Solvency Assessment and Management:

Steering Committee

Position Paper 62[1] (v 5)

Life SCR - Catastrophe Risk (for Mortality and Morbidity)

EXECUTIVE SUMMARY

This document discusses the structure and calibration of the Life Catastrophe risk sub-module of the Life underwriting risk module, pertaining to the risks of both mortality and morbidity. The paper includes discussion of the Solvency II developments, consideration of the approaches within other jurisdictions, highlights issues raised in the SAM QIS exercises' qualitative feedback, considers alternatives, and recommends an approach going forward.

The task group recommends that a similar structure to that of Solvency II is used, with the following amendments:

- The calibration of the mortality stress is parameterised to the underlying mortality rate as a proxy for the class of lives
- A morbidity stress calculation should be considered for inclusion in the Life Catastrophe risk sub-module rather than the non-Life catastrophe risk sub-module as the case is in Solvency II, due to the removal of the Health module in SAM and the intention for short term insurers to exclusively use the non-life module and vice versa.

1. INTRODUCTION AND PURPOSE

This document sets out the recommendations of the Capital Requirements task group with respect to the Standard Formula capital charge for the life catastrophe risk under SAM.

2. INTERNATIONAL STANDARDS: IAIS ICPs

IAIS is the international standards setting body for insurance supervisors. The FSB as a member of the IAIS aims to adhere to these standards. The standards are principled based and set out high level guidance on the setting of solvency capital requirements. There is no reference to the detailed capital requirements of individual risk sub-modules such as life catastrophe risk. However, the following are relevant within the broad framework of the capital requirements, of which underwriting risk (and life catastrophe risk as a sub-module) form part (reference: **"Insurance Core Principles, Standards, Guidance and Assessment Methodology – 1 October 2011"):**

ICP 17 Capital Adequacy

The supervisor establishes capital adequacy requirements for solvency purposes so that insurers can absorb significant unforeseen losses and to provide for degrees of supervisory intervention.

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[1] Position Paper 62 (v 5) was approved as a FINAL Position Paper by the SAM Steering Committee on 30 June 2015.

Some sub-points in this standard that should be considered includes:

> *17.7 The supervisor address all relevant and material categories of risk and are explicit as to where risks are addressed, whether solely in technical provisions, solely in regulatory capital requirements or if addressed in both, as to the extent to which the risks are addressed in each. The requirements are also explicit as to how risks and their aggregation are reflected in regulatory capital requirements.*

Types of risks to be addressed

> *17.7.1 The supervisor should address all relevant and material categories of risk - including as a minimum underwriting risk, credit risk, market risk, operational risk and liquidity risk. ….*
>
> *17.8 The supervisor sets out appropriate target criteria for the calculation of regulatory capital requirements, which underlie the calibration of a standardised approach…*
>
> *17.8.1. The level at which regulatory capital requirements are set will reflect the risk tolerance of the supervisor. Reflecting the IAIS's principles-based approach, this ICP does not prescribe any specific methods for determining regulatory capital requirements…*

3. EU DIRECTIVE ON SOLVENCY II: PRINCIPLES (LEVEL 1)

Article 105 3(g)

Solvency II defines the "life-catastrophe risk" as "the risk of loss, or of adverse change in the value of insurance liabilities, resulting from the significant uncertainty of pricing and provisioning assumptions related to extreme or irregular events.

Solvency II requires sufficient capital to be held in order to protect the solvency of the insurer and the best interests of the policyholders in the event of a catastrophe. Catastrophes are defined as 'extreme or irregular events, the effects of which are not adequately captured in the other life underwriting risk sub-modules'.

Article 105 3(c)

Although, as defined in Article 105 3(c) of the Solvency II Directive (2009/138/EC), morbidity risk, i.e. disability, sickness and morbidity rates, are covered in the life underwriting risk module, the contents of the Life catastrophe risk and the Non-Life catastrophe risk modules are not defined explicitly for morbidity catastrophe risk.

The EU Level 1 Directive principles have been adopted for the SAM Life Catastrophe Risk sub-module.

4. MAPPING ANY PRINCIPLE (LEVEL 1) DIFFERENCES BETWEEN IAIS ICP & EU DIRECTIVE

There are no differences in the principles between IAIS ICP and the EU directive.

5. STANDARDS AND GUIDANCE (LEVELS 2 & 3)

5.1 IAIS standards and guidance papers

This has already been covered in Section 2 above[2].

5.2 CEIOPS CPs (consultation papers)

CP49: Life underwriting risk

3.8 Life catastrophe risk

3.8.1Explanatory text

Introduction

3.181 Catastrophe risk stems from extreme or irregular events whose effects are not sufficiently captured in the other life underwriting risk sub-modules. Examples could be a pandemic event or a nuclear explosion.

3.182 This risk is normally treated by using a one-off extreme mortality and/or morbidity rate.

3.183 Catastrophe risk is mainly associated with products (such as term assurance, critical illness or endowment policies) in which a company guarantees to make a single or recurring and periodic series of payments when a policyholder dies or is diagnosed with a specified disease within a pre-agreed period.

