaining the current approach, whereby all three elements of credit risk are explicitly included in the basis. Derivatives counterparty risk exposures, in principle, should be treated like any other credit exposure.

Allowance for any collateral held in relation to credit risk should be taken into account. However, where derivative contracts provide for automatic collateral, credit should only be taken for collateral posted at the valuation date.

4.8 Liquidity risk

Liquidity risk relates to the risk that insufficient liquid assets will be available to meet liabilities when they are due, resulting in losses from unexpected forced borrowing or forced sale of assets.

Capital standards generally require consideration of liquidity risk, but specific capital amounts are not typically prescribed.

We recommend that this treatment be retained. Effectively, liquidity management is handled separately as a risk management activity.

4.9 Reinvestment risk

Reinvestment risk refers to the risk that returns on funds to be reinvested will fall below anticipated levels.

Capital in respect of this risk is not commonly prescribed, although the regulations for UK life insurers make an allowance via an upper limit on the reinvestment assumption.

The Actuarial Standards do require consideration of reinvestment risk. While there is no explicit allowance, there is arguably an implicit allowance via the interest rate shocks.

We recommend retaining the current approach, as an additional explicit allowance would result in a double count of interest rate risk.

4.10 Basis risk

Basis risk is the risk that offsetting positions in a hedging strategy will not experience price changes in entirely opposite directions from each other. This imperfect correlation creates the potential for excess gains or losses in a hedging strategy, thus adding risk to the net position.

This risk can arise from a number of areas:

- differences between movements in derivatives markets and physical markets (as discussed above as derivatives risk);
- differences between similar parameters in different markets, for example using UK RPI related bonds to hedge Australian CPI liabilities; or
- differences between markets/industries and specific stocks, for example using SPI futures to hedge an exposure to a specific listed stock.

This risk is not commonly dealt with explicitly, and is not addressed under the current Actuarial Standards.

The RRTF recommends that life companies be required to consider this risk, but does not suggest any explicit allowance be incorporated. This risk is unlikely to be material for companies in Australia, however, products[7] do exist in other markets which do expose companies to types of basis risk.

4.11 Concentration risk

Concentration risk is an extension of the generic risks of exposure to market movements as a result of exposure to specific risks of individual securities arising from insufficient diversification.

There are allowances under the Actuarial Standards for concentration (via the Inadmissible Asset Reserve). However, this is a fairly blunt approach, and does not necessarily ensure that there is appropriate diversification from a resilience perspective. In

[7] In Canada, a common product type pays a return based on a published index, but the company is free to invest in a mismatched asset portfolio. Basis risk might arise, for example, if the index was the market standard equity index, while assets were invested in a broad mix of equities similar to but not identical to the index. Many modelling approaches would generate zero capital against this basis mismatch.

considering the issue from a resilience perspective, we have not directly considered the Inadmissible Asset Reserve element of the Actuarial Standards.

As noted by the prior RRTF, the prescribed shocks under the Actuarial Standards were developed based on movements in broad market indices. Consequently, the shocks should be considered appropriate for "fully diversified" portfolios within each asset class.

We recommend that the Resilience Reserves should reflect the degree of concentration in an individual asset class, whereby the reserve required would increase with the degree of concentration within the asset class. For example, this could imply that the prescribed basis would require several elements:

- a shock for a fully diversified portfolio (equivalent to the current approach);
- a shock for a "fully concentrated" portfolio;
- definitions for fully diversified and fully concentrated; and
- a basis for interpolating between the shocks based on a measure of concentration of the portfolio.

The forms of concentration that should be considered include, but are not limited to:

- limited number of exposures (e.g. number of stocks in an equity portfolio); and
- concentration by nature of exposure (e.g. industry for an equity portfolio, sector or geographical region for direct property).

4.12 Inflation risk

Inflation risk relates to adverse impacts from fluctuations in inflation rates (representing forward-looking inflation) impacting assets and liabilities differently. The liability impact would include the effect of inflation on expenses.

In other markets, inflation is often not explicitly included as a market risk. Under the current Actuarial Standards, there is an allowance for inflation risk via the inclusion of an inflation margin in the Solvency Liability / Capital Adequacy Liability calculation. Further, inflation linked securities are treated as a separate asset class under the resilience test and there are specified real yield shocks.

The Task Force recommends that an explicit inflation shock be required in the Resilience Reserve calculation, that would be applied to both assets and liabilities.

At this stage, the Task Force has not considered the exact mechanics of such an allowance (i.e. whether it would be necessary to prescribe shocks for nominal yields, real yields and inflation or only two of these).

5 TIME HORIZON AND RELATED ISSUES

5.1 Introduction

The extent to which the economic environment can change will be directly impacted by the time horizon over which changes are assumed to occur, and consideration of what actions can be undertaken during that period. Consideration needs to be given to the following questions:

- Over what time frame should the changes occur?
- Should this time frame differ in respect of different types of assets?
- Is the test continuous or at the end of the period only?
- Should there be an allowance for expected returns over the period?
- Should there be an allowance for management actions during the period?
- If management actions are allowed, what actions should be allowed and how quickly should management be expected to respond?

5.2 Time Horizon

Notwithstanding the overarching requirement with the Actuarial Standards that the capital requirements be set based on a one-year time horizon, the Task Force did consider alternative options as follows:

- an arbitrary period other than one year;
- the period until the portfolio could be matched ("matching period"); and
- the term of the liability cash flows.

