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Addressing the Size and Volatility of the Solvency II Risk Margin Using a Tapering Approach
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Introduction

Since the introduction of Solvency II in January 2016, the Risk Margin has been identified as an area in need of review. An unintended consequence of the design of the Risk Margin is its high sensitivity to interest rates. This, exacerbated by the persistent low interest rate environment, has resulted in the Risk Margin making up a much larger proportion of Technical Provisions than was intended. Transitional Measures for Technical Provisions (TMTPs) alleviate some of this burden by offsetting the impact of the Risk Margin on existing business – although the TMTP is not fully dynamic. However, the Risk Margin still makes writing new business, in particular annuities and other long-term guarantee-based products, unattractive in the short term and can thus act as a barrier to entry and lead to less affordable prices for customers. As the TMTPs run off, this becomes a more material issue for existing business.

The Solvency II Directive and Delegated Regulations specify that the Risk Margin should be calculated using a Cost of Capital approach with a 6% per annum charge. EIOPA's draft proposals to the European Commission, currently open for consultation[1] as part of the EU Solvency II review, propose no change to this. Whilst this method is, in itself, unnecessarily onerous and the 6% charge looks high, with the impact exacerbated by current low interest rates, our proposal in this paper retains the Directive's approach. We believe that it can be explored and implemented without the need to make amendments at the EU-level to the Level 1 (Directive) or Level 2 (Delegated Regulation and Implementing Technical Standards) text.

Proposal – Permit tapering to allow for the non-repeatability of some risks in the future SCR

1. Introduction

The current approach for calculating the Risk Margin treats all future capital funding requirements as independent payments (i.e. based on future unconditional SCRs) and does not take into account any dependency over time. However, any economic approach to valuing risky payments would have to take into account the dependence of risks over time to avoid inappropriate conclusions – such as, in the case of annuity products, implausibly low mortality rates and the implication that more capital is at risk than the worst case scenario of policyholders living forever.

In our view, SCR capital requirements are not independent – some non-hedgeable risks (such as mortality/longevity risk and lapse risk) may be non-repeatable, so if they crystallise in one time period they cannot reoccur. This will have a downward impact on the calculation of forward SCR

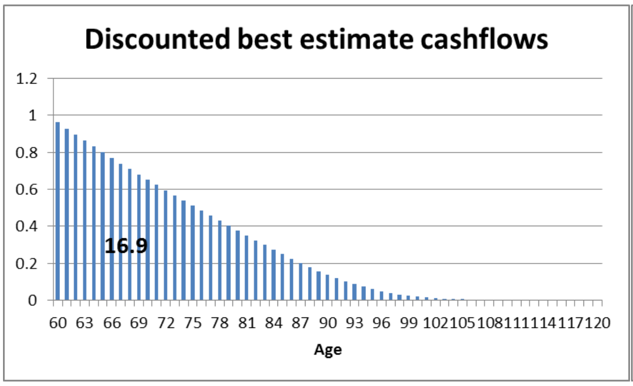
[1] EIOPA consultation paper EIOPA-CP-17-006 (6/Nov/2017)

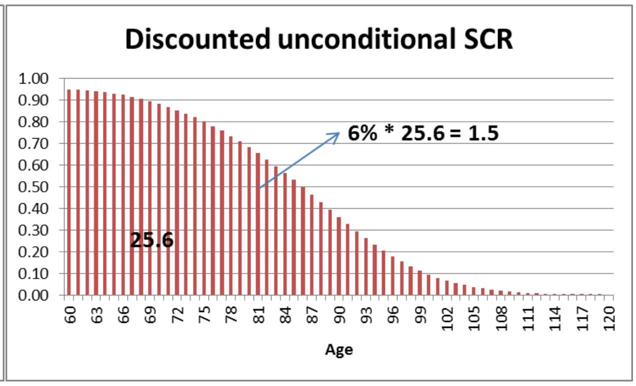
capital requirements. We make the following proposal on such a basis, and acknowledge further consideration may be required to confirm for which risks there is a negative correlation over time due such non-repeatability.

