MILLIMAN RESEARCH REPORT

# Measuring new business profitability under Solvency II ($S_2NBV$)

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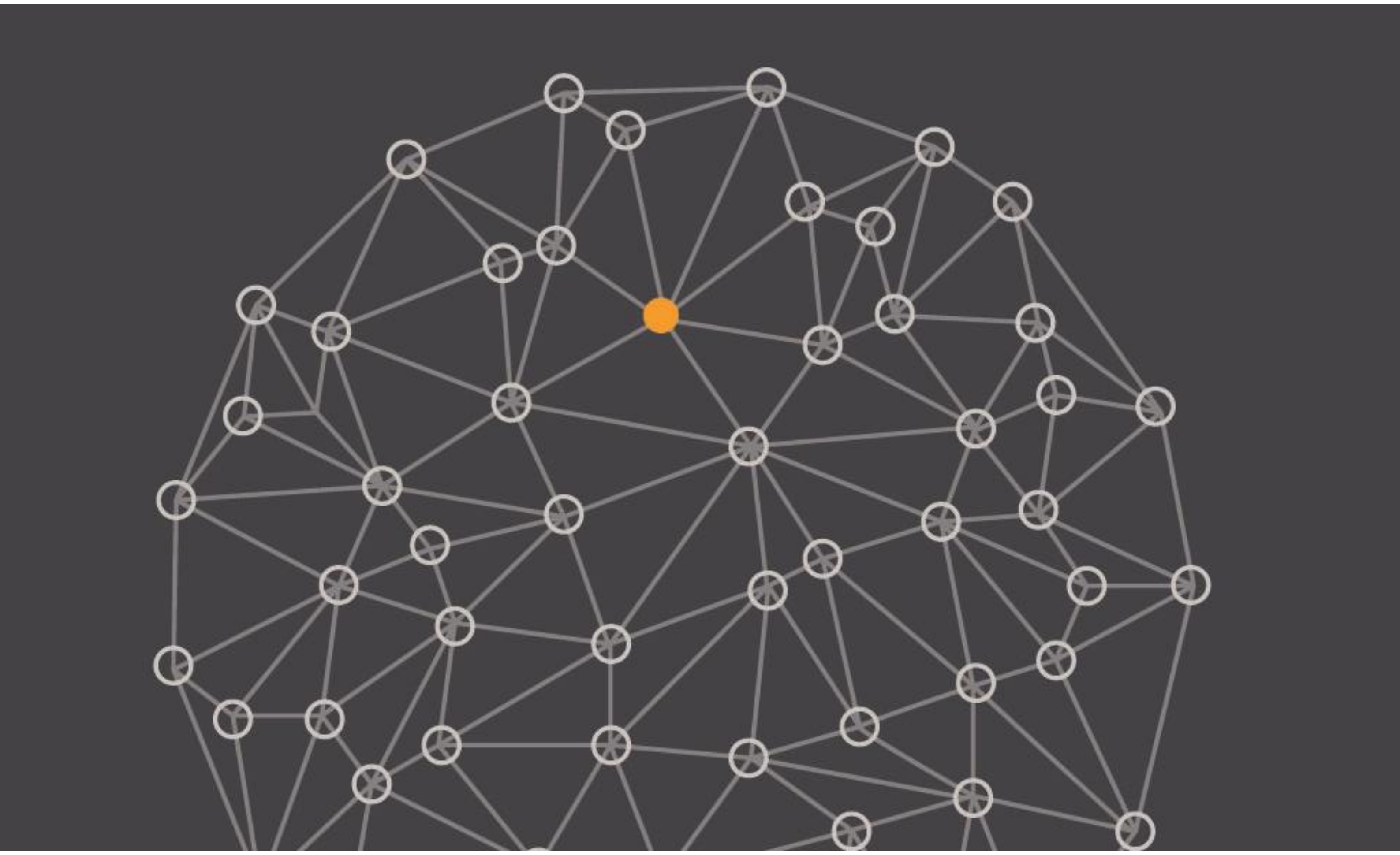
Ed Morgan, FIA
Jeremy Kent, FIA

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# 1. Executive Summary

Solvency II represents a radical shift in the way that European insurance regulation works and we believe it will fundamentally change the way European insurers view risk and returns. In this paper we introduce a new methodology for measuring new business value and new business profitability in this Solvency II world.

This method assumes assets and liabilities are valued, and required capital calculated, in line with Solvency II.

However, it considers a real-world perspective on investment returns, and allows for an appropriate Cost of Capital, including in respect of hedgeable risks, taking into account the company's required rate of return. These aspects would not be captured by the application of a market-consistent valuation alone. Furthermore it is applicable to life, non-life and health business.

Thus we define new business value and profitability in terms of the present value of expected future distributable profits on a Solvency II basis, discounted at the shareholders' required rate of return, but go on to express this in terms of a small number of elements, starting with the Own Funds generated at the outset of the contract. In this way, the key contributors to value can be clearly seen, such as the impact of taking hedgeable risks. We provide numerical examples to illustrate this.

The real value of this method comes because it can capture the impact on required capital and returns of different product designs and other management actions such as investment strategy and reinsurance. This means it can inform real decision making in insurance companies. We consider some key factors which can impact new business value and profitability under our method, and illustrate them with numerical examples of a participating life product and a non-life product. This includes examples highlighting the impact of considering new business value on a marginal, rather than a stand-alone, basis.

Finally we explore areas such as the calculation of the future new business or franchise value under an overall company appraisal valuation, and issues around contracts with short contract boundaries under Solvency II.

# 2. New business value under Solvency II ($S_2NBV$)

### 2.1 WHY A NEW METHODOLOGY MAY BE NEEDED UNDER SOLVENCY II

Under Solvency I capital requirements were formulaic, and hence there could often be little direct benefit to the capital position from reducing risk in product design, or other risk mitigation strategies. In contrast Solvency II attempts to determine capital requirements on an economic basis, reflecting the actual risks taken.

Therefore the Solvency II framework encourages insurers to consider the risks and resulting capital requirements arising from potential product design decisions.

However, we believe that many companies may be struggling with what Solvency II means for product pricing and profitability, such as the difficulty of understanding the impact of new business on both the Own Funds and the required capital.

We note, further, that market-consistent approaches to assessing new business profitability (even those aligned to Solvency II) do not allow for the cost of taking market risks (other than the small impact of frictional costs). Because market risks are often the most important drivers of capital requirements this makes it hard for shareholders to understand their expected returns on capital. Market-consistent approaches are also not aligned with the real-world thinking adopted by many insurers.

Additionally, methods which consider new business profitability on a stand-alone basis miss (potentially highly significant) interactions with the current balance sheet and in-force book, such as potential diversification benefit in respect of marginal capital requirements.

Product design decisions are critical as shareholders demand certain minimum returns on capital invested and public disclosures highlight insurers' solvency cover levels, making capital efficiency increasingly important. The current low interest rate environment also presents obvious challenges, particularly for life savings products, where the structure and level of guarantees will drive capital requirements and margins achieved.

Our method addresses these issues by providing a foundation which:

- Reflects the marginal capital required for writing new business, together with the cost of holding that capital based on the company's required rate of return, including that related to market risks
- Considers a projected real-world view
- Considers the marginal impact of writing new business on Solvency II Own Funds
- Allows an appropriate assessment of the benefit or otherwise of potential product design decisions and taking certain other management decisions, such as investing in risky assets, in the context of the previous points
- Is applicable to life, non-life and health businesses, including companies writing all of them

The method therefore provides a framework for companies to make robust decisions around new business, and to satisfy the demands of shareholders in a Solvency II world.

### 2.2 INTRODUCING THE METHOD

Our method follows on from the methodology set out in our paper '$S_2AV$: A valuation methodology for insurance companies under Solvency II.' Here we introduce *'$S_2NBV$: Solvency II new business value'* as the basis for assessing new business profitability.

*$S_2NBV$ is equal to: the net present value of expected future distributable profits on a Solvency II basis, discounted at the shareholders' required rate of return.*

Distributable profits are defined in terms of the required level of capital, and the Own Funds available and eligible to cover it, and projections are considered on a real-world basis, although with Solvency II Technical Provisions and the Solvency Capital Requirement (SCR) at a given point determined on a market-consistent basis.

Further, it is the marginal impact of writing the new business on this value which is considered, rather than considering new business on a stand-alone basis. Marginal effects can include the following:

- Solvency II-driven capital requirements for the new business will depend on capital requirements for the existing business, which is due in particular to diversification benefits.
- Impact on the asset-liability management (ALM) position of writing new business into a pooled fund with existing business. This type of arrangement is common in respect of participating life business in many European countries, where the assets and liabilities related to different generations of business are managed together and share in surpluses via policyholder profit sharing.
- The tax position (e.g., recoverability of tax losses).
- Spreading of overhead expenses.

Considering new business profitability on a stand-alone basis, particularly in a Solvency II context, can introduce material distortions and lead to bad pricing decisions.

## 2.3 ELEMENTS OF VALUE

In this and the following sections we will express S2NBV in terms of building blocks which can be shown to be equivalent to our definition above of the net present value of expected future distributable profits.

The S2NBV value can be broken down as:

- Initial Own Funds added by New Business ($OF_{NB}$).
- *Less* Cost of Capital (COC) in respect of non-hedgeable risks (compared with the Risk Margin [RM] generated at inception of the contract [$RM_{NB}$])
- *Plus* Impact of taking hedgeable risks

With the above determined on a marginal basis, and the various elements allowing appropriately for the impact of tax.