5.2.1 Arbitrary Period

Under this approach, an arbitrary period is set as a time horizon. Either the same time period would be used for all asset types, or different periods for different asset types.

While this approach is comparatively simple and objective (once the time period is set) there is the disadvantage that the period is arbitrary, and may not be appropriate in all circumstances. As an example, a one year horizon appears to have been adopted in the

Actuarial Standards on the assumption that a matched asset portfolio could be purchased after one year, whereas in reality, the time frame required to move into a matched asset portfolio could be significantly different.

5.2.2 Matching Period

Under this approach, the time horizon is the time period required to adjust the backing asset holding to a matched position. This could be done either by selling asset positions and purchasing matching assets, or by entering "hedging" transactions to align the market sensitivities of the assets with those of the liabilities.

The time periods would differ between assets depending on aspects such as the capacity to hedge their volatility and their liquidity.

This approach is more in line with the approach that management, or a judicial manager, would take in the event that there were adverse market movements that threatened the solvency of the entity, and it acknowledges that changes can be made quickly. For example, if a company is mismatched only by duration, this can be changed in minutes through a hedge transaction, rather than needing to allow for a year (or other period) of adverse movements.

However, the approach requires a subjective assessment of time frames required to make the necessary changes, including the time delay until management realises that action needs to be taken. Further, at least from the perspective of setting a prescribed basis, there may be theoretical difficulties in dealing with correlations between assets with different holding periods.

5.2.3 Term to Liability Cash Flows

Under this approach, the time horizon is set to the time at which future liability cash flows are due. Different assets could be matched to liability cash flows at different times in the future.

Consideration would also need to be given to those cash flows that can be "brought forward" versus those that can not, and the valuation basis for such cash flows. For example:

- An obligation to make a payment under a fixed term annuity can be brought forward through a commutation. However, a payment of, say, $100 in 5 years' time may be equivalent to a current payment of, say, $65 today due to high discount rate used under AS4.02 for annuities. Under this scenario, therefore, consideration would need to be given to the ability to meet both the immediate liability and the liability in 5 years.

- An obligation to make a payment under a disability income policy in 5 years' time can not be brought forward (except by agreement from the company) because the claimant must still be disabled at that time.

The generally longer timeframes under such an approach would mean that factors such as expected returns and whether or not the market is assumed to exhibit mean reversion would be expected to have a greater impact on results.

The advantage of this approach is that it more closely matches the actual obligations of the company based on when liabilities fall due. However, there would be the need to consider multiple time frames for cash flows based on the different times at which they could fall due, and there would be the issue of aligning tolerance levels with the targets set out in the Actuarial Standards.

5.2.4 Recommendation

For a prescribed basis, it would seem difficult to apply anything other than an arbitrary period. Therefore, the Task Force recommends retaining a one year fixed time period.

For an internal basis, more flexibility could be provided with an allowance to apply the matching period approach. This would need to have appropriate support through, for example, documented procedures that demonstrate the approach that would be taken in the event of adverse market movements.

5.3 Is the test continuous or at the end of the period only?

An "end of period only" test contemplates that there are scenarios under which the company may fail to meet solvency obligations (other than the Resilience Reserve) and at that point be reliant on market recoveries to move to a matched position. That is, there will be points at which the company would be unable to realise its current portfolio at

market rates and have sufficient assets to purchase a matched portfolio. This appears contrary to the principles of the standards.

Consequently, the Task Force concludes that the test must be continuous, and that if instantaneous shocks are to be applied, they should represent (at the appropriate confidence level) the most adverse movement that could be expected from the valuation date to any time over the next year.

5.4 Should there be allowance for expected returns over the period?

The purposes of the solvency and capital adequacy standards contemplate the meeting of liabilities under a range of adverse circumstances. The allowance for expected returns over the period could be seen to be contrary to this intent.

However, even under adverse circumstances, a level of yield would be made over the period. It would seem reasonable allow for such investment returns in the context of a projection.

5.5 Application of shocks

Given a one year time horizon, there is the question of whether the shocks should be applied instantaneously, or whether a projection over the year should be required (to capture the evolution of the asset and liability portfolios over the year).

For the prescribed basis, the Task Force recommends the retention of an instantaneous shock approach for simplicity. However, it would be expected that an internal model would apply a continuous test (projected over multiple time periods within the year), with allowance for investment earnings during the period.

Further, if a company develops an internal model that projects over multiple time periods within the year, then it would be reasonable to incorporate allowances for management actions each period. If these actions include moving into a more matched asset position, then the effect of these allowances may be to imply a shorter effective time horizon for the resilience test. Specified criteria would need to be met before management actions are allowed to be taken into account (e.g. limited to actual/mandated behaviour).

6 ASSET CLASSES

The Task Force has considered the division of assets into distinct classes for the purposes of applying the prescribed tests. The key considerations were the degree of diversification between the classes chosen and the desire to keep the number of distinct classes to a minimum (in order to reduce complexity).

6.1 Asset classes to be used for prescribed resilience test

The Task Force recommends that the following distinct asset classes should be included in the prescribed basis:

- equity;
- direct property;
- nominal fixed interest bearing assets; and
- real interest bearing assets.

In reaching this view, the Task Force considered the discussion set out in the 2005 Resilience Reserve Task Force report ("RRTF2005") relating to the levels of correlation between the assets classes – particularly with equity assets – and also their exposure to different economic risks, for example inflation. Further commentary is given in Section 7.3.