The non-repeatability means it is not appropriate to value the projected SCRs in the Risk Margin calculation as independent payments, which is the presumption implicitly made when applying the formula currently specified in Article 37(1) of the Delegated Regulation. Instead, when setting the compensation required to finance a liability (i.e. the level of payment required, in the form of a Risk Margin, to take on that risk), an investor will consider the distribution of outcomes at maturity of the liability being financed. In other words, when providing this capital an investor will necessarily consider the ultimate risk when assessing the compensation required to provide that capital. The impact of such risk dependency is to limit the ultimate loss that an investor can experience on any particular risk – if a risk cannot occur twice, it should not be charged twice.

2. Current Risk Margin funds too much capital

Consider a simple illustrative annuity example – a policyholder aged 60 with the IML00 base mortality table, a constant mortality improvement assumption of 1.8%, and a constant interest rate of 3%. This produces a best estimate annuity value of 16.9 (arbitrary units) and a Risk Margin of 1.5 (assuming Standard Formula stresses):





The current approach for calculating the Risk Margin implies total capital required over the lifetime of this policyholder of 25.6 (i.e. sum of discounted unconditional SCRs). However, if this policyholder were to live forever, the total cost would be 33.3 (i.e. a perpetual bond whose value is 1/0.03 = 33.3), implying a loss in this case of 16.4. This means that the current Risk Margin would require firms to fund more notional capital than even the worst case scenario of this policyholder living forever, which is clearly wrong. In fact, the worst possible case for the investor corresponds to a 1-in-200 shock in each and every year, which yields a lower loss than 16.4. Therefore, any capital raised above this level the investor will receive back *with certainty* – and hence will not charge a premium above risk-free for this (i.e. **this component of the total capital raised requires a corresponding Risk Margin of zero**).

The same reasoning can also be applied to other insurance risks. In the case of lapses, the current application of the Risk Margin formula will result in total lapse rates of greater than 100% (for example, for a five-year product with constant exposure, applying the Standard Formula stress of 40% each year implies that the Risk Margin should fund enough capital corresponding to a total lapse rate of 200%, or every policyholder lapsing twice).

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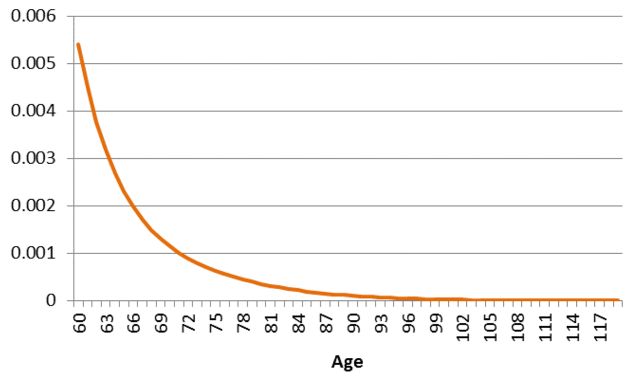
In fact, it is possible to show that the way that the Risk Margin formula is currently applied leads to arbitrage opportunities, and so can in no way be justified by any economic theory. We show below, via an example from a simple catastrophe insurance product and via an illustration based on the annuity above, how arbitrage opportunities can arise.

3. Current Risk Margin implies implausible mortality

The current approach assumes that the future SCR being funded is based on unconditional 1-in-200 shocks. However, a significant proportion of insurance risks are non-repeatable – this is the case for longevity risk (e.g. cancer can only be cured once). Considering longevity risk further, ignoring such risk dependency over time results in implausible mortality rates – for example, for the 60 year-old policyholder, if we apply the Standard Formula stress of a 20% reduction in mortality rates every year, this results in mortality rates which are effectively zero after the age of 90:



Historically, mortality rates have always increased with age. Therefore, the resulting mortality rates from applying the same unconditional shock year after year are completely implausible when viewed from a historic context and clearly not realistic – this is something that the use of a conditional stress (i.e. allowing for time dependency) would address.

4. Example – arbitrage opportunities for catastrophe insurance

We illustrate here how arbitrage opportunities can arise under the current application of the Risk Margin formula with a simple illustrative example of earthquake insurance.