We note that:

- $OF_{NB}$ includes the impact of:
  - Cash flows at the start of the contract, e.g., initial premium, initial expenses and initial commissions
  - *Less* Best Estimate Liabilities (BEL) generated at the start of the contract[1]
  - *Less* Risk Margin generated at the start of the contract
  - Tax (including deferred tax)
- Cost of Capital assumes the shareholders' required rate of return
- Cost of Capital in respect of non-hedgeable risks includes the cost of holding the Risk Margin
- Impact of taking hedgeable risks includes:
  - Cost of the additional capital arising from taking those risks
  - Impact of projected returns above risk-free, arising from an assumed real-world projection[2]
  - Impact on the value of liabilities, e.g., via impact on Time Value of Financial Options and Guarantees (TVFOG)

[1] This will exclude the impact of cash flows at the start of the contract. Future premiums and associated other cash flows will be included within the BEL cash flows to the extent that they are within the Solvency II contract boundary.

[2] This may include the impact of reducing the Cost of Capital to the extent that capital is covered by assets assumed to earn above risk-free, which may partially offset the cost of the additional capital which arises due to investments in such assets.

Under certain conditions it can be shown that:

**$S_2NBV = OF_{NB}$**

These specific conditions are:

- No taxation
- No hedgeable risks are taken,[3] and hence the projected SCR is assumed to be the same as that backing the Risk Margin calculation[4]
- The company can maintain a solvency ratio (Own Funds / SCR) of exactly 100%
- The shareholders' required rate of return above risk-free is equal to 6% (the Cost of Capital used in the Risk Margin calculation)
- Assets backing Own Funds and the Risk Margin earn risk-free rates
- The eligibility rules reflect the economic value of the relevant Own Fund items

A justification for this is set out in Appendix 1.

We can then build on this basic value by moving away from these conditions. We will illustrate this in the examples below, and the sections following.

We note that, at this stage, we are referring to $S_2NBV$ valued at the time a contract, or group of contracts are written. See Section 4 below for considerations around building up a value for new business assumed to be written over a number of future years.

A further point is that Solvency II contract boundaries may not correspond to management's view of the value added by writing a particular type of contract. This could include, for example, yearly renewable risk contracts or unit-linked contracts without guarantees or risk benefits, where future premiums which might reasonably be expected to be received, but the liabilities arising from them do not fall within the contract boundary. This is also discussed further in Section 4.

### 2.4 INITIAL EXAMPLE

To illustrate the methodology we initially consider a simplified example of new business on a stand-alone basis as follows:

- Life savings policy
- Single premium of 10,000
- 20-year term
- Profit sharing based on book value returns, with a guaranteed minimum rate of 1.0%, minimum margin of 1.0% and 100% profit sharing for returns above the minimum guarantee plus margin
- Accumulated profit sharing, including guaranteed minimum rate, payable on surrender or maturity
- Flat risk-free rate of 1.5%

The full set of assumptions is shown in Appendix 2.

For simplicity we ignore the impact of TVFOG in our example at this stage. (See Section 3.2 below for consideration of this issue.)

[3] The assumption that no hedgeable risks are taken is interpreted as implying that assets and liabilities will remain matched at future points in time, i.e., that asset cash flows will replicate liability cash flows at all future points in time in all scenarios.

[4] Note that this might not be precisely true in specific cases.

Under the conditions of required capital = 100% of SCR, shareholders' required rate of return above risk-free = 6%, no tax and no non-hedgeable (assumed to be market) risks taken, we arrive at $S2NBV = OF_{NB}$*, in this case 1.24%* (expressed as a percentage of single premium).

If we now move away from these conditions and set:

- A tax rate on profits of 20%
- Required capital of 120% of SCR
- Shareholders' required rate of return: risk-free rate plus 5%

We now have S2NBV =

- $OF_{NB}$
- *Less* Cost of Capital from holding the required capital (120% * SCR) and Risk Margin, in excess of $RM_{NB}$ * (1 – tax)

See Appendix 1 for the justification of this.

Note that SCR is still only related to non-market risks.

We now further assume that proportions of the Technical Provisions (BEL + RM) are invested in risky assets, with the company's assumed expected real-world rate of return on these assets as shown in the table in Figure 1.

**FIGURE 1: PARAMETERS FOR RISKY ASSETS**

| ASSET TYPE | PROPORTION OF TECHNICAL PROVISIONS | UPLIFT IN RETURNS OVER RISK FREE P.A. |
|---|---|---|
| ASSET WITH SPREAD RISK (CREDIT STEP 2) [5] | 20% | 2.0% |
| EQUITIES | 10% | 3.0% |

The above mix therefore produces an uplift in returns on Technical Provisions of 0.7%.

This has the following impacts:

- Increased returns to shareholders because, in the above example:
  - With risk-free returns of 1.5%, shareholders achieve a margin of 0.5%, which is due to the guaranteed rate of 1.0% (guarantees are in-the-money because the guarantee means that the full financial margin of 1.0% cannot be achieved; guarantees move out-of-the-money when earned rates reach 2.0%).
  - With real-world returns of 1.5% + 0.7% = 2.2%, shareholders achieve the full margin of 1.0% (guarantees out-of-the-money).

  We will refer to this as 'impact of real-world uplift.'
- Cost of Capital arising from the market SCR introduced.
- A potential, partial mitigation of the Cost of Capital from market SCR through the loss-absorbing capacity of Technical Provisions (LACTP). This arises because the asset stresses assumed in calculating the market SCR result in lower book value investment returns, hence potentially lower policyholder profit sharing (depending on the level of guarantees) and therefore lower liabilities.[6] This mitigation will be included in the Cost of Capital in the presentations of results.

[5] These correspond to corporate bonds with an S&P rating of around A. This attracts a particular capital charge under the Solvency II SCR spread risk sub-module. For determining this charge it is also assumed that assets with spread risk have a duration half of that of the outstanding duration of the policy at each point.

[6] For this purpose the impact of losses arising from asset stresses are assumed to be spread over four years in order to translate them into an impact on book value returns.

The build-up of S2NBV is therefore shown in the table in Figure 2.

**FIGURE 2: BUILD-UP OF S2NBV**

| COMPONENT | CONTRIBUTION TO S2NBV AS % OF SINGLE PREMIUM |
|---|---|
| $OF_{NB}$ | 1.00% |
| COC NON-MARKET RISKS IN EXCESS OF $RM_{NB}$ * (1-tax) | 0.00% |
| IMPACT OF TAKING MARKET RISKS | |
| COC | -2.12% |
| REAL-WORLD UPLIFT | 2.87% |
| | |
| **S2NBV** | **1.74%** |

$OF_{NB}$ has now reduced to 1.00%, compared with 1.24% in the initial example above, which is due to the introduction of tax.

It is noted that, in this simple example the assumed uplift from investing in risky assets exceeds the Cost of Capital associated with taking these market risks. In this case and based on these assumptions, therefore, it may be concluded that taking such a management decision would add positive value. However, in a real life situation there are likely to be other considerations around such a decision (e.g., considerations around risk appetite).

### 2.5 MEASURING NEW BUSINESS PROFITABILITY

The key measure we will consider we will term *'S2NBV margin,'* defined as:

S2NBV / PVNBP

PVNBP = present value of new business premiums, discounted at the shareholders' required rate of return, and consistent with Solvency II contract boundaries.

Whilst various measures could be used in assessing profitability, we feel that this captures the various aspects set out in Section 2.1 above, and also gives a measure which can be readily applied to volumes in order to produce the value added by new business.

However, as we will discuss later, the S2NBV margin can vary with the volumes of new business written, and so care must be taken.

# 3. Product design and risk management

### 3.1 FACTORS INFLUENCING VALUE

As noted in Section 2 above Solvency II attempts to reflect actual risks taken in the calculation of capital requirements. Therefore Solvency II rewards risk-mitigating product design and good risk management. We note that, whilst the Pillar I Standard Formula calculations may not capture all risks, companies are required to consider all material risks in the assessment of overall solvency needs as part of their Own Risk and Solvency Assessment (ORSA).

However, market-consistent approaches to assessing new business profitability, even where capital requirements are aligned to Solvency II, do not allow appropriately for the cost of taking market risks, shareholders' required returns on capital or the potential upside benefit from taking management decisions such as investing in risky assets.

We believe our method allows for these aspects in a robust and transparent way. Thus, actions which seek to mitigate risk through product design or other risk management actions such as good ALM will be reflected in a higher $S_2$NBV margin, as resulting lower capital requirements are reflected appropriately through lower Cost of Capital. Further, the impact of actions which may produce a potential upside for shareholders but with higher risk (such as investing in risky assets) can be assessed.

Hence, under the $S_2$NBV methodology described there are various factors which can influence value, including:

- Product pricing and design, including the nature of policyholder options and guarantees
- Management actions
- Policyholder behaviour
- The existing Solvency II balance sheet, including the size and composition of the SCR, and tax position
- Assumed volumes and mix of new business to be written (for instance, this will impact the level of diversification benefit)
- Economic conditions prevailing

In the examples below we explore the potential impact of these factors.

### 3.2 LIFE PARTICIPATING PRODUCT EXAMPLE: STAND-ALONE BASIS

We expand on the example above, changing the guaranteed rate to be 0.5% to be more realistic, given the low level of risk-free rates assumed, and consider variations on the product design described in the previous section.

In the case of a participating product such as this, we would normally expect stochastic simulations to be considered in the consideration of BEL and SCR under Solvency II. We can consider the impact of stochastic variations to create a TVFOG component of the BEL (as distinct from the calculation of BEL carried out on a deterministic basis, i.e., without consideration of stochastic variations).