If less common asset classes – such as convertible bonds – do not fit easily into one of the classes above then companies should consider the class they most closely resemble before assigning them for diversification purposes. In some instances, it may be most appropriate to look-through an asset to constituent components that are easier to classify. Alternatively, "disaggregation" of an asset into two components (as per the approach contemplated in the current Actuarial Standards) may be appropriate to reflect the specific nature of some assets.

It is noted that other asset classes exist (e.g. long-short hedge funds) that do not fit well with the recommended categorisation. If possible, the prescribed basis should be constructed in such a way as to accommodate additional asset classes. Alternatively, an internal model would be appropriate if such asset classes were material.

When assigning an asset to a class, the key consideration is the asset's expected response to the market risks set out in the resilience tests.

6.2 Asset classes to be used within an internal model

A company may assess that the categories above are too broad for its own portfolio. For example, if a company has significant holdings in unlisted equities then its internal model could analyse how this particular class would react to the market risks arising in the resilience scenario.

A company could use its internal assessment of asset correlations to drive the division of its assets into different classes. For example, a company invested entirely in fixed-interest bearing assets may be able to justify significant differences between the market risks faced by its domestic and overseas holdings.

A company's internal model should allow for the inter-relationships between the classes that the company has identified.

7 DIVERSIFICATION

7.1 Introduction

Diversification relates to the reduction in impact of a company's exposure to one particular market risk. This can be done by:

- creating a portfolio that is made up of a set of assets that are exposed to different market risks; or
- creating a portfolio that invests in a large number of assets.

For the purpose of the resilience test, extreme outcomes are being considered and therefore diversification effects in the tail of the distributions, not at expected levels, are relevant.

7.2 The current diversification formula

In the current Actuarial Standards, there is an allowance for diversification that applies to the yield shocks used in determining the Resilience Reserves. The existing diversification factor appears unsatisfactory for a number of reasons:

- It is applied to changes to the yield rather than the value of fixed term investments (fixed interest and indexed linked). Unlike the relationship between dividend yields and prices for equities, they are not interchangeable.
- It effectively assumes zero correlations between asset classes. There is evidence of non-zero correlations between the various asset classes.
- It is unclear how the basis should incorporate asset types other than the standard classes.

Some of the problems are illustrated in the table below in the simple case of just two classes of assets and a zero duration fixed liability. If the term of the fixed interest assets is relatively long (7 years in the third and fourth column), adding equities increases the diversification factor. If the term of the fixed interest assets is short, then even a 1% investment in equities appears, under the current basis, to create significant diversification benefits. The shocks specified in AS2.04 have been used in this example.

TABLE 2

Apparent inconsistencies in the existing diversification factor

		Term of fixed interest: 7		Term of fixed interest: 1	
	Yield	**Mix**	**Div factor**	**Mix**	**Div factor**
Equities	4%	99%	1.00	99%	1.00
Fixed Interest	5%	1%		1%	
Equities	4%	50%	0.77	50%	0.95
Fixed Interest	5%	50%		50%	
Equities	4%	1%	0.98	1%	0.86
Fixed Interest	5%	99%		99%	

It would therefore appear necessary to change the diversification factor to something that more reasonably reflects the expected correlations between asset classes and the asset mix of the portfolio.

7.3 Diversification across asset classes

Various interactions are possible between the asset classes that have been identified:

- nominal fixed interest bearing assets;
- real interest bearing assets;
- equities; and
- direct property assets.

Note that the equity asset class effectively represents a “catch all” class: that is, it includes all assets that do not fit into the other categories. This makes the determination of appropriate volatilities and correlations difficult because the asset class can include a broad range of asset types that may be unrelated to the listed equity market (which is typically assumed to be the benchmark for this asset class).

RRTF2005 included correlation coefficients in Appendix 4, which will be of relevance in considering this issue.

7.3.1 Real and nominal interest rates

This appears to be a major weakness in the current standards. When real and nominal interest rates change by a different percentage, the difference can be interpreted as changes to inflationary expectations. The allowances under the current Actuarial Standards appear insufficient when assessed against the historical volatility of these implied inflationary expectations.

The Resilience Reserves ought to be determined assuming that both assets and liabilities are valued at the appropriate real and/or nominal interest rates that incorporate shocks that reflect the possible movements in both real rates and inflationary expectations.

7.3.2 Fixed interest and equities

The RRTF2005 reports a correlation of 10% to 20% in the return between both real and nominal stocks and equities and recommended the use of a 20% correlation factor. Consequently, some correlation between these classes is likely to be appropriate.

In setting parameters for a basis, it would be important to consider the extent to which the equity assets under consideration are consistent with the "standard" stock market indices.

7.3.3 Equities and direct property

The RRTF2005 found that the correlation between listed property trust returns and broad equity market index returns was some 60%, and produced evidence that it was perhaps even higher in extremes.

The RRTF2005[8] argued that underlying direct property returns were likely to be at least as volatile as those of listed property trusts. However, for a number of reasons including the level of gearing in typical listed property trusts, the Task Force considers that there is a fundamental difference between direct property and listed property trusts. In recognition of this, the Task Force proposes that direct property be considered as a distinct asset class. Listed property trusts could then be looked-through (to the underlying direct property and debt elements) or else treated as equities.