Suppose that a government purchases earthquake insurance for a period of five years from two different entities. The first entity offers insurance with a compensation cap of 100 (the 1-in-200 year annual loss), while the second entity offers a product with no such cap. For both products, the sum of forward unconditional SCRs is 500, implying a Risk Margin of 30 for each. Therefore, each entity charges the government a premium to cover the BEL (which will be lower in the first case) and the Risk Margin of 30.

In this case, an investor can buy the reference undertaking with exposure to the product with capped losses for an outlay of 100 (which covers the SCR in each time period and the maximum possible loss), and invest a further 400 at the risk-free rate. Then, that same investor can short sell the other reference undertaking with exposure to the uncapped product and receive 500. The net outlay is therefore zero.

However, the net amount received at the end of the product's life is always greater than or equal to zero – giving rise to the possibility of unlimited arbitrage profit. The table below gives the cash flows that would arise in each period[2]:

	Short-sell reference undertaking with uncapped product	**Buy reference undertaking with capped product**	**Invest in risk-free**	**Net cash flow**
t = 0 (start)	+500	-100	-400	0
t = 5 (end)	-(500-X+30)	100-min(X, 100)+30	+400	$0 \leq X - \min(X, 100) \leq 400$

It can be seen that with the above strategy, for a net outlay of zero a profit of between zero and 400 is always made. This therefore presents an opportunity for arbitrage profits, illustrating how the current application of the Risk Margin formula is clearly economically wrong.

5. Example – arbitrage opportunities for annuity products

It is possible to show how the current application of the Risk Margin formula can also give rise to arbitrage opportunities for annuity products (and more generally). To illustrate this, we consider below a numerical example where an investor acquires a reference undertaking that insures the annuity product described in Section 2 above, and at the same time enters into an agreement in parallel with another counterparty to issue a derivative which offers a *single* payment linked to the reference undertaking's surplus at the *end* of the liability.

As highlighted, for this annuity product the current application of the Risk Margin formula implies a total capital of 25.6 needs to be raised. However, of this, the investor is guaranteed to receive back at least 9.2, since in the worst possible scenario (i.e. the policyholder living forever) the investor would incur a loss of 16.4. Therefore, an investor will not charge a risk premium for this excess amount. However, the current Risk Margin calculation does charge the cost of capital on this[3].

To illustrate how this could lead to arbitrage opportunities, assume that the investor invests 25.6 in the reference undertaking at the same time as: (i) borrowing 9.2 (i.e. the amount equivalent to the excess of this over the maximum possible ultimate loss); (ii) issuing a derivative with a payoff at the end of the liabilities set to the ultimate profit or loss of the reference undertaking less 9.2; and (iii) borrowing at risk-free to fund the compensation required by the counterparty in order to buy this derivative. In this case, the net outlay is zero:

[2] In the table, a positive X represents a loss, a negative X represents a profit.

[3] In fact, the maximum possible loss is lower than this and corresponds to the loss incurred after a 1-in-200 event in each year – but for illustrative purposes we assume the maximum loss corresponds to policyholders living forever.

	Buy reference undertaking	Borrow 9.2 + c	Issue derivative with payment equal to ultimate profit of the reference undertaking	Net cash flow
t = 0 (start)	-25.6	+9.2 + c	16.4 – c	0

In words, the expected payoff of the derivative at maturity, discounted at risk-free, has a present value of 16.4. However, any counterparty purchasing the derivative will require some compensation c – and so will pay an amount 16.4 minus c in order to acquire this.

At maturity of the liability (e.g. when the policyholder would reach age 120), the ultimate profit or loss (i.e. the initial capital raised of 25.6 less the remaining surplus of the company – rolled up at the risk-free rate of 3%) is known, and the investor receives this and the Risk Margin back. The investor then pays the obligation under the derivative they issued, and also pays back the amount borrowed (9.2 + c), rolled up at the risk-free rate. The cash flow at maturity then is as follows:

	Buy reference undertaking	Borrow 9.2 + c	Issue derivative with payment equal to ultimate profit of the reference undertaking	Net cash flow
t = T (end)	$(16.4)(1.03^T) – X + 9.2(1.03^T) + RM(1.03^T)$	$-(+9.2 + c)(1.03^T)$	$-(16.4(1.03^T) – X)$	$(RM – c)(1.03^T)$