For illustrative purpose we consider the TVFOG only in respect of stochastic variations in returns on equities, and ignore stochastic variations in respect of interest rates or other economic factors such as credit spreads. Also, for simplicity, we will calculate SCR components on a deterministic basis only.

In respect of the TVFOG calculation:

- We assume 20% per annum (p.a.) turnover of unrealised gains/losses on equities (with all outstanding gains/losses realised at the end of the policy projection). Given that we are assuming that policyholder profit sharing is based on book value returns such turnover allows these gains/losses to pass through the profit-sharing formula. This can be considered a management action (investment management) assumption.
- The stochastic scenarios are described in Appendix 3.
- A policyholder behaviour (dynamic lapse) rule based on the level of unrealised gains is included. This reflects the value of the option to the policyholder to surrender based on book value returns at a time when market values on underlying assets have fallen. See Appendix 2 for details.

We can view TVFOG as the average present value of the impact of 'stochastic variations' in each future year on the value of liabilities. As we project forward from end of year t - 1 to end of year t we assume that the TVFOG unwinds, releasing the impact of such 'stochastic variations' corresponding to year t. We assume that such releases have negative impact on projected cash flows in each future year. Whilst, as we travel forward along a real-world deterministic path, such variations would not emerge, it does not seem appropriate just to assume that the TVFOG element of the Technical Provisions is effectively released into distributable profits going forward, as this would understate the cost of options and guarantees.

The table in Figure 3 shows the S2NBV margin, broken down into components, of our 'base case' going forward (noting that PVNBP = single premium).

FIGURE 3: BUILD-UP OF S2NBV FOR LIFE PARTICIPATING 'BASE CASE'

| COMPONENT | CONTRIBUTION TO S2NBV MARGIN |
|---|---|
| $OF_{NB}$ | 4.56% |
| COC NON-MARKET RISKS IN EXCESS OF $RM_{NB}$ * (1-tax) | -0.02% |
| IMPACT OF TAKING MARKET RISKS | |
| COC | -1.80% |
| REAL-WORLD UPLIFT | 0.00% |
| IMPACT OF TVFOG | -2.18% |
| IMPACT OF DYNAMIC LAPSES | -0.63% |
| | |
| **S2NBV MARGIN** | **-0.07%** |

It can be seen that the impact of investing in 'risky assets' is effectively the sum of the last four items, and is therefore negative. In particular the product structure and the assumed level of risk-free rates means that the assumed real-world uplift from risky assets passes straight to the policyholders and therefore has no positive impact.

However, there are other reasons to invest in risky assets, in particular to achieve competitive returns for policyholders, and hence drive new business volumes.

We now consider possible different product designs, with the intention of seeking to improve the S2NBV margin, in particular by looking for ways to mitigate the COC market risks, impact of TVFOG, and impact of dynamic lapses.

Ten different pricing variations were considered; full details of results are given in Appendix 4, but we focus here on four separate variations from the base design, labelled A to D:

A 0% interest guarantee.

B Profit sharing based on 80% of investment returns, subject to minimum guarantee (rather than a fixed margin). In this case the policyholder return is expressed as: max (80% * investment return; minimum guarantee).

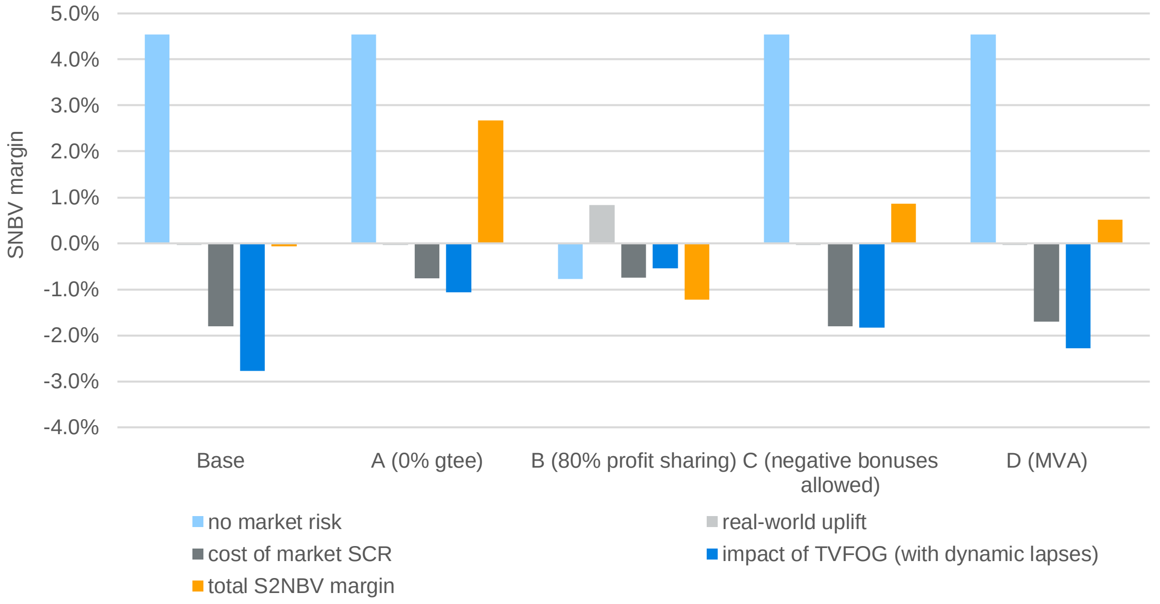
C Negative bonuses allowed in a given year (subject to the annual guaranteed interest rate being payable on maturity or surrender).

D Market value adjustment (MVA) of 50% of unrealised losses on surrender (i.e., this reduces the surrender value paid when there are unrealised losses on underlying assets).

The graph in Figure 4 shows the impact of the different product designs, compared with the base, noting that:

- 'Without market risk' refers to the value $OF_{NB} + RM_{NB}$ * (1 - tax) - COC non-market risks (including COC related to holding the Risk Margin)
- Impact of TVFOG includes the impact of dynamic lapses
- These are absolute values of S2NBV margin, not differences from the base case

FIGURE 4: S2NBV MARGIN FOR DIFFERENT PRODUCT DESIGNS

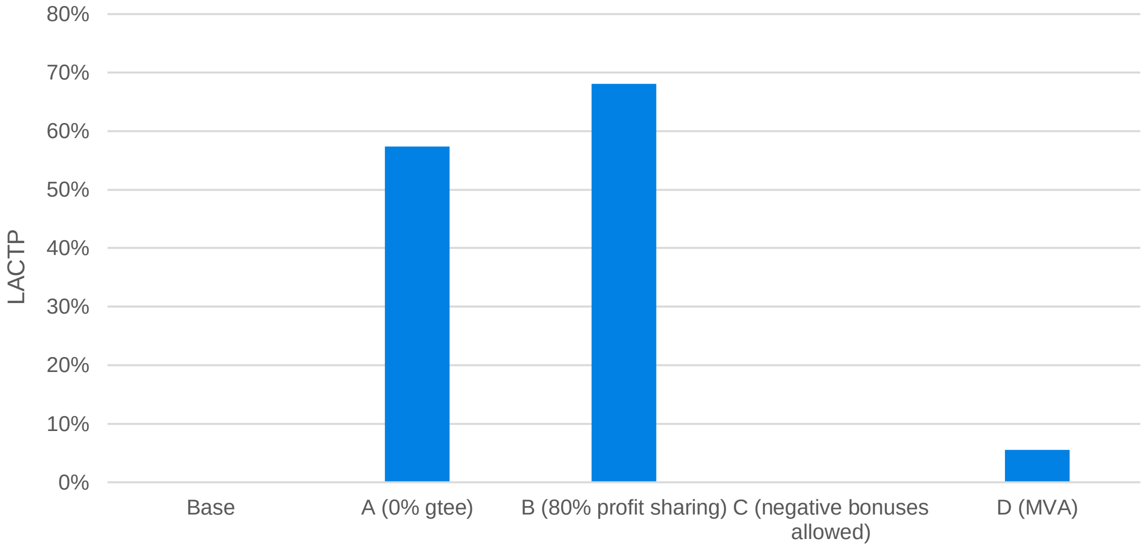



Commenting on these results:

- In each case the value with no market risk is the same, except for design B, where the effective financial margin for the company is reduced from 1% to 20% * 1.5% = 0.3% (there is also a small reduction in the cost of SCR for non-market risks, which is due to a lower SCR for lapses). This is because guarantees are out-of-the-money on the deterministic basis in all cases.
- Only design B provides a benefit in respect of uplift from investing in risky assets because, effectively, shareholders can take 20% of this uplift, whereas for the other designs with fixed margins of 1%, all the additional return goes to policyholders.
- Designs A and B result in significant reductions in the cost of market SCR. This is because these designs allow reductions in investment returns arising from market SCR stresses to be partially passed to policyholders (resulting in material LACTP, as described in the initial example in Section 2.4 above). Design D results in a small reduction in cost of market SCR (small LACTP) as part of the losses can be absorbed on early surrender via the MVA mechanism; this is limited to surrenders in the period for which asset stresses are assumed to be spread (four years). There is no impact for design C, because allowing negative bonuses does not help under the SCR stresses.

The graph in Figure 5 shows the LACTP percentage in respect of market SCR (i.e., the percentage reduction of market SCR due to loss-absorbing capacity) for the different designs.