Catastrophe Task Force report on standardised scenarios for the catastrophe risk module in the standard formula

2. General considerations on the use of catastrophe standardised scenarios

1.3...the CTF would like to highlight that any standardised scenario is going to be a trade off between accuracy and ease of use. There may be many circumstances where the standardised scenarios will be inadequate because it is impossible to allow for all undertakings and risk profile particularities within the standard formula. The CTF recommends that undertakings should consider alternative measures, in particular partial internal models before choosing to use the standardised scenarios.

SEG Consolidation Commission Draft Regulation 201102

Article 115 LUR8

(Art. 105(3) of Directive 2009/138/EC)

Life-catastrophe risk sub-module

"1. The capital requirement for life-catastrophe risk referred to in point (g) of Article 105(3) of Directive 2009/138/EC shall be equal to the loss in basic own funds of insurance and reinsurance undertakings that would result from an instantaneous addition of 0.15 percentage points to the mortality rates (expressed as percentages) which are used in the calculation of technical provisions to reflect the mortality experience in the following 12 months.

2. The increase in mortality rates referred to in paragraph 1 shall only apply to those insurance policies for which an increase in mortality rates to reflect the mortality experience in the following 12 months leads to an increase in technical provisions taking into account the following:

[2] The IAIS Insurance Core Principles, Standards, Guidance and Assessment Methodology issued October 2011 has superseded previous Standards and Guidance (in this case Standard No. 2.1.1 and Guidance paper No. 2.1.1 on the structure of regulatory capital requirements).

(a) multiple insurance policies in respect of the same insured person may be treated as if they were one insurance policy;

(b) where the calculation of technical provisions is based on groups of policies as referred to in Article TP16, the identification of the policies for which technical provisions increase under an increase of mortality rates may also be based on those groups of policies instead of single policies, provided that it would give approximately the same result;

3. With regard to reinsurance policies, the identification of the policies for which technical provisions increase under an increase of mortality rates shall apply to the underlying insurance policies only and shall be carried out in accordance with paragraph 2.

Consultation papers relevant to health/morbidity catastrophe risk

The EIOPA Consultation paper 48 states that the health catastrophe risk shall fall under the scope of the non-life catastrophe risk sub-module. Furthermore Consultation paper 50 distinguishes between health business pursued on a similar technical basis to that of life insurance (SLT) and health business pursued on a similar technical basis to that of non-life insurance (NSLT) - i.e. the SLT Health catastrophe risk and the NSLT Health catastrophe risk.

The Health (SLT) Catastrophe is considered to include the risk of loss, or of adverse change in the value of insurance liabilities, resulting from the significant uncertainty of pricing and provisioning assumptions related to outbreaks of major epidemics, as well as the unusual accumulation of risks under such extreme circumstances.

The Health (SLT) CAT scenarios could include the following (which consultation paper 50 describes as a "non-exhaustive list"):

- pandemic, e.g. bird flu
- mass accident
- polio type debilitating disease effects
- bio-hazard from an insecure laboratory
- terrorist action (e.g. pathogen released, terrorist action with delayed effects)
- concentrated office block accident
- sudden downturn in the economy (e.g. with impact on the disability/morbidity inception rate).

The Health (non SLT) Catastrophe is considered to include the following three scenarios, namely terrorism, (mostly for group contracts), pandemics and stagflation. Stagflation touches on the "death spiral" territory and therefore may not be well captured in the premium and risk component.

In Europe's QIS5 the standardised approach taken was to consider three specific and independent scenarios, namely Arena disaster, the Concentration scenario and the Pandemic scenario.

5.3 Level 2 Implementing Measures (Draft – 31 October 2011)

The draft level 2 implementing measures contain no differences from QIS 5.

5.4 Other relevant jurisdictions (e.g.OSFI, APRA)

5.4.1 Canadian approach (OSFI)

Current Legislation – Mortality catastrophe risk

An alternative approach is taken by Canada and is explained below.

The capital required for the catastrophe risk is given as: Σ K over all products. The book of business needs to be partitioned into sets.

K = α x C x E/F, where

α = 0.05 for adjustable and participating policies that meet set-out criteria for reduced factors and 0.1 for all other products

C = projected value of the upcoming year's total net death claims for all policies in the set. This includes claims projected to occur after policy renewal dates.

E = total net amount at risk[3] for the policies in the set

F = total net face amount[4] for the policies in the set

For purposes of the catastrophe component, group policies with no rate guarantee beyond the current year are considered adjustable by 5% or 15% depending on the type of business.

Current Legislation – Morbidity catastrophe risk

While there is an allowance for mortality catastrophe risk in the Minimum Continuing Capital and Surplus Requirement (MCCSR) there is no explicit allowance for morbidity catastrophe risk.