[8] For further details, see Sections 3.3.3 and 4.4 of IAAust RRTF 2005.

7.3.4 Fixed interest and direct property

The RRTF2005 reported that the correlation between listed property trusts and both nominal and real fixed interest returns was about 40%. As there is more of a fixed interest component to the rents of a property investment, this appears to recognise a real difference.

Due to the typical level of gearing in listed property trusts, a higher correlation would be expected between fixed interest and direct property.

7.4 Diversification between assets and liabilities

The Task Force recommends that an allowance for diversification between assets and liabilities be explicitly incorporated. It is likely that such an allowance would take the form of liabilities being included as negative assets in the calculations.

7.5 Incorporating correlations into a formula

The current diversification factor is theoretically inappropriate and can produce counter-intuitive results, yet is relatively simple to apply. In deriving an approach to diversification, it is likely that there will be a need for some trade off between simplicity and theoretical accuracy. In terms of the balance between these two, the Task Force expects to investigate a more “accurate” method, which is likely to imply a more complex approach to that currently in place.

8 HYPOTHECATION

8.1 Introduction

Hypothecation is the process of tagging certain assets as backing specific liabilities within a statutory fund, and applying the specified Resilience Reserve approach to that combination of assets and liabilities.

8.2 Consistency among the current Actuarial Standards

Hypothecation is currently explicitly allowed under the Capital Adequacy Standard, but explicitly disallowed under the Solvency Standard and Management Capital Standard (although, as discussed in Section 1.2.2, there is a partial allowance for hypothecation under the Solvency Standard to the extent that policy owner liabilities "move in harmony with the assets supporting them"). This leads to an inconsistency among the Actuarial Standards.

The rationale often put forward to support disallowing hypothecation under the Solvency Standard relates to the context of the assessment of risks under the Solvency Standard (closed to new business), and relies on the fact that in the case of wind-up, all the assets of the statutory fund would effectively be available to meet the liabilities of the fund. However, this argument would appear to have been ignored in respect of policy owner liabilities which "move in harmony with the assets supporting them".

The purpose of the Resilience Reserve (which is to ensure that there is sufficient capital such that after the happening of a prescribed set of changes in the economic environment, the company is able to meet the liabilities of the statutory fund (as per the relevant measurement basis)), does not preclude hypothecation.

The Task Force can see no reason why allowing for hypothecation would be inconsistent with the concept of all assets being available to meet the liabilities of the fund in wind-up. If hypothecation was allowed, then, after the relevant shock, sufficient assets would exist to meet the liabilities. All assets would still be available to meet the liabilities of the fund.

Consequently, the Task Force recommends that a consistent approach be adopted across all the Actuarial Standards.

8.3 Rationale for hypothecation

The application of hypothecation effectively allows a life company to invest its free assets in its desired asset allocation without impacting its Resilience Reserves. Consider, for example, a capital guaranteed investment product backed entirely by cash, but where the life company invests its excess assets in equities. Without hypothecation, the investment of the free assets into equities would result in a non-zero Resilience Reserve, even though the value of the equities could reduce to zero and the life company would still be able to meet its liabilities, which are perfectly matched.

As illustrated above, not allowing hypothecation can result in the free assets of a fund producing a Resilience Reserve where none is required to support the liabilities. That is, if there were no free assets, no Resilience Reserve would be required; however one arises as a result of the inclusion of free assets. This is contrary to section 11.3 of AS2.04 and AS3.04, and section 10.2 of AS6.03, which state that it is not necessary to hold Resilience Reserves on the free assets of the fund.

Consequently, we recommend that hypothecation be allowed under each of the Actuarial Standards.

8.4 Level of assets to be hypothecated

The Solvency Requirement, Capital Adequacy Requirement and Management Capital Requirements are set on the basis of the amount of assets that need to be held prior to the happening of a prescribed set of changes in the economic environment, such that after the changes the company can still meet its liabilities. The changes in the economic environment will also impact the assets backing the Resilience Reserve. For the purposes of hypothecation, the total amount of assets to be considered, therefore, must include the Resilience Reserve itself.

By contrast, the life company is not required to hold Resilience Reserves on its inadmissible assets, although the addition of the Inadmissible Asset Reserve arises prior to the addition of the Resilience Reserve in the calculation of the various requirements.

We therefore recommend that the appropriate level of assets to be hypothecated is:

- the requirement immediately prior to the addition of the Inadmissible Asset Reserve (that is after item (f), (d) or (b) in AS2.04, AS3.04 and AS6.03 respectively); plus

- the Resilience Reserve itself.

Note that the above recommendation is on the basis of all liabilities in a fund being hypothecated together. Appropriate adjustments should be made for hypothecation at a sub-fund level.

Finally, under each standard, a single allocation only of assets to liabilities should be allowed, and the allocations should be consistent between Solvency and Capital Adequacy. Different allocations for different risks should not be allowed.

9 ADAPTIVENESS OF BASIS

9.1 Introduction

A lot of thought was given to mean reversion by the previous Task Force. In this context mean reversion refers to a market's tendency to revert to an underlying long-term position. Further research is summarised in Anthony Asher's paper[9].

The paper concludes that there are bands around this underlying mean where reversion is weak. While markets stay within these bands the price history is expected to resemble a random walk – deviation from the underlying mean can be prolonged. Outside these bands – i.e. when markets reach extreme levels – there is greater empirical evidence of reversion to within the bands.

