

May 2015

**Subject F202 — Life Insurance**

**Specialist Applications**

**MARKING SCHEDULE**

## QUESTION 1

**A life insurance company has traditionally performed an analysis of surplus (AoS) for risk products in aggregate on the valuation basis. Management has asked to see an AoS for disability income (DI) separately for the past few years as they suspect that profitability issues on this product may be masked by results from the large volumes of other risk products.**

**Upon receiving this information, management noticed that the morbidity component of the surplus has become a smaller portion of the total DI surplus each year.**

- (i) Provide the reasons for analysing the change in valuation surplus over a year, and describe how you would measure the surplus arising through morbidity experience (using a non-formula approach)**

*This question was largely bookwork and well answered. A number of candidates did seem to confuse a more traditional actual vs. expected investigation with the AoS required in the second part of the question. Some candidates also seemed to switch between pricing and valuation bases in their answers.*

### Reasons for analysing

A company will want to analyse the change in the surplus for lines of business and for each product type.

It shows the financial impact of the actual experience versus that expected in the valuation basis.

It will show the financial effect of writing new business over the course of the year.

Checks on valuation data and results are provided through various elements of the analysis of surplus.

This includes the checking of items of surplus for reasonability as well as various consistency checks.

The analysis could assist in the distribution of surplus by identifying items of surplus that are not likely to recur.

Trends in items of surplus would provide useful management information to the company.

The analysis would assist in setting future assumptions.

The analysis would show the effect of policy alterations.

The analysis is required as part of the statutory returns.

### How to perform an AoS

The value of the surplus allocated to the morbidity item will depend on the method (formula or non-formula) used to calculate surplus as well as

- the order in which various items are measured
- whether we measure actual (A) against Expected (E) or the other way around.

Using the non-formula approach (and expected to actual direction) to measure the surplus would require the following:

- Assets are allocated to the DI contracts equal to the value of the liabilities at the beginning of the year.
- The assets and liabilities are projected forward to the end of the year using the beginning year valuation assumptions as the expected experience over the year.
- The values of the assets and liabilities at the end of the year are calculated using the data from the prior step and the beginning year valuation assumptions.
- The prior two steps are repeated by changing one of the items of experience from the expected value to its actual value. In this case we are interested in morbidity item
- The recalculated surplus at the end of the year less the surplus from the prior iteration gives the contribution from the item of experience.
- This is repeated for each other item of experience.

#### **(ii) Describe the further investigations that could be performed in order to assess**

- a) why the morbidity component is becoming a smaller portion of the DI surplus each year, and**
- b) the possible reasons driving this change.**

*The candidates who did well in this question considered the higher level issue of the morbidity component being smaller not necessarily being a problem (i.e. other surpluses could be growing or the basis may have been updated). Weaker candidates went straight into the generic details of why disability experience could worsen. Better candidates also provided more scenarios under which the experience could be worsening.*

### Reasons for reducing morbidity portion of surplus

The concern is likely to be that the risk experience (claims incepting and terminating) of DI book is worsening. First need to establish whether this is the case.

It is remarked that the morbidity surplus is becoming a smaller proportion, but it could be that it is stable and other sources (e.g. investment income) are increasing in absolute terms.

If this is the case the concern over the DI morbidity experience would be lessened or removed entirely.

It would be useful to know what the total surplus has been in recent years and the individual contributions towards it.

If the surplus for this item is actually reducing then it is the case that the actual experience is worsening relative to the expected experience.

At this point we are dealing with actual and expected experience and we need to ascertain whether the expected experience has in fact been stable or whether there have been basis changes.

If the expected experience is changing each year through basis changes, it could be that the actual experience is not necessarily worsening but the expected experience is moving and reducing the surplus.

This could be the case if the experience has actually been very good in the past and the company has been lowering the valuation basis and / or risk rates (e.g. competitive reasons) and as such the expected claims cost.

If the lowering of the basis (and as such expected claims) happens at a stage when the experience is relatively stable, then the actual versus expected (AvE) claims ratio will worsen.

The impact on the AoS will also depend on whether basis changes apply to new business only or new and in-force.

You should also consider the volumes of business written. If these are changing they would affect the surplus arising each year. A shrinking book should deliver a smaller surplus in absolute terms for the morbidity item but other sources of surplus on this product like investment income are likely to be linked to the size of the claims in payment reserves and not new business volumes, i.e. not all surplus changes relative to changes underlying business volumes.

If you are able to confirm that the surplus from DI is reducing and there has been no change in the expected basis then it is the case that the experience is worsening.

#### What is causing morbidity component to reduce

At this stage detailed investigations could be done into the reasons behind worsening experience. This implies that the claims cost is increasing each year relative to our valuation basis.

For DI this could mean :

- We are seeing more claims occurring than expected
- Less claims are terminating than expected

Changes in interest rates can also affect the profitability of DI book but this would often come through as a change in valuation basis (claims in payment reserves) item in the AoS. You should check whether this is the case and hasn't been included in the morbidity item for some reason.

To analyse whether more claims are occurring than expected you would look at the actual claims occurring and compare to the expected claims using your basis for expected incidence and an appropriate exposure measure.