Canadian QIS5 – Mortality catastrophe risk

The latest Canadian QIS exercise (Canadian QIS5) proposes a similar approach to Solvency II for life catastrophe risk. The shock is an absolute increase in the number of deaths per thousand insured over the following year and varies by location. As an example, an increase of one death per thousand applies to business in Canada. Accidental death and disability products use 60% of the mortality catastrophe risk parameters.

Canadian QIS5 – Morbidity catastrophe risk

Morbidity catastrophe risk is calculated on incidence rates for all active lives that include a morbidity risk. For some products, a total claims shocks applies to active and disabled lives instead of a shock to incidence rates. A catastrophe shock does not apply on claims rates for products such as group medical and dental as well as individual and group travel and credit insurance.

The shocks for catastrophe risk on incidence rates are:

Individual active DI	25%
Group active LTD	25%
Individual and group active WP	25%

[3] The net amount at risk for a set of policies refers to the total net face amount of the policies minus the total net reserve for the policies, both net of reinsurance.

[4] Face amount: The amount stated on the face of the policy that will be paid on the death of the life insured or at the maturity of the policy. It does not include additional amounts payable under accidental death or other special provisions, or acquired through the application of policyholder dividends. Also called the "sum insured".

Individual CI	5%
Group CI	5%
Other A&S (other than disability and CI)	25%

The shocks for catastrophe risk on claims rates are:

Group active and disabled STD	10%
Individual active and disabled LTC	10%
Group active and disabled LTC	10%

The shock is for one year only and is a multiple of the best estimate morbidity assumption (i.e. 125% or 110% of best estimate assumptions). The solvency buffer for catastrophe risk is the difference between the present value of the shocked cash flows and the present value of best estimate cash flows for all years.

5.4.2 Australian approach (APRA)

Mortality catastrophe risk

The Standard Method for calculating the Insurance Risk Charge component of the prescribed capital amount includes an allowance for an event stress. The event stress allows for the impact of single events that could commence in the 12 months following the reporting date and cause multiple claims. These events could include pandemics, terrorist attacks and natural catastrophes and may affect either or both mortality and morbidity experience. The Appointed Actuary must determine an appropriate event stress that provides a 99.5 per cent probability of sufficiency with respect to single events that could potentially commence over the following 12 months. The event stress must include as a minimum a pandemic scenario with a 0.5 per thousand increase in annual mortality rates at each age for the following two years.

Morbidity catastrophe risk

The event stress must include as a minimum a pandemic scenario with the following impacts on morbidity claims experience:

- an annual incidence rate of total disablement at each age, as a result of the event, of 10 per cent of lives insured for the two years following the reporting date
- of those lives becoming disabled as a result of the event, half remain disabled after 14 days, one quarter remain disabled after 30 days and none remain disabled after 60 days
- if disability continues to the end of the policy waiting period, one month's benefit will be paid. For waiting periods other than zero, 14, 30 or 60 days, interpolation must be used to find the proportion of policies for which a benefit will be paid

5.5 Mapping of differences between above approaches (Level 2 and 3)

Mortality catastrophe risk

CEIOPS and APRA are identical, while the Canadian approach is not directly comparable to CEIOPS or APRA – depending on the underlying mortality of a set of policies it may be a more or less onerous stress relative to CEIOPS or APRA.

Morbidity catastrophe risk

The APRA approach defines a disability scenario relative to incidence claim duration while the OFSI capital requirement is a shock to morbidity incidence and claim rates. Both of these approaches differ from the Solvency II approach which defines three specific and independent scenarios, namely an Arena disaster, a Concentration scenario and a Pandemic scenario. The APRA approach is similar in that it defines a scenario, but it only defines one event and leaves discretion to the appointed actuary to add other events, or increase the severity of the defined event.

6. ASSESSMENT OF AVAILABLE APPROACHES GIVEN THE SOUTH AFRICAN CONTEXT – ALLOWANCE FOR MORTALITY IN THE Life SCR - Catastrophe Risk

6.1 Discussion of inherent advantages and disadvantages of each approach

The approaches for assessing mortality catastrophe risk are either to apply a short term shock to mortality rates (Solvency II and APRA) or to estimate the impact of such a shock by taking a percentage of annual death claims paid (OSFI).

The Canadian approach appears to be more complex and will be more difficult to integrate into cashflow projection models than the Solvency II/APRA approach. It may also lead to inconsistencies of treatment across insurers, if the partitioning requirements contained in it are at all subjective.

The Solvency II/APRA approach is believed to be more intuitive and hence is regarded as the preferred approach.

For all approaches, credibility is a concern as South Africa does not have significant historical data on catastrophes in the country.

6.2 SA QIS3 feedback

The main themes of feedback from SAM QIS3 were as follows:

- The impact of the mortality catastrophe shock is believed to be too onerous
- The formula is difficult to incorporate on a policy level for some insurers.

To better understand possible callibrations, three papers researching the expected impact in South Africa of mortality related catastrophes were consulted.