One option for resilience would be to determine the bands of relative inaction. If market statistics at the valuation date were to lie outside of these bands, then we might consider future reversion when setting the resilience test at that time. This could lead to variations in the size of the shocks that would be applied if a statistic was outside its band, and/or asymmetric tests (since mean reversion implies that further divergence from the mean is less likely than a bounce-back towards it).

There are two issues with this approach:

- The resilience test is designed to assess whether a company can survive, at the appropriate confidence levels, all shocks that may occur over the year from the valuation date. It is quite possible that a shock prior to the valuation date could force the market indicator outside the bands, inducing reversion, but that such reversion would not be observed until the resilience test period had passed (take Japanese bond yields as an example). The pace of reversion to a long-term mean is just as important as its existence for the purposes of the resilience test.

- Market conditions change over time. The bands would need to accommodate this in some way, either through periodic review or through their formulation as a function of historical / implied market parameters. Using periodic review or historical data to set the bands may lead to them being out-of-date and failing to spot a genuine alteration

[9] "Mean reversion in investment markets: a survey"; stored at http://www.actuaries.asn.au/IAA/upload/public/fsf06_paper_asher_mean%20reversion.pdf

in market conditions. Using implied parameters places an over-reliance on market prices at the time of valuation – these are likely to be consistent with the observed statistic, making the banding approach less powerful.

The purpose of this section is to consider the following questions:

- Should the resilience tests be weakened following adverse market movements prior to the valuation date (or strengthened following positive ones)?
- Should the tests be asymmetric?
- Should internal models allow for mean reversion?

9.2 Should resilience tests be weakened following adverse market movements?

There are two extremes that illustrate the scale of basis flexibility:

- After seeing a resilience-level shock just prior to valuation date, the basis is so flexible that the resilience test is effectively removed – we are assuming that the resilience scenario has now occurred and we are certain that the market will revert to its previous level over the coming year.
- Following such a shock, the basis is so rigid that the company has to find a way to cover a further shock of the size that it has just withstood.

It is not acceptable to expect no further deterioration in market conditions following an adverse market movement.

The disadvantage of having a perfectly rigid test would be that companies might have to take severe remedial action in order to remain solvent (by covering a resilience test that later turned out to be too onerous). For example funds exposed to equities might have to exchange such assets for less risky ones (cash or fixed interest). This could exaggerate a market fall, making conditions worse for those that were still holding equities.

9.2.1 Flexibility in the current basis

For equities, the resilience test in the Solvency Requirement is a fixed increase in dividend yield. If markets were to fall sharply prior to valuation date then the base

dividend yield would increase. The stress test would be a smaller percentage reduction to the asset value than it would have been before the fall.

The resilience test in the Capital Adequacy Requirement is partly a fixed increase in dividend yield and partly a proportional increase. The test is more rigid than under the Solvency Standard.

For fixed interest yields, the Solvency Requirement shows a fixed change in yields. The resilience test is likely to be nearly as strong after an adverse market movement as it was before.

For the Capital Adequacy Requirement, there is a fixed and proportionate change to yields. The resilience test will be more flexible than under the Solvency Standard.

9.2.2 Options

A number of options exist, as set out below:

- make the basis as rigid as possible (for example, a fixed yield change applied to fixed-interest yields or an equity test expressed as a percentage fall in the asset value on the valuation date);
- allow the methodology to permit some flexibility (for example, the fixed interest test expressed as a proportion of the in-force valuation yields); or
- actively promote flexibility in both the methodology and the parameters (for example, the equity test could be expressed as a percentage fall in asset value on the valuation date, with the percentage reducing following sharp market falls and/or increasing after market rises; such rises / falls could be based on the position of the market relative to its long-term bands).

9.3 Should the resilience tests allow for mean reversion through asymmetry?

If market parameters at the valuation date were to lie outside of the bands of inaction, then we might expect greater future movement back towards the mean than away from it. The resilience test could allow for this expectation. A question arises as to the speed of this reversion (or the degree of asymmetry).

The allowance would depend critically on the assumed long-term mean and pace of reversion. Both may alter over time as markets evolve. This could lead to an ongoing need to review the basis in the light of recent history.

9.3.1 Allowance in the current basis

No allowance is currently made for asymmetry in this context.

9.3.2 Options

A number of options exist, as set out below:

- make no further allowance for asymmetry; or
- actively promote asymmetry through adjustments to the resilience test parameters (where the adjustments would be based on market levels relative to an identified long-term reversion band).

9.4 Should internal models allow for mean reversion?

It is for individual companies to decide whether an element of mean reversion should be built into their models.

9.5 Task Force Recommendations

- The flexibility of the basis should be the same under all Actuarial Standards, with only the strength of the test differing amongst them.
- There should be flexibility in the method to alter the strength of the test. Such flexibility should have particular regard to the levels of market parameters relative to historical experience, although consideration should be given to changes to the environment that may impact such market parameters (e.g. changes to tax laws that lead to different dividend payout ratios).
- The resilience test under the prescribed basis will not make further allowance for asymmetry.
- Companies may allow for mean reversion in their models (but would need to provide justification for the approach).

10 MISCELLANEOUS

10.1 Taxation

The RRTF recommends that, consistent with the current Actuarial Standards, tax effects should be included, although credit for tax benefits should only be taken to the extent that such benefits would be realisable in the scenario under consideration.