If this is the issue more detail could be considered by doing this analysis by the various risk factors. i.e. is the worsening being driven by a specific risk group (e.g. males or smokers)

To analyse whether less claims are terminating than expected you would look at the actual terminations occurring and compare to the expected terminations using your basis for expected terminations and an appropriate exposure measure.

You could also provide more detail here by analysing by risk factors.

It would be important for the termination analysis to perform a duration analysis to the extent that the data allows.

There being less terminations than expected in the first few years as compared to later years (if not all years) are quite different problems that would require different solutions.

One would point to potentially improving initial claims assessment and management and the other ongoing claims management, or changing the shape of your termination curve.

For both incidence and termination rates it is important to do the analysis by numbers and amounts.

It could be that the correct number of claims are occurring and terminating but we are still seeing a negative impact on surplus. This would mean our claims experience is becoming skewed toward more larger claims than expected occurring or the larger claims having a longer duration than the smaller claims.

If it is a termination issue you are also likely to need to increase reserves which will impact total surplus further through change in valuation assumptions for termination rates.

If it has been established that the experience is worsening there are a number of areas you could consider looking at.

Firstly, are there any internal changes that have occurred that may have impacted experience?

- Changes in target market or mix of business
- Change in distribution channel
- Changes in product without commensurate changes in basis (i.e. weakening of claims definitions, increasing replacement ratios)
- Any changes to the underwriting approach and the policies allowed onto books
- Any change in claims management practices

There could also be a number of external forces influencing the experience.

It could be that claims patterns are changing over time. Propensity for people to claim may be increasing and / or likelihood of claimants returning to work is reducing through poorer employment prospects. *{or any scenario where experience is just worsening}*

There is also evidence of disability experience being influenced by economic conditions. It could be that the worsening in experience has occurred during an economic decline.

It would be useful to know whether this is industry wide or only affecting the company. External shocks would impact most of industry.

You could discuss this with a local reinsurer who would have a wider view.

**National treasury is implementing a change in the method of taxing DI policies. In the past premiums were paid from pre-tax income (tax relief on the premiums), and benefits were taxed as income in the hands of the beneficiary, at the appropriate income tax rates. From 1 March 2015 the premiums must be paid from post-tax income, and benefits will be paid tax free. The change applies for policyholders as well as claimants.**

**Management are concerned about the impact of this change on the surplus emerging over the course of the year for the DI business.**

**(iii) Discuss whether the tax changes will result in changes to the morbidity experience and how this will affect the surplus arising.**

*Candidates struggled with question iii and iv. Candidates that performed poorly did not :*

- *demonstrate an understanding of the mechanics of the change, that tax would simply not be collected from claimants anymore. Some candidates went looking for a source of funding for this “liability”*
- *grasp that different actions would be required for claimants, policy holders and new business.*
- *identify the worsening experience as the dominant issue. Some candidates spent a lot of energy discussing the potential sales impact of the premiums now not being tax*

*deductible. Policy holders would now be buying less cover (to cover net salary) and as such premiums would be lower as well.*

The actual experience is more than likely to worsen.

If nothing else changes – an individual's cover amount will increase (not taxed further).

This will result in their replacement ratios (cover / salary) increasing which would likely increase the propensity to claim and reduce the likelihood of return to work.

The impact on surplus would depend on any changes made that would mitigate the expected changes to experience.

The impact on surplus is a combination of how actual claims change relative to what was expected. The company could try and reduce the potential worsening in actual experience by changing products or terms and conditions, or by changing the basis (increasing expected claims cost) which would alter the expected experience.

The negative impact of the basis change depends on the year in which it is implemented. If it is implemented this year it will reduce surplus. If it was implemented last year in anticipation of worsening experience, then the impact this year would only be how the actual experience turns out relative to the new expected basis. [CF2]

The company would want to try and maintain their profit margins through a combination of these changes.

**(iv) Identify changes that the company might consider to respond to the tax changes and the impact of these on the morbidity experience and surplus arising.**

The company would need to consider impact in three areas:

Current claimants

This is the most difficult one to manage as the company is obliged to pay what was contractually agreed. The payments being made cannot be reduced, they just won't be taxed from 1 March.

There is nothing that can be done in terms of product changes, and premiums are no longer being collected for these policies.

The fact that claimants are no longer taxed means that their benefits will increase and this is likely to impact terminations rates negatively.

For lower salaried claimants the impact will be less but for claimants who are taxed at the marginal rate the additional benefit will be substantial.

Many of these higher salaried claimants could be getting a bigger disability income than the salary that they would otherwise be earning. This creates a moral hazard.

The company could attempt better / stricter claims management for these claimants but the potential impact could be limited.

The company is likely to consider altering termination rates in the valuation basis for these claimants which would impact the surplus negatively through the change in valuation basis item in the analysis of surplus. (Reserve strengthening)

### In-force policies

For in-force policies there is the ability to potentially alter the product rules if policy conditions allow for this, e.g. ability to amend conditions if there are regulatory / legal / tax changes.