**FIGURE 5: LACTP (% OF MARKET SCR) FOR DIFFERENT PRODUCT DESIGNS**




- All alternative designs result in some reduction in TVFOG. The most pronounced effects are for designs A and B, with B having the largest reduction. With design A guarantees only come into the money for earned rates less than 1% (below which the 1% margin for shareholders becomes squeezed), whereas for design B guarantees only come into the money for earned rates less than the guaranteed rate of 0.5% (above 0.5%, the effective margin of 20% of investment returns can still be taken by the company). This compares with the base case where guarantees come into the money at earned rates less than 1.5%.
- For design C, whilst negative bonuses are allowed in a given year, there is still the underlying 0.5% p.a. guaranteed rate, thus the reduction of TVFOG arising from this design is limited. Similarly design D only provides protection in the case of surrenders in scenarios where there are unrealised losses.

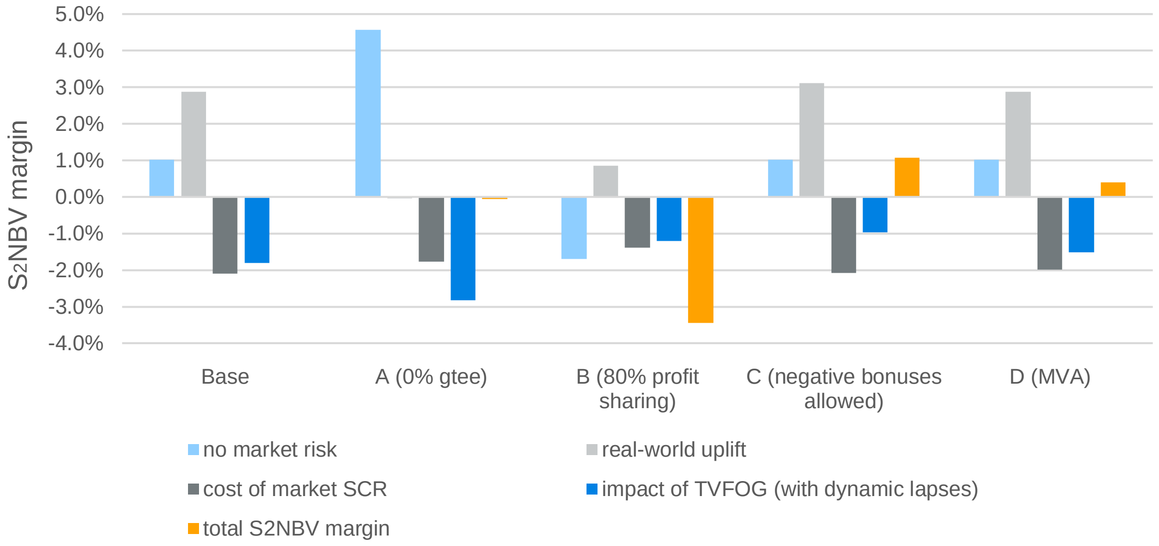
Overall, design A (reducing the interest guarantee to 0%) produces the highest $S_2$NBV margin in this scenario, with design B (80% profit sharing instead of a fixed margin of 1.0%) producing a lower $S_2$NBV margin than the base case.

We note that this doesn't necessarily mean that design A is the 'best' design, nor are we commenting here on the relative merits of, for example, a fixed margin versus profit sharing based on a percentage of investment returns. Rather we are illustrating how the profitability of such features can vary, and how it can be measured.

Different examples of the above types of features under different conditions could produce quite different relative profitabilities. Also, the commercial attractiveness of different designs will depend on the perceived value to the customer of the structures. We do not comment on this further here.

By way of a sensitivity, the graph in Figure 6 shows the S2NBV margin for different product designs with a 1%, rather than a 1.5%, risk-free rate.

FIGURE 6: S2NBV MARGIN FOR DIFFERENT PRODUCT DESIGNS (1% RISK-FREE RATE)




The picture here looks quite different from that with a 1.5% risk-free rate. In particular:

- On the deterministic basis (1% investment returns) the guarantees are now in-the-money on all but designs A and B. Design A (0% guarantee) thus shows a much higher value without market risk than the other designs, as a 1% margin can be taken by the company, compared with only a 0.5% margin for the base design and designs C and D (where the guarantee is 0.5%).
- All designs now benefit from the uplift from investing in risky assets, except A where guarantees are not in-the-money assuming risk-free returns. The uplift creates an earned rate of 1.0% + 0.7% = 1.7%, meaning that the full margin of 1% can be taken by the company for all designs, except B where shareholders can only take 20% of the uplift.
- With guarantees being further into, or nearer to, the money with a 1% earned rate the potential for reducing market SCR under different designs is more limited.
- TVFOG is now highest for design A rather than the base because, on the deterministic basis, guarantees are right at the money (the full margin of 1% can be taken, but this will be squeezed if returns are reduced at all). Thus there is the greatest ‘asymmetry’ between scenarios providing upside (all the upside goes to policyholders) and scenarios providing downside (all the downside goes to shareholders). (This compares with the 1.5% earned rate where guarantees were at the money on the base design, which therefore exhibited a higher TVFOG than design A.) As with the 1.5% earned rate, designs B to D provide some reduction in TVFOG.

### 3.3 LIFE PARTICIPATING EXAMPLE: MARGINAL BASIS FOR CAPITAL

Thus far we have considered our example on a stand-alone basis.

In reality (apart from the case of a completely new entity), new business will interact with the existing business and balance sheet. One particular area is around diversification benefits in respect of capital requirements.

We consider three cases for writing new business (assuming base product design, and risk-free rate 1.5%) together with existing in-force business:

- 'Similar in-force life book': A portfolio of life business having an SCR of similar size to that of the assumed volume of new business written, with a similar mix of SCR sub-module risks.
- 'Small, dissimilar in-force book': A portfolio of life business having an SCR of similar size to that of the assumed volume of new business written, with only interest rate, mortality and operational SCR risks (thus completely different risks from the new business).
- 'Large, dissimilar in-force book': A portfolio of life business with the same profile as the small, dissimilar, in-force book, but 10 times the size.

The table in Figure 7 shows the $S_2$NBV margin and NPV (SCR) / NPV (TP),[7] a measure of the additional SCR requirement arising from adding the new business.

**FIGURE 7: MOVING TO MARGINAL BASIS IN RESPECT OF CAPITAL REQUIREMENTS**

| | $S_2$NBV MARGIN | NPV(SCR) / NPV(TP) |
|---|---|---|
| STAND-ALONE | -0.1% | 5.0% |
| MARGINAL – SIMILAR IN-FORCE LIFE BOOK | -0.1% | 4.9% |
| MARGINAL – SMALL, DISSIMILAR IN-FORCE LIFE BOOK | 0.6% | 3.6% |
| MARGINAL – LARGE, DISSIMILAR IN-FORCE LIFE BOOK | 1.0% | 2.7% |

As can be seen, the existing balance sheet, and the relative volumes and mix of new to in-force business can make a significant impact on the capital requirements and hence $S_2$NBV margin.

If the profile of the existing in-force book is similar to the new business, there is little or no reduction in the marginal capital requirement compared with the stand-alone basis. The benefit comes in particular where the in-force book is different in terms of risks, and even more so where the in-force book is large in comparison with the volume of new business written.

These lower marginal capital requirements result from the diversification benefit achieved via the correlation matrices used in the Solvency II Standard Formula SCR calculations. The graphs in Figures 8, 9, and 10 illustrate this by showing the diversification benefit between the sub-modules of $SCR_{market}$ and $SCR_{life}$, respectively, and between the modules of the Basic SCR (BSCR).

[7] This is the net present value of the SCR at the start of each year / net present value of the Technical Provisions at the start of each year, discounted at the shareholders' required rate of return.