The three papers consulted were:

- Pandemic Influenza a 21st Century Model: Swiss Re; 2007
- Evaluating the Impact Of Avian Flu: Lorna Mclaren, Paul Lewis; 2006
- Catastrophe Modelling: Deriving the 1-in-200 year mortality shock for a South African insurer's capital requirements under solvency assessment and management (SAM): AA Plantinga, DJ Corubolo and R Clover; 2014

The last paper is an update on the honours research paper authored by Platinga in 2013.

The main findings in the papers were:

- Previous mortality catastrophe events, namely flu pandemics, have varied in their severity with the worst catastrophe being the Spanish Influenza.

- The discovery of penicillin is expected to reduce the likelihood of a pandemic on the scale of the Spanish Influenza in the future.
- The additional mortality modelled ranged from 1 per mille per annum to almost 10 per mille per annum.
- However, approximately 3 per mille per annum is still the consensus additional mortality required for a 1-in-200 year event.
- Platinga, et al found that the split between instantaneous events and pandemic events is 10% and 90% respectively.

To allow for the above findings, the onerousness of the parameterisation has been reduced – by reducing the upper limit of the stress to 3.6 per mille per annum, from 6 per mille per annum. The formula structure has been maintained. It is acknowledged that it is more complex than the component in the standard formula under Solvency II, but it is not considered to be unnecessarily complex and a simplification is available where it is not practical to perform the detailed calculation required.

6.3 Proposed approach for SAM

The increase in the rate of policyholder's dying of 1.5 per mille adopted for Solvency II was set with developed countries in mind, i.e. the wider EU – a flu pandemic or nuclear event were the scenarios envisaged. South Africa, by contrast, is a developing country with varying levels of access to quality healthcare and a high prevalence of HIV infections. Neither of these characteristics would be expected to result in a different concentration risk, as would be relevant in a nuclear event or other manmade and natural disasters, relative to those in the EU.

The impact of a flu pandemic on people who are accustomed to lower levels of quality healthcare is debatable. Lower quality healthcare would be expected to result in those that fell seriously ill succumbing more easily to their infection, however their resilience to infections would be expected to be higher than an individual who relies on quality healthcare whenever they fall ill (natural selection). This should mean that they wouldn't fall seriously ill as easily.

It is clearer that a flu pandemic is expected to affect an HIV positive person more severely than an HIV negative person, due to an HIV positive person having a suppressed immune system. Hence, a higher shock would be justified for South Africa than under Solvency II for this reason.

A combination of a fixed addition and a percentage increase to the underlying mortality rate was proposed for SA QIS3. The percentage increase to underlying mortality is intended to cater for lives that are expected to be more susceptible to a pandemic or similar event, with the fixed addition covering the remainder of lives and an allowance for an instantaneous event.

The proposed calculation is:

Addition to the annual mortality rate for the 1 month following the valuation date of the following:

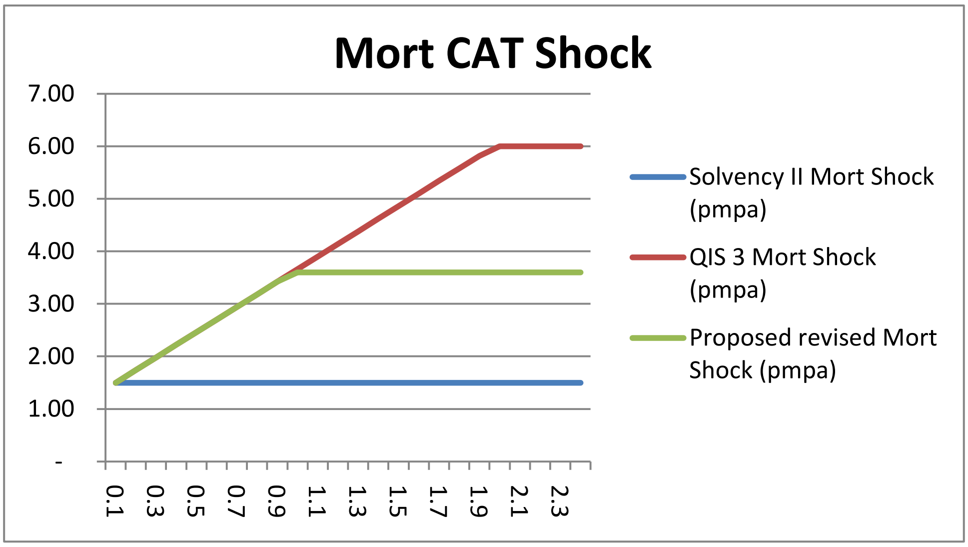
12 * min(max(0.200 * MortRate + 0.105; 0.125); 0.3) / 1000