Below the payoff in each column is described in words:

- First column: At maturity, the investor receives from the reference undertaking with certainty the excess amount above the maximum possible loss (=9.2) and the Risk Margin RM (=1.5), both rolled up at the risk-free rate. In addition, the investor receives the capital at risk (16.4) rolled up at the risk-free rate, less the total capital lost X (i.e. a positive X amounts to a loss, a negative X amounts to a profit).
- Second column: The investor pays back the amount (9.2+c) borrowed, rolled up at the risk-free rate.
- Third column: The investor pays out the derivative payoff, which is equal to the profit of the reference undertaking less 9.2, i.e. is equal to 16.4 rolled up at the risk-free rate less the loss of X.
- Fourth column: This gives the net cash flow at maturity, equal to $(RM-c)(1.03^T)$, i.e. the sum of the previous three columns.

We can see that under the arrangement above, the only way to avoid arbitrage is if c is equal to RM. The key question is therefore what level c will be set at. This is the compensation that a counterparty would require in order make a single payment at the start to acquire the derivative with a single payment at maturity of the liability of 16.4 (the total capital at risk in the investment

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firm) less the loss made on that liability. Since this is a single payment, the counterparty will only consider the distribution of this payment at maturity when setting the compensation required to take on this risk. **This shows that arbitrage opportunities will arise as long as the Risk Margin is not valued taking into account the ultimate risk (and hence the risk dependency over time) of the liabilities being insured**.

6. Proposal

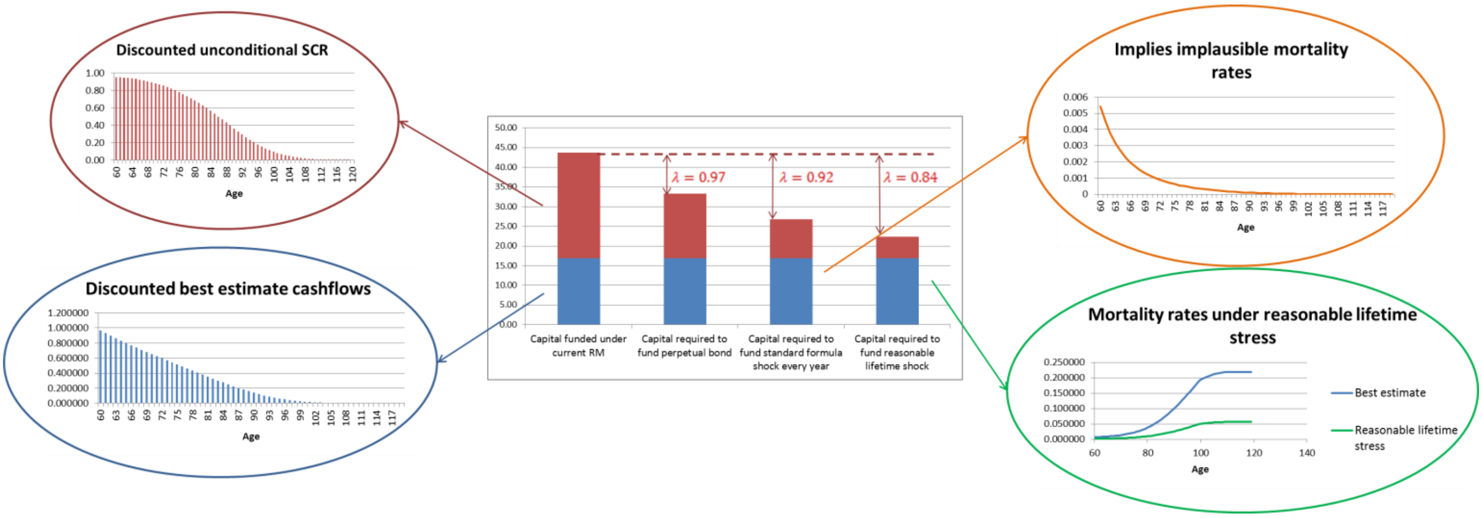
We propose that internal model firms are allowed to model risk dependence over time in their SCR projections in the Risk Margin calculation. The simplest way to do this would be for firms to use a tapering parameter λ^t to derive the projected SCR in the Risk Margin formula provided in Article 37(1) of the Delegated Act, i.e.:

$$RM = CoC \sum_{t \geq 0} \frac{SCR(t)}{\left(1 + r(t+1)\right)^{t+1}}$$

where $SCR(t) = \lambda^t SCR'(t)$ and $SCR'(t)$ denotes the unconditional SCR at time t.