**FIGURE 8: COMPONENTS OF SCR MARKET (INCLUDING DIVERSIFICATION BENEFIT BETWEEN SUB-MODULES OF SCR MARKET)**

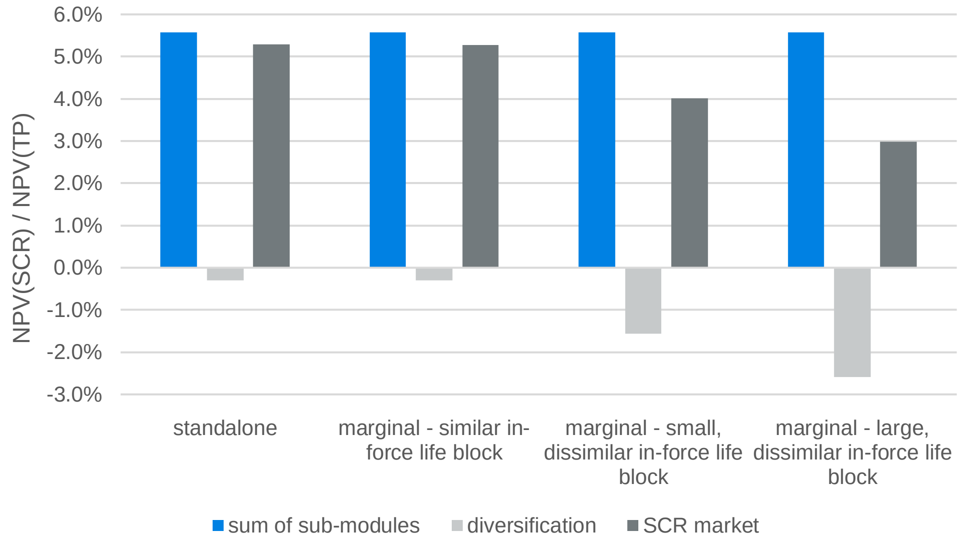



**FIGURE 9: COMPONENTS OF SCR LIFE (INCLUDING DIVERSIFICATION BENEFIT BETWEEN SUB-MODULES OF SCR LIFE)**

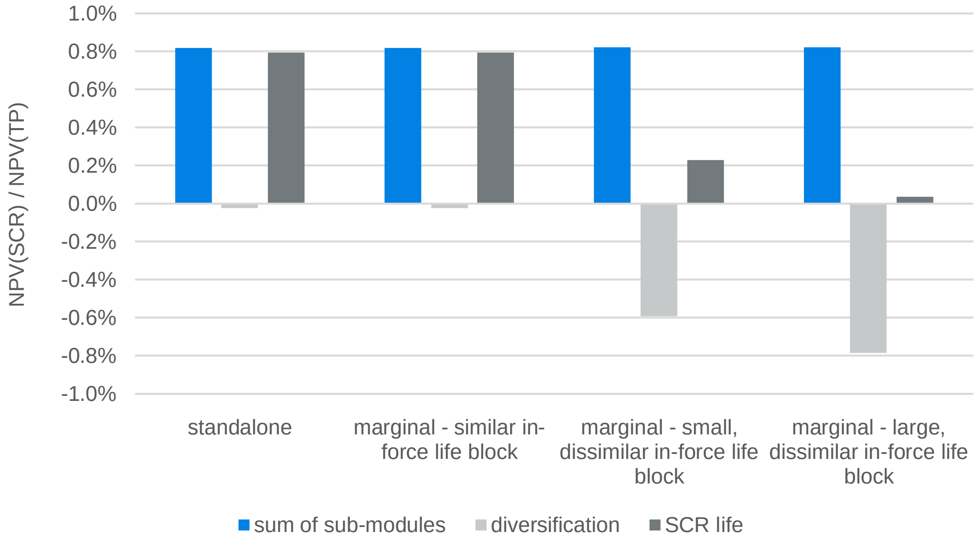
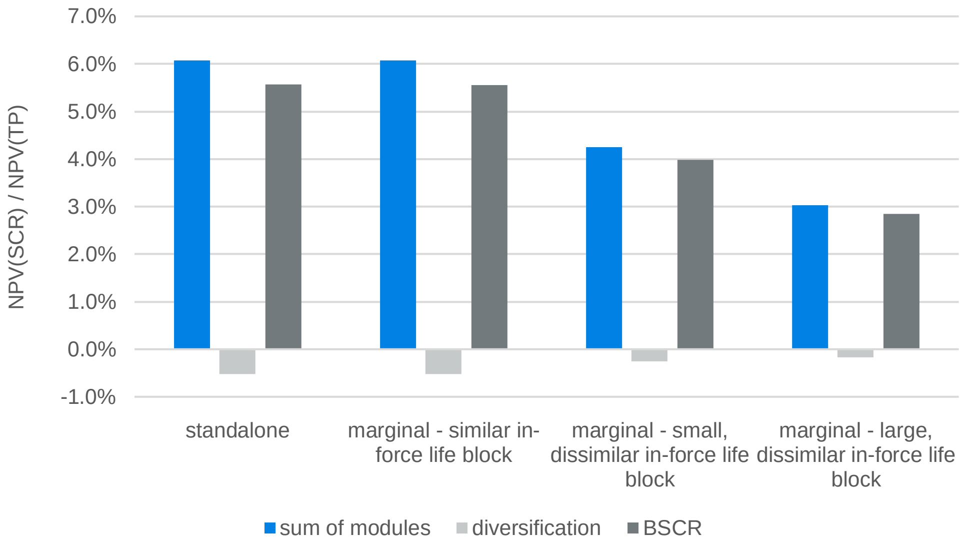


FIGURE 10: COMPONENTS OF BSCR (INCLUDING DIVERSIFICATION BENEFIT BETWEEN MODULES)




In Figure 10 the 'sum of modules' bars incorporate the diversification benefit within modules, shown in Figures 8 and 9, and thus differ between the cases. The diversification benefit shown is thus that between the modules $SCR_{market}$ and $SCR_{life}$.

These reductions in capital requirements result in a reduced Cost of Capital, and hence increased $S_2$NBV margins.

Thus, all other things being equal, benefit can be gained by writing business with risks which are different from those on the existing balance sheet.

This also raises an interesting point in that consideration needs to be given to the volumes of new business to be written when considering product pricing for a new product, for example. It may be reasonable to consider planned new business volumes over one year for that product for this purpose.

### 3.4 LIFE PARTICIPATING EXAMPLE: MARGINAL BASIS, FURTHER ASPECTS

A further aspect to this in respect of life participating business with profit sharing based on book value returns arises from writing new business into a pooled fund with in-force business.

This can have a significant impact on the ALM position of the fund as new premium inflow and liability outflow combine with the existing situation; for instance premium cash flows coming in could reduce the need to sell assets in order to meet liability outgo.

Another aspect is around the sharing of investment returns between in-force and new business for the purpose of determining policyholder profit sharing. As noted previously this type of arrangement is common in respect of participating life business in many European countries, where the assets and liabilities related to different generations of business share are managed together and share in surpluses via policyholder profit sharing.

This is illustrated by the following, simplified example.

- We have an in-force block with reserves of 500 million, running off linearly over five years.
- We write new business with initial reserves (= single premium) of 100 million running off linearly over 10 years.
- Profit sharing is paid on the basis of: max (guaranteed rate; earned rate - 1%), so that guarantees come into the money when earned rate = guaranteed rate + 1% (because any reductions in earned rate then cause the 1% margin to shareholders to be reduced).
- New business is assumed to have a guarantee of 0%. The in-force policies are all assumed to have the same guaranteed rate (a range of rates will be considered).
- Projected (book) investment yields related to the in-force are assumed to be flat for all future years (a range of values will be considered). New money yields (risk-free rates) are assumed to be earned on new business. The resulting yield from combining in-force and new business in each future year is assumed to be a weighted average of the two.

- Second order effects (e.g., impact on projected reserves or unit costs) are ignored.

Assuming that book investment yields on in-force are higher than new money yields (i.e., market interest rates have fallen, resulting in unrealised gains), there are two potential effects from the resulting 'blended' yield:

- Lower profit sharing payable on in-force business (depending on guarantees), resulting in a positive impact on shareholder profits
- Higher profit sharing payable on new business (depending on guarantees), resulting in a negative impact on shareholder profits

For this purpose we are just considering 'shareholder profits' on a profit and loss basis. We assume there is a fixed quantum of investment income (which on its own contributes to profits by a fixed amount), and, hence, profit sharing subsequently serves to decrease profits. If applying blended yields produces lower profit sharing overall (in-force plus new business) then, overall, profits are increased, and, conversely, if blended yields produce higher profit sharing overall then profits are decreased. In this way, in our analysis below, we can just consider the amount of profit sharing.

Considering the impact on *net present value of projected gross of tax shareholder profits* (discounted at the risk-free rate), *expressed as a percentage of new business single premium written*, we get the following, for different combinations of:

- Book investment yields on in-force (IF yield)
- Guaranteed rates on in-force (IF gtee)
- New money (market) yields related to new business

FIGURE 11: IMPACT OF INTERACTIONS BETWEEN IN-FORCE AND NEW BUSINESS PARTICIPATING, 0% NEW MONEY YIELD

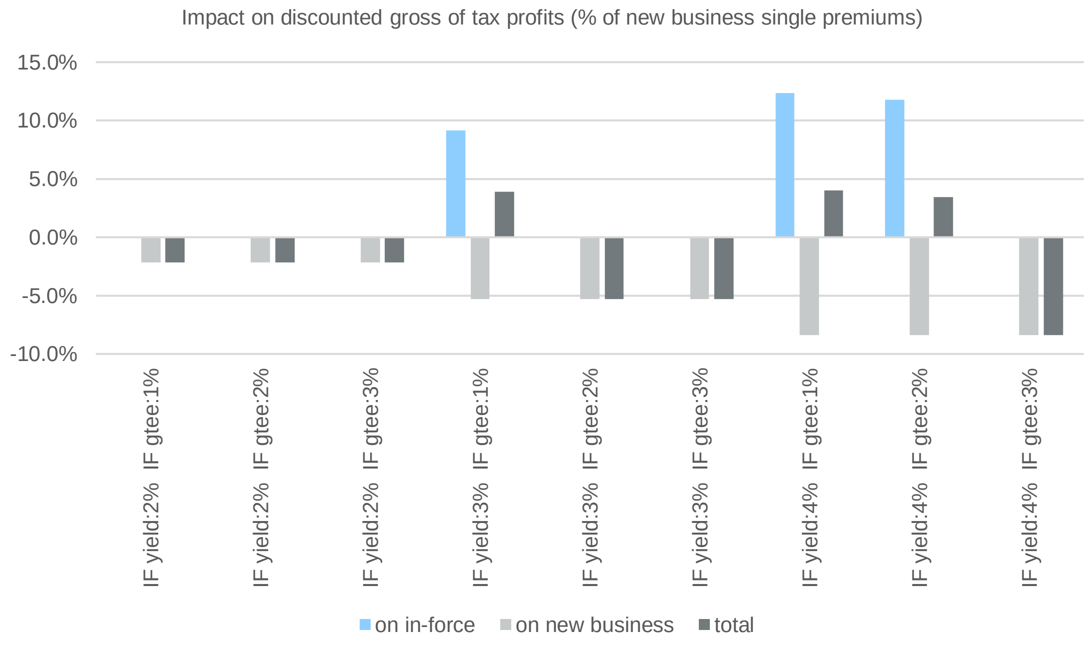
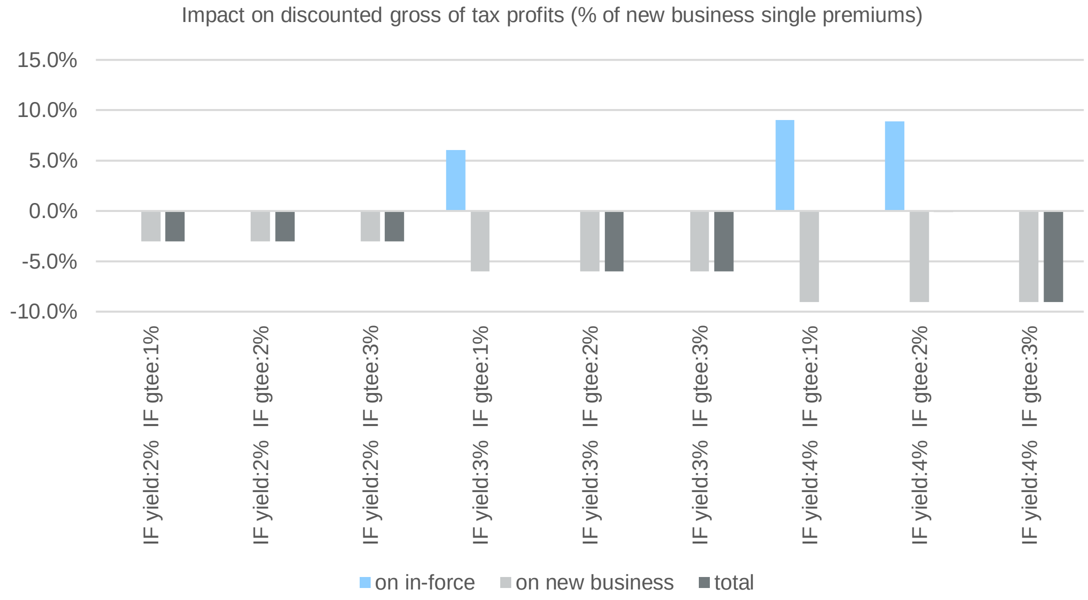