where,

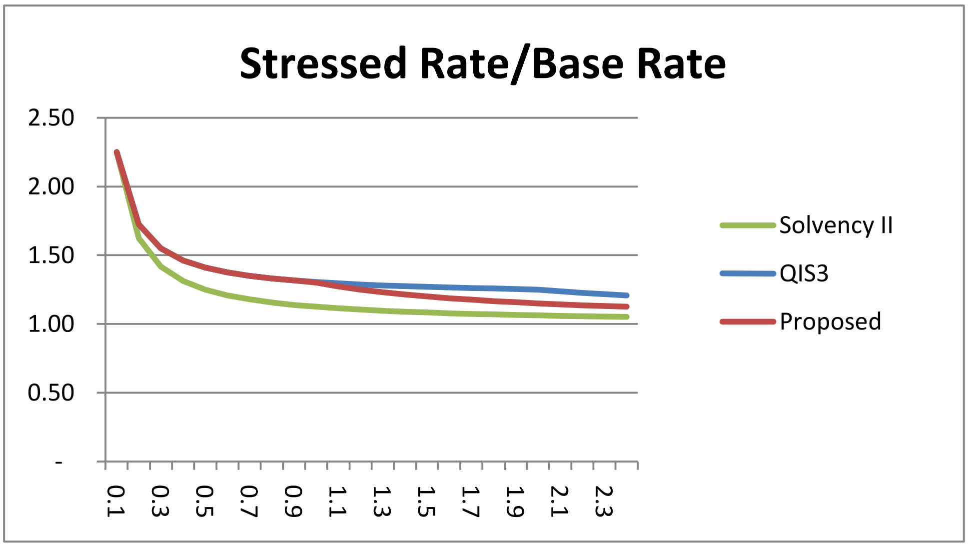
MortRate is the underlying mortality rate per mille per month for each life. Where it is not practical to determine a mortality rate per life, then exposure weighted averaging can be done at a higher level. It should, however, be done at least at the segmentation level as required in the SAM Technical Provisions calculations.

To allow insurers to cater for risk mitigation, the stress has been allocated between instantaneous events (such as nuclear disasters, earthquakes, floods and tsunamis) and epidemic/pandemic causes (e.g. a flu pandemic or new form of influenza). The split has been updated from the split used in SA QIS3 of 30% for instantaneous events and 70% for epidemic/pandemic causes, to 10% for instantaneous events and 90% for epidemic/pandemic causes. This is based on the findings of Platinga, et al. The initial split was set in the absence of any research available. It is noted that this may reduce the extent of risk mitigation possible for some insurers, however this is considered justifiable if the expected contribution to the underlying stress is more heavily weighted to events for which the insurer does not have a risk mitigation approach.

The graphs below compare the impact of the proposed approach with that adopted for SA QIS3 and Solvency II:



Solvency II has a flat addition of 1.5 pmpa. The starting point of the SA QIS3 and proposed parameterisation is a shock of 1.5 per mille per annum, with the shock then increasing linearly as the mortality rate increases until the relevant upper limit is reached.



When the underlying base mortality is low the graph shows a higher proportional adjustment, compared to a lower proportional adjustment when the underlying base mortality is high.

Therefore the principle that there is a limit to the overall impact on mortality from an event, i.e. if the underlying mortality is already high the difference between the limit and the current level is lower on a proportional basis than the reverse, holds.

6.4 Impact of the approaches on EU 3rd country equivalence

The approach proposed is similar to that of Solvency II, an increase to mortality rates for a fixed period of time. The parameterisation is more onerous, for the reasons discussed above, to meet what is believed to be a 1-in-200 year event requirement for South Africa. Hence 3rd country equivalence is not expected to be affected.

6.5 Comparison of the approaches with the prevailing legislative framework

There is no explicit allowance for catastrophes in the prevailing legislative framework.

6.6 Conclusions on preferred approach

An increase to the modelled mortality rate for the 1 month following the valuation date is the most appropriate approach. The South African market is different from the EU in two key respects:

- The prevalence of AIDS
- The diversity of underlying mortality and access to healthcare across the market

These distinguishing features of the South African market should be taken into account in the calibration of the parameters for this sub-module.

After considering the QIS3 feedback, however, the calculation that was adopted for QIS3 has been changed for the proposed SAM basis.

For QIS3 the approach was parameterised to be an instantaneous shock increasing the rate of mortality incidence in the month following the valuation date by a percentage of the annual mortality rate. This was done to ensure the approach for contract boundaries was consistent and the accurate evaluation of risk over a one year period. The SAM QIS2 approach of increasing incidence rates for one year provides an appropriate approximation for an instantaneous shock. The SAM QIS2 approach of increasing incidence rates for one year provided an appropriate approximation for an instantaneous shock. However, for policies with short contract boundaries the increase in incidence rates for a one year period would be cut-off at the contract boundary. An instantaneous shock therefore deals more directly with the instantaneous nature of a catastrophe. Similar allowances for minimum stresses were applied in the level mortality and disability/morbidity sub-modules on contracts with short contract boundaries.