10.2 Minimum level

In certain other markets, a "market risk" reserve is required even if the asset portfolio is perfectly matched and risk-free. Given the purpose of the Resilience Reserve as an allowance for mismatches, the RRTF does not recommend that any form of non-zero minimum should be applied.

10.3 Structure of basis

In some overseas markets, particular "resilience reserve" approaches have been developed to accommodate newly evolved products. This has resulted in a fragmented approach, with one basis applying to certain product types, and an alternative basis applying to other product types.

The RRTF recommends that a prescribed basis should follow a single consistent approach for all product types. However, the RRTF does not consider that such a rule should be applied to internal models, and considers that the development of internal model approaches could be enhanced by allowing various levels of sophistication to apply to different product lines according to the materiality of each product line and the nature of the mismatch risks to which it is exposed.

Despite this, the RRTF notes that in other markets, internal models are typically only approved if used internally for management purposes, which suggests that even if different approaches were to be used across product types, similar risk metrics should be produced.

10.4 Asset mix

The asset mix adopted should reflect the actual mix at the calculation date. Under an internal model projection, changes to that mix that reflect the scenario under consideration would be allowed, but only to the extent that the modelled actions are

considered to be highly reliable and that the modelled response times are appropriate given the scenario under consideration.

Further, the costs of making such changes in asset mix should be consistent with the scenario under consideration. For example, the level of buy/sell spreads or credit spreads may be expected to change following the market movement that triggers a change in asset mix. If material, this type of effect should be incorporated in the internal model.

11 PARAMETERS

For the purposes of this paper, we have focussed on the manner in which parameters should be set. We have not explicitly considered the structure of the parameter-set that would be required (as this is dependent on the outcome of subsequent phases of work), nor have we explicitly considered the appropriate level of any potential parameter.

We have considered how parameters could be set both from the perspective of setting a prescribed basis, and also from the perspective of developing an internal model.

Parameters could potentially be drawn from an analysis of one or a combination of the following:

- historical (non-overlapping) annual data;
- historical (overlapping) annual data;
- historical data over shorter time periods (non-overlapping) "ratioed-up"; or
- forward-looking market estimates (e.g. implied volatility).

11.1 Issues to consider

11.1.1 Historical data period

The time horizon over which potential future market movements are assessed (which will generally be one year) impacts the period over which historical data would need to be analysed. We must develop "shocks" (either instantaneous or a progression over the period) that reflect what might be expected over a one year period, at a 1 in 20 year or 1 in 100 year confidence level. This implies that a long period of historical data is required.

This presents challenges in obtaining a sufficient volume of relevant historical data to enable credible statistical analysis. This differs from traded market risk in banking, which adopts a much shorter time horizon (10 days). This shorter time horizon lends itself to a historical VaR approach, as it is easier to access credible volumes of relevant data. (A two-year observation period yields approximately 500 daily movements, which gives some measure of stability to results at the confidence levels being considered. The daily results can be scaled up to 10 days by multiplying by $10^{0.5}$.)

It is not possible to get a similar volume of observations over a one-year period. The scaling up approach is also not appropriate, since daily movements over the past 2 years are unlikely to appropriately capture the potential distribution of results over a year into the future. Further, such an approach could lead to enormous volatility in required capital.

In conclusion, a "long" observation period is required (at least 20 years). Care however does need to be taken to consider changes in markets that may have occurred over such time periods.

Particular attention would need to be paid in respect of any asset class with less than a 20-year history.

Finally, it is generally accepted that there is higher correlation (lower diversification benefit) in "extreme" market conditions than would typically be observed in "normal" market conditions. Given the limited data in respect of extreme market movements, it is likely that any historical analysis of correlations will focus on normal market movements. However, it would not be sufficient to simply adopt such correlations and assume that they would continue to apply in the face of extreme market movements.

11.1.2 Historical data analyses

When undertaking analyses of historical data, the relevant movement in a variable over the year should be its maximum movement at any point during the year from the starting value.

11.1.3 Rigour

The method of deriving parameters should be objective. In the case of an internal model, it would be expected that the method would not change from valuation to valuation. Similarly, for the prescribed basis, it is desirable for an approach to be defined that would allow the parameters to be updated in future (e.g. if market conditions become significantly different than those envisaged when the basis was set).

Any basis that relies on the identification of a persistent market change is going to suffer from the subjective nature of this decision.

11.1.4 Stability

Companies may prefer a stable basis that allows them to project capital needs with some certainty. From a regulatory perspective, this would imply setting capital parameters based on "worst case" (or near worst case) market conditions, to ensure that the basis was sufficient throughout market cycles.

11.1.5 Recommendations

The prescribed basis will require a set of parameters which are developed having regard to a long history set. To avoid the need for frequent updating of these parameters (assuming that APRA would not wish to be responsible for publishing a series of factors each quarter), they should be set conservatively. Nevertheless, the form of the prescribed basis should adapt to market conditions. The Task Force recommends that this be achieved by continuing to base the prescribed shocks around yield movements.

The RRTF sees no reason to prescribe methods that should be adopted to develop shocks for internal models, as this would likely stifle innovation. However, the broad principles referred to above would suggest that certain approaches are unlikely to be appropriate and companies ought to be able to demonstrate that their approaches are in line with the broad principles set out above.