FIGURE 12: IMPACT OF INTERACTIONS BETWEEN IN-FORCE AND NEW BUSINESS PARTICIPATING, 1% NEW MONEY YIELD




The basic pattern in this example is that the total impact on profits from this effect becomes less positive or more negative as the book yields on in-force decrease, as the guarantees on in-force increase, and as the new money yields increase.

The reason for this pattern is as follows:

- With a new money yield of 1% guarantees on new business are at the money (guaranteed rate + margin = 1%), so any uplift in yields is passed through to the policyholders with a resulting negative impact on profits (ignoring the impact of investment income itself, as discussed above).

  The corresponding reduction on in-force profit sharing (which would result in an increase in profits) is either equal and opposite to the impact on new business (resulting from reduced profit sharing if guarantees are out-of-the-money) or zero (if guarantees are at or in-the-money), giving a zero impact or a negative impact on profits from new business and in-force combined, respectively. The extent to which guarantees on in-force are in-the-money will increase as guarantees increase, or as the in-force fund yield decreases.

- With a new money yield of 0% guarantees on new business are well in-the-money, so only some of the uplift in yields is now passed through to policyholders as increased profit sharing, resulting in a lower negative impact on profits than for a 1% new money yield.

  The pattern for in-force (either a positive impact on profits, or a zero impact) is the same as for a 1% new money yield, but more pronounced, as the 0% new money yield drags the yields down further.

  Overall, we therefore see a less negative or more positive impact for a 0% new money yield than a 1% one.

We note that, of course, with a 0% new money yield the stand-alone new business margin will be (probably significantly) lower than with a 1% new money yield. The marginal impacts considered above would be added to the stand-alone new business margin.

Of course in practice the situation is likely to be more complex than this, with, for instance, the in-force being made up of business with different guaranteed rates, and we are also ignoring other ALM issues in this example.

However, this illustrates how significant this effect can be, and should be considered in decisions about the destination for new business (e.g., write in an existing pooled fund, or start a new fund, which is an option in some European countries). Of course, it may not be possible to write significant volumes of new business without the 'uplift' in yields derived from an in-force block; on the other hand this historic uplift will not last indefinitely.

There may be other marginal impacts, such as those related to the usage of tax losses, but we do not consider them further here.

### 3.5 NON-LIFE PRODUCT EXAMPLE

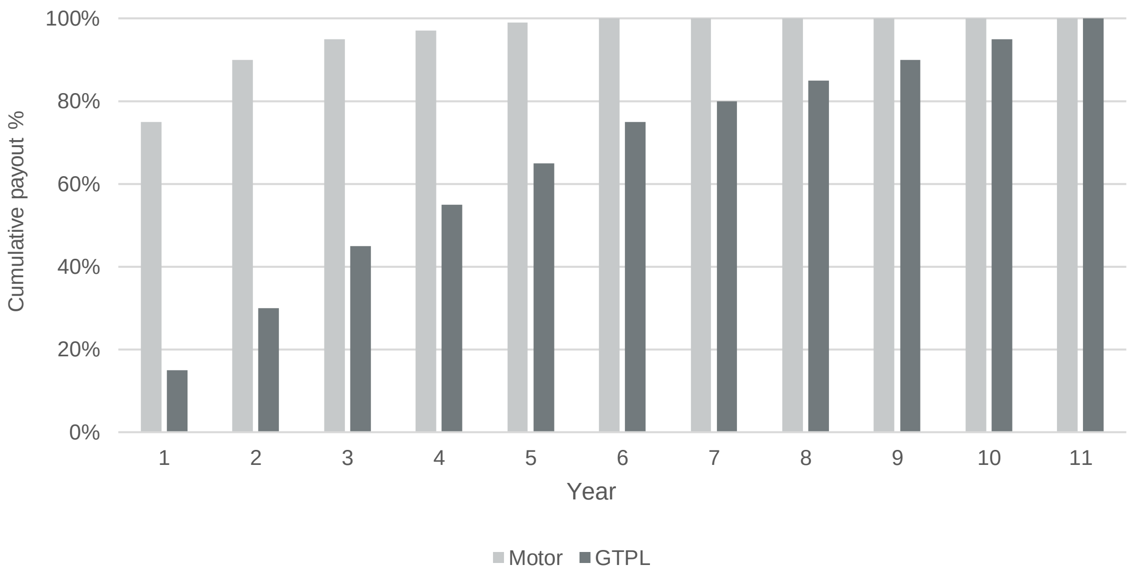
As we have noted, this methodology is equally applicable to non-life and health business.

We consider an example here of non-life, with the possibility of writing:

- Motor Other. i.e., excluding motor third-party liability (MTPL)
- General Third-Party Liability (GTPL)

They have different assumed lengths of payout period, reflecting the nature of these liabilities, with GTPL having a much longer tail, as illustrated in the graph in Figure 13.

FIGURE 13: CUMULATIVE PAYOUT PATTERN BY LOB




Other key assumptions:

- Ultimate loss ratio (ULR): 65%.
- Expense ratio: 25% of gross written premium (GWP), payable at the start.
- Stand-alone basis (no diversification benefit with life business, for example, considered).
- Risk-free rate of 1.5%.
- A tax rate on profits of 20%.
- Required capital of 150% of SCR.
- Shareholders' required rate of return: risk-free rate + 8%.
- SCR for Operational Risk = 10% of Premium and Reserve risk; no other non-market risk SCR, apart from Premium and Reserve risk.
- Initially we assume that no market risk is taken.
- No reinsurance is assumed.

S2NBV is defined in the same way for life business, i.e., the present value of expected future distributable profits on a Solvency II basis, discounted at the shareholders' required rate of return, with distributable profits defined in terms of projected Own Funds and required capital.

The table in Figure 14 shows results for the two different classes, and an equal mix of both, with S2NBV margin defined as S2NBV / GWP, together with a breakdown into components, similar to that for life business above (with Cost of Capital including that related to holding the Risk Margin). However, for the purpose of clarity of understanding the results we show $OF_{NB}$ before the impact of $RM_{NB}$ * (1 - tax), with the impact of $RM_{NB}$ * (1 - tax) shown separately.

**FIGURE 14: S2NBV MARGIN BY LOB**

| | $OF_{NB}$ (BEFORE IMPACT OF $RM_{NB}$*(1-TAX)) | $-RM_{NB}$ * (1-TAX) | COC NON-MARKET RISKS IN EXCESS OF $RM_{NB}$*(1-TAX) | $S_2$NBV MARGIN |
|---|---|---|---|---|
| MOTOR | 9.1% | -2.1% | -2.1% | 4.9% |
| GTPL | 11.4% | -6.1% | -5.3% | 0.0% |
| MIX | 10.3% | -3.6% | -3.1% | 3.5% |

We note the diversification benefit of writing two classes together, which reduces the Cost of Capital, from 7.8% to 6.7%, thus producing an overall $S_2$NBV margin of 3.5% compared with 2.5% achieved for the two lines of business (LOBs) taken separately.

Whilst the combined ratio is the same in all cases (90%), there are significant differences in the $S_2$NBV margin.

We can break these differences down into three components:

1. Difference in Cost of Capital (including that related to a different Risk Margin) arising from different standard deviation (σ) factors underlying the non-life premium and reserve risk component of the SCR.
2. Difference in Cost of Capital arising from different times of settlement of claims, i.e., for the longer-tail class it is necessary to hold capital in respect of reserving risk, and in respect of the Risk Margin, for much longer—something which did not happen under Solvency I where capital requirements did not depend on reserves.
3. Impact of different times of settlement of claims on the initial BEL * (1 - tax), and hence on $OF_{NB}$ before impact of the initial Risk Margin. This arises due to the time value of money; total claims based on ULR do not take into account discounting, whereas the calculation of BEL does discount future claims. Therefore, in respect of this point and all other things being equal, a class with longer-tailed claims will have a lower initial BEL (although it may well have a higher Risk Margin, which will be reflected in a higher Cost of Capital, as noted in the previous bullet point).