It is noted that the above calculation would result in a very small stress for a new insurer, where most of their policies are still in the waiting period at the valuation date. This scenario is expected to be quite rare, hence no specific allowance will be made for it in the standard formula – however, insurers should consider if they are in such a scenario and allow appropriately for it in their ORSA. It has also been noted in discussions on the Life Risk module that neither this sub-module nor the Mortality sub-module allows for capital requirements to cover typical fluctuation of mortality experience. Fluctuation in mortality experience would be expected to be relevant in the following cases:

- Insurers with very few policies, especially with higher average sums assured per policy relative to the size of their operations.
- Larger companies with large variability in the size of their sums assured per policy such that they have significant numbers of high sums assured relative to their average book size.

The South African life insurance market is serviced by a few large insurers, a few medium size insurers and a large number of smaller insurers. Medium and large insurers would be expected to have reasonable book sizes that do not present excessive mortality fluctuation risk, especially when compared to the other mortality related stresses considered within the Life SCR module. In contrast, the vast majority of small life insurers operate in the funeral segment where there are large numbers of lives covered for small sums assured. Hence, the capital requirements for mortality risk proposed by the standard formula are considered to be sufficient and no addition to the calculations is required. If a specific insurer has an excessive mortality or morbidity risk profile, relative to the overall industry, this should be captured in their ORSA.

7. ASSESSMENT OF AVAILABLE APPROACHES GIVEN THE SOUTH AFRICAN CONTEXT – ALLOWANCE FOR <u>MORBIDITY</u> IN THE Life SCR - Catastrophe Risk

7.1 Discussion of inherent advantages and disadvantages of each approach

Similar considerations apply as for mortality catastrophe discussed in section 6.1.

7.2 SA QIS3 feedback

Limited feedback from SAM QIS3 on the morbidity section of the Life CAT Risk sub-module was received. The only comment being that the impact of the shock is believed to be too onerous

The research reviewed did not contain specific information on expected increases to morbidity under a catastrophe scenario. The comment provided also did not give specific justification for why it is believed that the stress is excessively onerous.

Due to this, the stress has been left unchanged from what was included in SAM QIS3.

7.3 Proposed approach for SAM

For insurance business that does not fall within the scope of Non-SLT-Health obligations, the morb CAT shock is proposed to be defined as the absolute increase in the rate of policyholders becoming sick or disabled at the valuation date (an instantaneous shock) as specified below (only applicable to morbidity incidence rate and not the recovery rate):

morb CAT shock = 12 * 70%*MorbRate/1000

where, MorbRate is the exposure weighted average underlying morbidity incidence rate per mille per month.

Averaging should be done at a policy level, where practical. Where this is not practical then averaging can be done at a higher level, but it should be done at least at the segmentation level as required in the SAM Technical Provisions calculations.

For insurance business that does not fall within the scope of Non- SLT Health obligations, the formula for morb CAT shock is proposed to be defined as follows:

morb CAT shock = 70% * F

where F is the annual claims frequency.

7.4 Conclusions on preferred approach

Since the Solvency II Health Module was moved to the Life Module in the SAM SCR a consistent approach with the mortality shock seems appropriate. Stresses on incidence rates are used in both the APRA and OFSI approaches.

The underlying base risk rate for morbidity varies significantly based on the definition of the risk (for example the differences between functional and an occupational definition).

The proposed parameterisation of a 70% stress was determined for SAM QIS2. In the absence of other evidence the mortality catastrophe parameterisation was used as a base to set the morbidity catastrophe parameter. The starting point was to derive the mortality catastrophe shock as a percentage of the underlying mortality rate. The mortality catastrophe shock for SAM QIS2 was approximately 35% of the underlying mortality rate on average. The relativity of the morbidity shock to the mortality shock was determined with reference to the level shock parameters for SAM QIS2. Mortality risk is determined as a permanent 15% increase in mortality rates while lump sum morbidity risk was determined as an increase of 35% in morbidity rates for the year following the valuation date and morbidity risk for medical expenses was determined as a 5% increase in claims. The morbidity shock was therefore set to be approximately two times the mortality catastrophe shock based on these values.

When relying on averages, it must be noted that the result may differ depending on the rate of increase of morbidity by age, which in itself is age dependent. Theoretically it should increase at a slower rate for younger ages and faster at older ages. In addition, age is not the only significant determining factor of the underlying morbidity. The level of education and wealth (i.e. socio-economic class) being the notable factors that also need to be considered.

For QIS3 the approach was parameterised to be an instantaneous shock which increases the rate of morbidity incidence by a percentage of the annual morbidity rate in month 1. This was done to ensure the approach for short contract boundaries was consistent and the accurate evaluation of risk over a one year period. The SAM QIS2 approach of increasing incidence rates for one year provided an appropriate approximation for an instantaneous shock. However, for policies with short contract boundaries the increase in incidence rates for a one year period would be cut-off at the contract boundary. An instantaneous shock therefore deals more directly with the instantaneous nature of a catastrophe. Similar allowances for minimum stresses were applied in the level mortality and disability/morbidity sub-modules on contracts with short contract boundaries.