11.2 Other considerations

In certain markets where the option exists to use an internal model or to follow a prescribed basis, the prescribed basis is deliberately set to be conservative. This approach has the benefit of encouraging companies to undertake (worthwhile) risk management activities to better understand their business by offering an (expected) capital saving.

The RRTF proposes that the initial parameter-set for the prescribed basis should not include any such conservatism, but that the parameters should be changed (made more conservative) should the option of an internal model approach be introduced in future.

APPENDIX A - REFERENCE MATERIAL

Asher A 2006, *Mean reversion in investment markets: a survey*, Institute of Actuaries of Australia Financial Services Forum 2006

IAA (International Actuarial Association) risk classification

IAAust RRTF 2005, *Resilience Reserve Taskforce (2005) Report*, Institute of Actuaries of Australia Biennial Convention 2005 (updated version dated 14 June 2005)

LIASB 2005, *Revised Actuarial Standards to coincide with the implementation of International Financial Reporting Standards - Explanatory Statement*, Life Insurance Actuarial Standards Board

LIASB 2006a, *Actuarial Standard 2.04 – Solvency Standard*, Life Insurance Actuarial Standards Board, 30 March 2006

LIASB 2006b, *Actuarial Standard 3.04 – Capital Adequacy Standard*, Life Insurance Actuarial Standards Board, 30 March 2006

Taylor M P 1995, The Economics of Exchange Rates Journal of Economic Literature 3.1 13-47

APPENDIX B - MARKET-RELATED CAPITAL BASES

B.1 Comparison of approaches in other markets

	USA	Canada	UK	South Africa	Singapore	Australian GI
Interest rate risk (Section 4.2)	10th percentile of surplus given term-based stochastic projection	Additional reserve held based on term of policy liabilities	Static change to whole curve	Static change to whole curve	Change to yields is based on term to maturity, risk status, coupon level, recent direction of movements in interest rates	Capital requirement is loading to asset value
Other asset price risks (Section 4.3)	10th percentile of surplus given stochastic projection	Asset market values reduced by varying percentages	Equity and property asset value stress combined with changes to income assumptions	Equity and property asset value stress; other non-cash assets also have MV stress	Equity and property asset value stress; also stresses to company-issed loans and miscellaneous assets	Capital requirement is loading to asset value
Yield curve risk (Section 4.5)	Modelled in stochastic projection	Term-based component to interest rate risk	No explicit allowance	No explicit allowance	Yield curve stress based on maturity term of FI security	No explicit allowance
Currency risk (Section 4.6)	Overseas equities projected separately from US equities	No explicit allowance	Consider and establish explicit reserve if mismatched	Market value falls of max(domestic asset fall, 20%)	Flat % asset stress for unmatched liabilities	No explicit allowance
Credit risk (Section 4.7)	Corporate bonds projected separately to Treasury bonds	Corporate bond stresses vary depending on credit rating	Individual instrument yield stresses based on instrument's credit rating	No explicit allowance	Allowance for risk status in yield test	Loadings to asset values dependent on counterparty rating
Liquidity risk (Section 4.8)	No explicit allowance	No explicit allowance	Consider and establish explicit reserve if required	No explicit allowance	No explicit allowance	No explicit allowance
Reinvestment risk (Section 4.9)	Allowance through term-based stochastic projection	No explicit allowance	Cap on valuation discount rate	No explicit allowance	No explicit allowance	No explicit allowance
Basis risk (Section 4.10)	No explicit allowance	Effectively modelled with interest rate risk	No explicit allowance	No explicit allowance	No explicit allowance	Liabilities ignored in calculation
Concentration risk (Section 4.11)	Some allowance if portfolios are expected to differ significantly from the market	No explicit allowance, although asset class definitions are narrow compared to other countries	No explicit allowance	No explicit allowance	No explicit allowance	No explicit allowance
Inflation risk (Section 4.12)	No explicit allowance	No explicit allowance	No explicit allowance	No explicit allowance	No explicit allowance	No explicit allowance
Time horizon (Section 5.2)	Term of policy liabilities	Not specified	1 year	Not specified, but reference to 1 year	Not specified	1 year
Asset classes (Section 6.1)	Treasury bonds split by term, corporate bonds, US / international equity, other equity classes	Large range: broad groups are equities, bills/paper, debt, bonds, mortgages, equity, property; these are then split into smaller groups with similar levels of risk	Equity, property, debt securities; possibly different local / foreign tests	Equity, property, fixed interest, index-linked bonds, cash, other	Equity, property, debt securities, property, derivatives, loans issued by company	Cash, government debt, other graded debt, equities (listed / unlisted), property, loans to employees
Diversification across asset classes (Section 7.3)	Achieved through stochastic model	Combination test only specified (no individual tests)	Combination test only specified (no individual tests)	Formula approach; formula based on capital requirements	Combination test only specified (no individual tests)	No explicit allowance
Diversification between assets and liabilities (Section 7.4)	Liabilities run on same stochastic scenarios as assets	No explicit allowance	Incorporated through combination test	Each test internally consistent; diversification formula applied to capital requirements under each test	Liability adjustment is through term-based stresses to valuation interest rate; sign changes consistent with assets but size of changes could differ	Liabilities ignored in calculation
Adaptiveness of basis (Section 9)	No prescribed flexibility	Stress tests based on % of current market values	Equity stress test reduced if current market position is low relative to last 90 days; all stress tests are % of current parameters	Equity % stress test based on current level of dividend yield - will weaken when market values are low relative to earnings	Basis assumes that the yield curve stress test occurs in the same direction as the recent curve movement; otherwise tests take % of current asset value	Stress tests based on % of current market values

APPENDIX C - INTERNAL MODEL CONSIDERATIONS

C.1 Introduction

Internal models are models for the determination of capital requirements that are based on a company's internal determination of their risks, and not on a standardised, prescribed regulatory approach.