The table in Figure 15 shows these components for GTPL compared with Motor.

**FIGURE 15: ANALYSIS OF DIFFERENCE IN S2NBV MARGIN BETWEEN MOTOR AND GTPL**

| | $OF_{NB}$ (BEFORE IMPACT OF $RM_{NB}$*(1-TAX)) | $-RM_{NB}$ * (1-TAX) | COC NON-MARKET RISKS IN EXCESS OF $RM_{NB}$*(1-TAX) | $S_2$NBV MARGIN |
|---|---|---|---|---|
| IMPACT ON COST OF CAPITAL OF σ FACTORS | 0.0% | -1.7% | -1.5% | -3.1% |
| IMPACT ON COST OF CAPITAL OF SETTLEMENT SPEED | 0.0% | -2.3% | -1.7% | -4.0% |
| IMPACT ON INITIAL BEL*(1-TAX) OF SETTLEMENT SPEED | 2.3% | 0.0% | 0.0% | 2.3% |
| TOTAL DIFFERENCE | 2.3% | -4.0% | -3.2% | -4.9% |

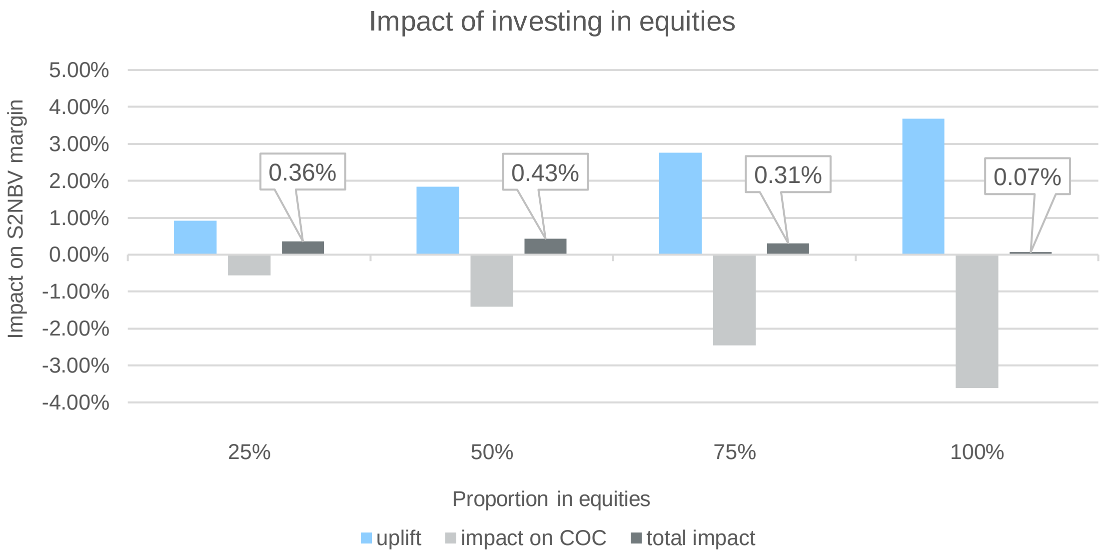
This shows that pricing which considers only a target combined ratio is not appropriate to capture new business profitability in a Solvency II world.

We note that the positive impact of the different settlement speed on initial BEL * (1 - tax) would become higher relative to the negative impact of the other two points for a higher risk-free rate (all other things being equal).

A further potential element here is to decide whether to take market risk, in the hope of getting extra investment returns, but balanced against the cost of holding additional capital for this risk.

If we assume that a proportion of Technical Provisions are invested in equities, and that they achieve an uplift in investment returns of 3% p.a., then the graph in Figure 16 shows the impact of this on the $S_2$NBV margin (assuming the mix of the two LOBs is written), broken down into these two components, followed by the total impact shown as a line graph.

**FIGURE 16: IMPACT ON S2NBV MARGIN OF INVESTING IN EQUITIES**



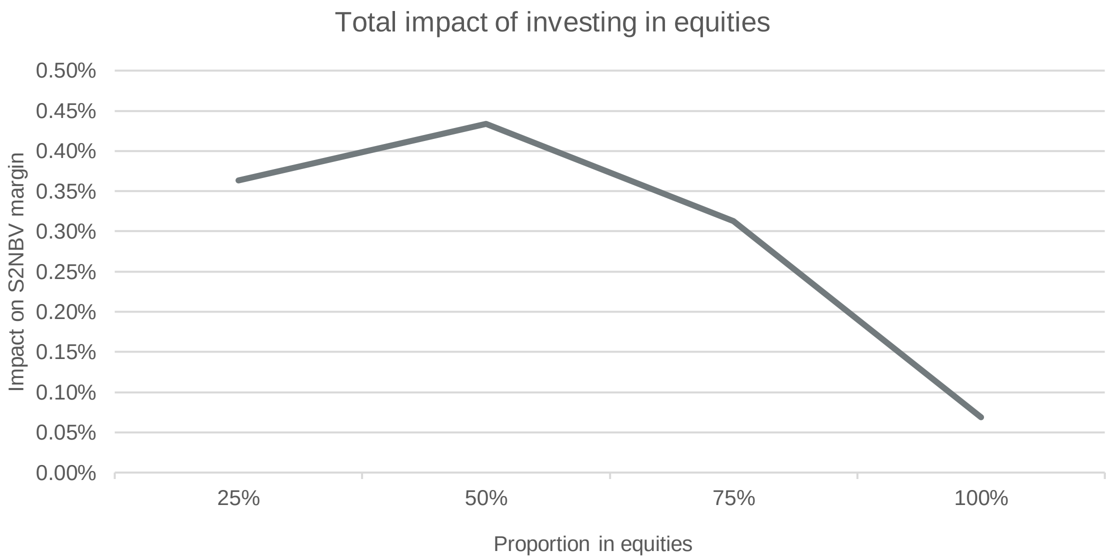




Figure 16 shows that there is an optimal proportion to invest in equities (around 50%) in order to achieve the highest uplift in $S_2$NBV margin. This is because the uplift increases pro rata with the proportion of equities, whereas the impact on Cost of Capital increases more than proportionately, which is due to the decreasing impact of diversification benefit with other risks as the market risk increases.

Of course, this impact depends on various factors, and investment in equities may be constrained by the company's risk appetite framework, etc., but we can see how the $S_2$NBV provides a methodology for assessing such management decisions.

# 4. Other considerations

It is possible to use the techniques set out above in order to measure new business value ($S_2$NBV) overall, and then to build the value up into a total franchise value as part of a Solvency II appraisal value calculation.

We have noted above that, when considering $S_2$NBV margin for product pricing purposes, it is necessary to make some assumptions about the volumes of new business to be written, particularly because of marginal effects, such as diversification benefits around capital requirements, which can make profitability volume-dependent. It may not, therefore, be appropriate simply to multiply $S_2$NBV margin by the assumed volumes to be written in order to arrive at $S_2$NBV.

Similarly, when considering $S_2$NBV for a particular period (e.g., one year) it is important that the whole of the new business (potentially including non-life as well) for the period under consideration is taken into account, rather than just considering business lines in isolation and summing the results.

When building up a franchise value (i.e., the total value of future new business in the context of an overall appraisal valuation of an insurance company) such effects will clearly also come into play, as the new business written changes the risk profile of the balance sheet going forward, in addition to effects such as moving along the yield curve. However, approximate methods could be used to allow for this, which would be reasonable given the various uncertainties surrounding future new business (e.g., volumes and margins); nonetheless such effects should not be overlooked. We note that projected $S_2$NBV in future years need to be discounted back to the valuation date. A higher discount rate than the risk discount rate (shareholders' required rate of return) assumed for the $S_2$NBV may be appropriate to reflect such uncertainties.

As mentioned in Section 2.3 above, Solvency II contract boundaries may not correspond to management's view of the value added by new business, for instance where future recurrent premiums are excluded under Solvency II. This may not present particular problems when building up franchise value, as long as future new business volumes are consistent with Solvency II contract boundaries. For example, future recurrent premiums excluded from the Solvency II contract boundary are considered as future new business for this purpose, with an adjustment to avoid acquisition costs being counted multiple times on the same contract, and an appropriate allowance for decrements from lapses, etc. (It wouldn't be appropriate just to assume a 'long' contract boundary, as this would result in Technical Provisions and SCR which would not correspond to those actually held under Solvency II.) This approach could be adopted when considering new business profitability for the purpose of product design and pricing for such a contract, by taking into account future recurrent premiums in this way. For this purpose it is probably appropriate not to use the higher discount rate for valuing $S_2$NBV arising from these future premiums.

# 5. Conclusions

We believe that the method set out in this paper provides a robust approach to measuring new business profitability under Solvency II, as set out in Section 2 above.

The numerical examples shown illustrate the high significance of Cost of Capital, including that for market risks, and how the impact on $S_2$NBV margins can be used as a metric for driving product design and other management decisions (such as investment decisions), based on a real-world view. Methods based purely on market consistency, such as Market Consistent Embedded Value (MCEV), would not reflect these points appropriately and, in particular, will generally give the best result when no market risks are taken, all other things being equal (because any real-world uplift from taking market risk will not be valued, whereas there will be a corresponding Cost of Capital, albeit in a limited way, through frictional Cost of Capital). Intuitively this does not seem right, and, in fact, most insurance companies will take some level of market risk. Pure market-consistent approaches do not provide any means of measuring what an appropriate level of market risk may be.