8. RECOMMENDATION

Catastrophe risk sub-module (Life$_{CAT}$)

Description

The life catastrophe sub-module is restricted to (re)insurance obligations where an increase in mortality or morbidity from an instantaneous or pandemic/epidemic event leads to an increase in technical provisions

Catastrophe risk stems from extreme or irregular events whose effects are not sufficiently captured in the other life underwriting risk sub-modules. Examples could be a pandemic event or a nuclear explosion.

Catastrophe risk is mainly associated with products (such as term assurance, critical illness, disability or endowment policies) in which a company guarantees to make a single, recurring or periodic series of payments when a policyholder dies or suffers disability or critical illness.

The type and extent of management actions assumed in SCR stress scenarios, and the way in which dynamic assumptions should respond to these stresses, will vary depending on whether the stress is assumed to be company-specific or industry-wide.

The stress applied in the life catastrophe sub-module is considered to result entirely from industry-wide events.

Impairments should be made to the risk mitigating effect of risk mitigating strategies, as specified in SCR.5.

Input

The following input data is required for this module:

CAT_{Mort} = Capital requirement for mortality catastrophe risk

CAT_{Morb} = Capital requirement for morbidity catastrophe risk

Output

The module delivers the following output:

$Life_{CAT}$ = Capital requirement for life catastrophe risk

Calculation

The capital requirement for life catastrophe risk is derived by combining the capital requirements for the mortality catastrophe risk and the morbidity catastrophe risk using a correlation matrix as follows:

$$Life_{CAT} = \sqrt{\sum_{rxc} CorrCAT_{rxc} \bullet CAT_r \bullet CAT_c}$$

where:

$CorrCAT_{rxc}$ = Entries of the matrix $CorrCAT$

and where the correlation matrix $CorrCAT$ is defined as follows:

CorrCAT	CAT_{Mort}	CAT_{Morb}
CAT_{Mort}	1	
CAT_{Morb}	0.25	1

Capital requirement for mortality catastrophe risk

The capital requirement for the life catastrophe risk component is defined as follows:

$$CAT_{Mort} = \Delta BOF \mid Mort\ CAT\ shock$$

where:

ΔBOF = Change in the value of Basic Own Funds (BOF)

BOF = Basic Own Funds (BOF) is the excess of assets over liabilities, valued in accordance with SAM rules, plus subordinated liabilities, less any exclusions from Own Funds.

Mort CAT shock = An instantaneous increase in the rate of policyholders dying as specified below (only applicable to policies which are contingent on mortality from an instantaneous or pandemic/epidemic event). The full increase in mortality is applied immediately in the month following the valuation date, after which mortality returns to the best estimate level.

Mort CAT shock = 12*min(max(0.200*MortRate + 0.105;0.125); 0.3) / 1000

where,

MortRate is the underlying mortality rate per mille per month for each life. Where it is not practical to determine a mortality rate per life, then exposure weighted averaging can be done at a higher level. It should, however, be done at least at the segmentation level as defined in sections [*Reference to relevant secondary legislation related to SA QIS3 specification paragraphs TP.4 and TP.5*].

For illustrative purposes, a policy with a monthly best estimate mortality rate of 0.1% (or 1 per mille per month) would have a stressed rate of 0.1% + 12 * min(max(0.200 * 1 + 0.105; 0.125); 0.3) / 1000 = 0.1% + 0.36% = 0.46% in the first month only, and then 0.1% per month thereafter.

The result of the scenario should be determined under the condition that the value of future discretionary benefits can change and that insurer is able to vary its assumptions in future bonus rates in response to the shock being tested. The resulting capital requirement is CAT_{Mort}.

The mortality catastrophe shock relates to two causes, namely instantenous manmade or natural events (such as earthquakes, nuclear disasters, floods and tsunamis) and from epidemic and pandemic causes (e.g. a new form of influenza).

Natural events are expected to have an indiscriminate effect on all lives irrespective of the base mortality assumed for the insured population. The additional mortality from natural events is also independent of the quality of accessible health care.

In the case of epidemic and pandemic causes, the socio-economic circumstances can have a bearing on the impact of the catastrophe on mortality experience. E.g. people living in poorer communities may have access to poorer health care facilities.

For a given assumed split of likelihood between catastrophic events and epidemic and pandemic causes, the impact of the mortality catastrophe shock can vary according to the level of the underlying mortality assumed.

The effect of risk mitigating strategies can be taken into account when determining the mortality catastrophe shock. This should be done on the basis that 10% of the Mort CAT shock is from manmade or natural catastrophic events and 90% of the shock is from the epidemic and pandemic causes.

Simplification

The simplification may be used provided the following conditions are met:

- The simplification is proportionate to the nature, scale and complexity of the risks that the insurer faces.
- The standard calculation of the catastrophe risk sub-module is an undue burden for the insurer.