In this context, λ represents an estimate of the degree to which the ultimate risk reduces relative to a series of independent risks, and is linked to the reduction in size of future 1-in-200 risks following a 1-in-200 loss in previous periods. This could be based on targeting an appropriate extreme lifetime shock to mortality rates. For example, for annuities, if we target an ultimate mortality rate of 5% at age 100, in this example this would result in a λ of 0.84.

The diagram below demonstrates the impact on best estimate cash flows and notional SCR for the simple annuity product discussed above for (from left to right): (1) capital funded under the current Risk Margin (λ = 1); (2) capital required to fund a perpetual bond (λ = 0.97); (3) capital required to fund a standard formula shock every year (λ = 0.92); and (4) capital required to fund a reasonable lifetime shock (λ = 0.84):



It is important to note that the tapering approach is one possible way to implement the main proposal – which is to allow for risk dependence over time and hence take into account the ultimate risk to the investor. Alternatively, firms could be allowed to use their internal models to achieve this by projecting forward SCRs using their internal model in a way that is consistent with their own view of the ultimate risk.

7. Legal basis

The key Level 1 requirements for the Risk Margin are given in Article 77 of the Solvency II Directive. In particular:

- Article 77(3) states that "The Risk Margin shall be such as to ensure that the value of the technical provisions is equivalent to the amount that insurance and reinsurance undertakings would be expected to require in order to take over and meet the insurance and reinsurance obligations".
- Article 77(5) states that "Where insurance and reinsurance undertakings value the best estimate and the Risk Margin separately, the Risk Margin shall be calculated by determining the cost of providing an amount of eligible own funds equal to the Solvency Capital Requirement necessary to support the insurance and reinsurance obligations over the lifetime thereof".

As illustrated above, the current approach adopted in calculating the Risk Margin results in insurers holding technical provisions for insurance risks such as annuities and lapses that enable an insurer to raise sufficient capital to withstand a scenario that corresponds to a loss which is greater than the maximum possible ultimate loss (e.g. for annuities in which mortality rates fall to zero over the lifetime of the insurance obligations, or for lapses a lapse rate of more than 100%).

This clearly contravenes Article 77(3), as no insurer would expect this level of protection to take over and meet the insurance obligations. In addition, it runs counter to the financial stability objectives of regulators, as it effectively forces insurers to transfer insurance risks to off-shore jurisdictions and results in the creation of a highly material, artificial, interest rate risk sensitive balance sheet item.

As explained in the analysis above, one of the key reasons the current approach gives rise to a value of technical provisions for insurance risks exceeding that stipulated by Article 77(3) is that it does not take account of risk dependence over time, and therefore overstates the total capital-at-risk.

There is, however, nothing in the legal text that prevents insurers taking account of risk dependence over time when calculating a set of SCR(t)s in Article 37(1) and (2) of the Level 2 Delegated Acts so long as they do not contravene Level 1 requirements.

As described above, we consider that the best way to determine a set of projected SCRs that fully meet the Level 1 requirements is to ensure that they are consistent with an extreme but plausible lifetime shock.

For standard formula firms, we believe that it could also be possible to find reasonable approximations and simplifications for longevity risk, which would allow them also to take risk dependency over time into account, while remaining compliant with the Level 1 and Level 2 requirements.

We anticipate that the approaches described here would result in a more realistic run off profile for future capital requirements, and a more realistic calculation of their NPV as a consequence. We believe that this NPV value (and hence the Risk Margin itself) could be materially reduced while remaining reasonable and prudent.