Furthermore, the method is applicable equally to life, non-life and health business. This allows a holistic view to be taken of the company's business, consistent with how Solvency II views things.

Traditional methods of pricing non-life products, based on combined ratios, miss the crucial impact of Cost of Capital arising from different LOBs and speeds of settlement, but this is captured using our method as illustrated in the examples.

Decomposing the value into different elements, as we have shown, can also be useful in seeing how different elements build up into the total value, ensuring the value of each element is reasonable, and in understanding the impact of different potential decisions.

We have also shown how material the impact of taking a marginal view of new business can be, both in respect of capital requirements and of other features. By capturing this, the company can make better decisions concerning the volumes and mix of new business it should target.

There is plenty of scope to improve values with good risk management and product design and this activity should be given much more attention by insurers than perhaps it is now. The method we have described provides a solid basis for assessing the impact of such potential management decisions, and could thus become a powerful tool in an insurer's decision-making process.

# Appendix 1: Justification that $S_2NBV = OF_{NB}$ under certain conditions

We assume the following conditions:

- No taxation
- No hedgeable risks are taken, and hence the projected SCR is assumed to be the same as that backing the Risk Margin calculation
- The company can maintain a solvency ratio (Own Funds / SCR) of exactly 100%
- The shareholders' required rate of return above risk-free is equal to 6% (the Cost of Capital used in the Risk Margin calculation)
- Assets backing Own Funds and the Risk Margin earn risk-free rates
- The eligibility rules reflect the economic value of the relevant Own Fund items

We note that:

- Initial distributable profit = $OF_{NB}$ less SCR at the start of the contract (time 0)
- Future distributable profits in each future year arise because of releases of SCR and Risk Margin (RM), and interest at the risk-free rate on these items, over the policy term

Thus NPV (distributable profits) @ discount rate d, with risk-free rate i and a policy term of n years:

$$= OF_{NB} - SCR(0) + \sum_{t=1}^{n} \frac{RM(t-1)*(1+i) - RM(t)}{(1+d)^t} + \sum_{t=1}^{n} \frac{SCR(t-1)*(1+i) - SCR(t)}{(1+d)^t} \qquad (1)$$

$$= OF_{NB} + RM_{NB} - COC_{RM}(0) - COC_{SCR}(0)$$

Where:

- SCR(t) is the SCR at time t years, thus SCR(0) is the SCR at the start of the contract
- RM(t) is the Risk Margin at time t years, with RM(0) the Risk Margin at the start of the contract, written as $RM_{NB}$
- $COC_{RM}(0)$ and $COC_{SCR}(0)$ are the cost of holding the Risk Margin and SCR, respectively, valued at the start of the contract

And, if the discount rate d = risk-free rate, i + 6% it can be shown that:

$$RM_{NB} = COC_{RM}(0) + COC_{SCR}(0)$$

And thus $NPV\ (distributable\ profits) = OF_{NB}$

If we introduce taxation at rate *tax* then the above expression (1) generalises to:

$$OF_{NB} - SCR(0) + (1 - tax) * \sum_{t=1}^{n} \frac{RM(t-1)*(1+i) - RM(t)}{(1+d)^t} + \sum_{t=1}^{n} \frac{SCR(t-1)*(1+i*(1-tax)) - SCR(t)}{(1+d)^t}$$

$$= OF_{NB} + RM_{NB} * (1-tax) - COC_{RM}(0) - COC_{SCR}(0)$$

With $COC_{RM}(0)$ and $COC_{SCR}(0)$ now allowing appropriately for tax.

Furthermore, if we now assume a target solvency ratio (TSR) greater than 100%, so that required capital = TSR * SCR this becomes:

$$OF_{NB} + RM_{NB} * (1-tax) - COC_{RM}(0) - TSR * COC_{SCR}(0)$$

For a full, algebraic derivation of these various results we refer the reader to our paper noted at the start of Section 2.2.

# Appendix 2: Assumptions for life participating example

The assumptions considered for the example in Section 2.4 above are as follows:

**Product structure and pricing**

- Life savings policy
- Single premium of 10,000
- 20-year term
- Profit sharing based on book value returns, with a guaranteed minimum rate of 1.0%, minimum margin of 1.0% and 100% profit sharing for returns above the minimum guarantee + margin
- Accumulated profit sharing, including guaranteed minimum rate, payable on surrender or maturity
- Initial load: 2.0% of premium
- Surrender penalties: 2.0%, 1.5%, 1.0%, 0.5% in years 1-4 respectively and 0% thereafter

**Commissions**

- Initial: 1.0% of premium
- Renewal: 0.3% p.a. of accrued maturity capital

**Other assumptions:**

- Flat risk-free rate of 1.5%
- Lapses: 7% p.a.
- Initial expenses: 1.0% of premium
- Renewal expenses: 0.1% p.a. of accrued maturity capital

**Dynamic lapse rule:**

Calculated as part of TVFOG calculation only; based on (Unrealised Gains/Losses less impact of MVA adjustment) / Book Value of assets (call this 'U').

The rationale for this rule is that, when market values of assets are below book values, which drive surrender values, the propensity to lapse the policy and take advantage of the resulting in-the-money guarantee may be higher (and vice versa when market values of assets are above book values).

The shape of the rule, which is piecewise linear, with a band within which no dynamic lapses are assumed to occur, and a ceiling and floor on resulting lapse rates, is typical of what we have seen across companies in Europe for traditional, participating products.

If U < -band then lapses' = lapses * (1 – (U + band) * up factor), subject to a maximum lapse rate

If U > band then lapses' = lapses * (1 - (U - band) * down factor) subject to a minimum lapse rate

Our central dynamic lapses rule has:

Band = 1%

Up factor = 40

Down factor = 20

Maximum lapse rate = 50%

Minimum lapse rate = 0%

# Appendix 3: Details of economic scenarios

We have constructed sets of 100 economic scenarios of equity returns, consistent with the assumed deterministic risk-free rate (1.5% or 1%, respectively).

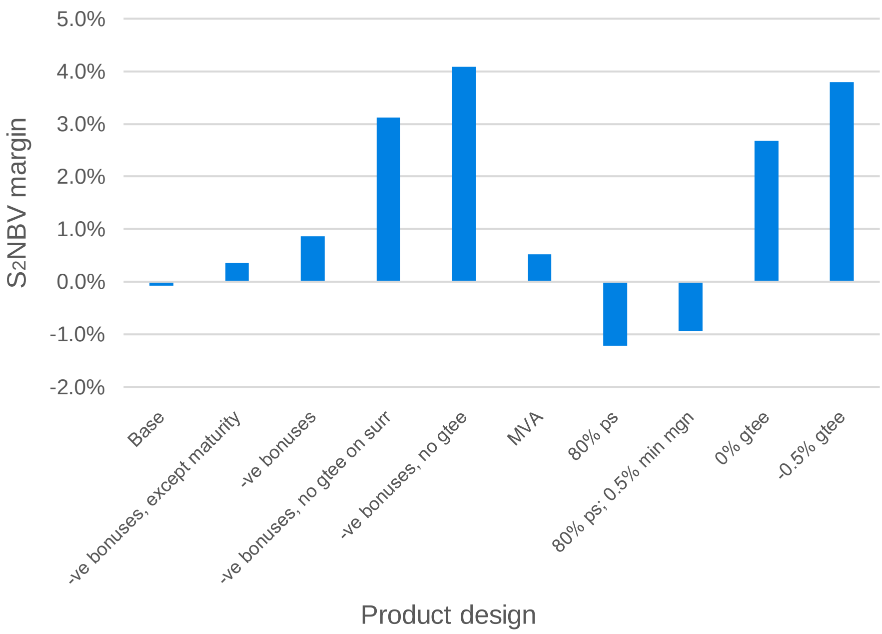
The equity model was calibrated to Eurostoxx 50 ATM implied volatilities.

# Appendix 4: Complete set of S2NBV margins

As noted in Section 3.2 above ten different pricing variations were considered on a stand-alone basis, with a 1.5% risk-free rate. These variations are set out here, together with the S2NBV margins:

1. Base as considered in Section 3.2 above.
2. Negative bonuses allowed in a given year (subject to the annual guaranteed interest rate being payable on maturity on surrender), but not when policy is held until maturity.
3. Negative bonuses allowed in a given year (subject to the annual guaranteed interest rate being payable on maturity on surrender). Design C as considered in Section 3.2 above.
4. As in 3 above, but also no interest rate guarantee on early surrender.
5. As in 3 above, but also no interest rate guarantee on either early surrender or maturity.
6. Market value adjustment (MVA) of 50% of unrealised losses on surrender (i.e., this reduces the surrender value paid when there are unrealised losses on underlying assets). Design D as considered in Section 2.4 above.
7. Profit sharing based on 80% of investment returns, subject to minimum guarantee (rather than a fixed margin). Thus policyholder return is expressed as: max (80% * investment return; minimum guarantee). Design B as considered in Section 2.4 above.
8. Profit sharing based on 80% of investment returns, subject to minimum guarantee, together with a minimum margin of 0.5%. Thus policyholder return is expressed as: max (min {80% * investment return; investment return - 0.5%}; minimum guarantee).
9. A 0% investment guarantee. Design A as considered in Section 2.4 above.
10. A -0.5% investment guarantee.

FIGURE 17: S2NBV MARGINS FOR ALL PRODUCT DESIGNS CONSIDERED




We note that we are not suggesting you can decide the merits of these designs from these numbers alone, but rather they provide a good illustration of how sensitive the results are to different potential pricing decisions.

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CONTACT

**Ed Morgan**
ed.morgan@milliman.com

**Jeremy Kent**
jeremy.kent@milliman.com