The following formula may be used as a simplification for the mortality catastrophe risk sub-module:

$$CAT_{Mort} = \sum_i Mort\,CAT\,shock \cdot Capital\_at\_Risk_i$$

where the subscript i denotes each policy where the payment of benefits (either lump sum or multiple payments) is contingent on mortality from instantaneous or pandemic/epidemic events, and where $Capital\_at\_Risk_i$ is determined as:

$$Capital\_at\_Risk_i = SA_i + AB_i \cdot Annuity\_factor - BE_i$$

and

BE_i = Best estimate provision (net of reinsurance) for each policy i

SA_i = For each policy i: where benefits are payable as a single lump sum, the sum assured (net of reinsurance) on death.

AB_i = For each policy i: where benefits are not payable as a single lump sum, the Annualised amount of Benefit (net of reinsurance) payable on death.

Annuity_factor = Average annuity factor for the expected duration over which benefits may be payable in the event of a claim

Capital requirement for morbidity catastrophe risk

The capital requirement for the morbidity catastrophe risk component is defined as follows:

$$CAT_{Morb} = \Delta BOF \mid Morb\ CAT\ shock$$

where:

ΔBOF	=	Change in the value of Basic Own Funds (BOF)
BOF	=	Basic Own Funds (BOF) is the excess of assets over liabilities, valued in accordance with SAM rules, plus subordinated liabilities, less any exclusions from Own Funds.
Morb CAT shock	=	For insurance business that **does not** fall within the scope of Non-SLT-Health obligations: An instantaneous increase in the rate of policyholders becoming sick or disabled as specified below (only applicable to policies which are contingent on morbidity from instantaneous or pandemic/epidemic events). The full increase in morbidity is applied immediately in the month following the valuation date, after which morbidity returns to the best estimate level. *morb CAT shock = 12 * 70% * MorbRate /1000* where, *MorbRate* is the underlying morbidity rate per mille per month for each life. Where it is not practical to

determine a morbidity rate per life, then exposure weighted averaging can be done at a higher level. It should, however, be done at least at the segmentation level as defined in sections [*Reference to relevant secondary legislation related to SA QIS3 specification paragraphs TP.4 and TP.5*].

For insurance business that **does** fall within the scope of Non- SLT Health obligations:

An instantaneous increase in the expected annual claims frequency, applied in the month following the valuation date, as specified below, after which the claims rate returns to the best estimate level (only applicable to policies which are contingent on morbidity from instantaneous or pandemic/ epidemic events):

*morb CAT shock = 70%*F*

where,

F is the expected annual claims frequency for each life. Where it is not practical to determine a morbidity rate per life, then exposure weighted averaging can be done at a higher level. It should, however, be done at least at the segmentation level as defined in sections [*Reference to relevant secondary legislation related to SA QIS3 specification paragraphs TP.4 and TP.5*].

For illustrative purposes, a policy with a Morb CAT shock of 70% and a best estimate morbidity rate of 0.12% per annum, or 0.01% per month (or 0.1 per mille per month), the stressed rate would be 0.01% + 12 * 70% * 0.1 / 1000 = 0.094% in the first month, and then 0.01% thereafter.

The result of the scenario should be determined under the condition that the value of future discretionary benefits can change and that the insurer is able to vary its assumptions in future bonus rates in response to the shock being tested. The resulting capital requirement is CAT_{Morb}.

The morbidity catastrophe shock relates to two causes, namely manmade or natural events (such as earthquakes, nuclear disasters, floods and tsunamis) and from epidemic and pandemic causes (e.g. a new form of influenza).

The effect of risk mitigating strategies can be taken into account when determining the morbidity catastrophe shock. This should be done on the basis that 10% of the Morb CAT shock is from manmade or natural catastrophic events and 90% of the shock is from the epidemic and pandemic causes.

Simplification

The simplification may be used provided the following conditions are met:

(a) The simplification is proportionate to the nature, scale and complexity of the risks that the insurer faces.

(b) The standard calculation of the catastrophe risk sub-module is an undue burden for the insurer.

The following formula may be used as a simplification for the morbidity catastrophe risk sub-module:

$$CAT_{Morb} = \sum_i morbCAT\ shock \cdot Capital\_at\_Risk_i$$

where the subscript *i* denotes each policy where the payment of benefits (either lump sum or multiple payments) is contingent on morbidity, and where $Capital\_at\_Risk_i$ is determined as:

$Capital\_at\_Risk_i = SA_i + AB_i \cdot Annuity\_factor - BE_i$

and

BE_i	=	Best estimate provision (net of reinsurance) for each policy *i*
SA_i	=	For each policy *i*: where benefits are payable as a single lump sum, the sum assured (net of reinsurance) on sickness or disability.
AB_i	=	For each policy *i*: where benefits are not payable as a single lump sum, the Annualised amount of Benefit (net of reinsurance) payable on disability.
Annuity_factor	=	Average annuity factor for the expected duration over which benefits may be payable in the event of a claim