There is clearly a continuum between sophisticated risk-based internal models of the risks facing companies and crude rules of thumb such as 4% of assets. Banking models historically were somewhat crude (but are becoming increasingly sophisticated). Life insurance models have tended to be more sophisticated in that they have used discounted projections of cash flows that have contained a variety of margins related to different risks.

Companies adopting an internal model should be required to provide for the risks identified in Section 4 above, or demonstrate that they are not material.

There are three different issues in considering the approach to internal models.

- The first is whether companies can be given the opportunity to use more sophisticated models to evaluate their capital requirements.
- The second is whether the models should be approved by the regulators.
- The third is whether they should be given the freedom to determine their own parameters.

C.2 Justification

The additional freedom offered by internal models seems to have two justifications.

- They can be more accurate: companies use more appropriate capital models rather than crude approximations.
- They can be "incentive compatible." They are intended to align the interests of the shareholders of the company with that of the policyholders/regulators.

The latter is problematic. There is still the possibility of incompatible incentives if the shareholders want to take risks with policyholders' money that the regulators see as

excessive. Information asymmetry means that the company management is able to withhold information from the regulator. If managers are intent on taking more risks, there are infinite ways of doing so. The current Resilience Reserve basis for equities provides an example. If a company wants to increase its exposure to market beta without increasing its Resilience Reserves, it merely buys higher beta stocks. If this is insufficient it sets up a range of listed investment companies that gear up to the desired level. Buying higher beta stocks is entirely legitimate and most appointed actuaries would allow some leeway before intervening. The regulator can step in to require additional reserves if it identifies the problem, but again would be likely to offer a fair amount of leeway.

If there is an internal model, then the company and the actuary have to give explicit thought to the risk and actually have to be dishonest, or lacking in experience/expertise, to avoid putting up additional capital. The internal model is therefore much closer to the ideal of enforced self-regulation that is acknowledged to provide much better regulatory results. There can be no doubt therefore that internal models that give more flexibility to companies are superior in principle (provided the companies possess the appropriate expertise).

One disadvantage however is that the internal models may give results that cannot be compared between different companies.

C.3 Compulsory use of internal models

Given that the prescribed basis will not adequately address all aspects of market-related risk, it would conceivably be possible to require the use of an internal model if any such risks were material.

In one sense, this aligns with the approach under the current Actuarial Standards, where the Appointed Actuary is required to set an appropriate reserve where risks are not adequately addressed by the standards.

If the option of a full internal model approach was made available, then this concept could be extended to require the use of a full internal model where ever the prescribed basis was not deemed to adequately address all risks.

C.4 Other considerations

In certain markets where the option exists to use an internal model or to follow a prescribed basis, the prescribed basis is deliberately set to be conservative. This approach has the benefit of encouraging companies to undertake (worthwhile) risk management activities to better understand their business by offering an (expected) capital saving.

The RRTF proposes that the initial parameter set for the prescribed basis should not include any such conservatism, but that consideration should be given to changing the parameters (to be more conservative) should the option of an internal model approach be introduced in future.

C.5 Regulatory approval

The current Actuarial Standards cover relatively common products, and require actuaries to develop internal models for risks that are inadequately covered. "Asymmetric risks" are specifically covered. Actuaries are free to develop the models and the parameters, and have little guidance.

It has been suggested that some of the incentive and comparability problems can be reduced by the regulators specifying "key parameters and the constrained calibration of models." The key parameters would include the shape, tail dependence and – where relevant – the trends of relevant distributions. In the case of Resilience Reserves, for instance, this means the shape and tail dependence of share and property prices, interest rates, anticipated inflation and currency rates. It might also include share price volatilities.

This would mean that the Actuarial Standards should specify the parameters but not the formulae. This would allow companies to use stochastic or deterministic stress test methods to determine their capital requirement. If their particular asset and liability profile required the addition of different parameters, they would have to be calibrated to give results that were broadly consistent with the specified key parameters.

C.6 Summary

- In order for an internal model to be approved, the modelling should be more sophisticated that the prescribed basis, either providing increased granularity or more detail (such as considering more risk types), or else being otherwise tailored to the

specifics of the business. The basis adopted for setting the parameters underlying an internal model should be documented and robust.

- In relation to the statistical processes used to describe the behaviour of various economic variables underlying an internal model, different options exist:

  — Option 1: As different views exist as to the most appropriate processes to use, no formal constraints should be applied. Nevertheless, a company would need to be able to explain its choice of model, and demonstrate that it could be a reasonable representation of future outcomes.

  — Option 2: While the choice of the underlying processes and their parameterisation could be left to companies to decide, a small number of key aspects of the distribution of results could be subject to minimum threshold criteria. (As an example: the model must give at least a 5% probability that the ASX200 falls by 30% over a year). Prescribing such aspects would allow for greater comparability and would contribute to a more level playing field.

  — Option 3: The regulations could prescribe the processes (or distributions), with companies allowed to set the relevant parameters. This would aid comparability across companies for APRA.