The company could make alterations in order to try and put the policyholder in the same position as he / she was and not an enhanced position in terms of benefit amounts (examples):

- Change gross income for net income
- Institute a maximum benefit amount in terms of net income
- {other examples possible}

There is also the option to alter the rates, if outside of any guarantee periods, for any risk that can't be managed through policy changes.

If a company could successfully alter all in-force covers to a cover based on net salary and keep policyholders in the same net position, the premiums per policy would reduce (smaller cover = smaller premium) by the effective tax rate of that policy and as such reduce the total premium income for the company and industry for this product.

Significantly reduced premium would also reduce the contribution to overall surplus from this line of business even if the profit margin was maintained.

Any changes to policy conditions are likely to impact on TCF principles and these should be considered.

In-force business would be less of an issue for group business which is annually reviewable and as such changes could be made within a year at the most.

The impact on the surplus over the year will depend on the ability of the company to make these changes that would impact actual and expected claims as well as their will to do so (given potential premium and TCF impacts).

There may be competitive pressures to consider in terms of how other companies are handling the change.

#### New business

The impact will be similar to in-force policies except that there are no contractual obstacles to setting out the product, policy and rates as required in order to manage and mitigate risks under the new tax rules.

There will still be competitive pressure in terms of what other companies are doing in terms of new products and rules after the change.

The tax change could have some impact on sales volumes due to potential for marketing.

## QUESTION 2

**A life insurance company sells a regular premium unit-linked product. This product has a guaranteed minimum maturity amount equal to the sum of the gross premiums paid.**

- (i) Describe the way in which the supervisory reserves for this product should be calculated (Statutory Valuation Method)**

*This question was largely bookwork and well answered. Some candidates left out the IGR which is the subject of part ii.*

The supervisory reserves comprise a unit reserve, a rand reserve and a reserve for the investment guarantee, calculated according to SAP104, APN110 and Board Notice 14.

The unit reserve is equal to the market value of the assets underlying the units allocated to policies (allowing for actuarial funding where relevant).

The rand reserve, calculated on an individual policy basis, may be required for future administration expenses and for other non-unit cashflows. Expected profits should not be recognised in respect of future options expected to be taken up (e.g. automatic premium increases), but expected losses in respect of such options should be recognised.

This involves projecting the cashflows of each policy to maturity. A discounted cashflow method is used where projected cashflows are calculated and discounted at the valuation rate of interest back to the valuation date.

Assumptions are made for items such as the future investment return and per policy expenses. Assumptions are best estimate, with an allowance for compulsory margins as prescribed by SAP 104 and discretionary margins.

If future cashflows are positive, it may be possible to hold a negative rand reserve to help reduce new business financing strains.

If the total reserve held in respect of any policy is less than the surrender value payable the office would have to levy a surrender penalty if the policy were to discontinue or limit the negative reserve in their reserving basis.

A reserve for the investment guarantee is obtained using a stochastic method.

In calculating the reserve for the investment guarantee, the business is projected forward under a large number of randomly generated investment scenarios, calculating the cost for each policy of the guarantee biting at maturity. Where the guarantee exceeds the fund at maturity, the excess is discounted back to the valuation date and accumulated across all policies.

The guarantee reserve is usually the average of the discounted losses over all the simulations.

- (ii) Describe the model that the company should build to calculate the investment guarantee reserve (ignoring any guarantee charges); as well as the checks that the company should carry out on the model.**

*This question was reasonably well answered. Better candidates generated more points, specifically around the model checks - the poorer attempts at this question generally lacked enough points around the checks.*

### Model build

Guidance on the reserving method of Embedded Investment Derivatives is provided in APN110.

A stochastic model should be used- APN110 recommends a market consistent model. This is because the cost of the guarantee is dependent upon future investment returns.

If future returns exceed a certain level so that the fund at maturity is more than the sum of the gross premiums paid, then there will be no cost to the company. But if they are below that level then there will be a cost, which increases as returns reduce. Hence a range of future investment scenarios should be tested.

Appropriate assumptions should be made for the underlying term structure of interest rates and volatilities. A zero coupon yield curve or a swap curve is recommended for the term structure of interest rates.

Unless stated otherwise, assumptions should be consistent with the best estimates used in the valuation. Assumptions are also required for future mortality, surrender and paid-up rates. These affect the build-up of the unit funds and the guarantees.

These will probably be allowed for on a deterministic basis. All assumptions should be consistent with each other.

Some assumptions may be dynamically linked (e.g. lapses to the value of units and probability of any guarantees biting) and should be capable of being overridden (e.g. nil lapses for supervisory valuations).

Model points may be used rather than a policy-by-policy projection to reduce the run time of the model. The model points will be based on actual in-force data and be an appropriate representation of the underlying policies.

The model will project the unit values to maturity, allowing for the investment returns (after tax) of each simulation, future premiums and decrements. The model should also allow for changes to guarantees as a result of paid-ups or partial surrenders.

This will be done under a large number of randomly generated investment scenarios. The preferred number of simulations as per APN110 are 2,000 and the minimum recommended simulations are 1,000.

The model will then compare the projected maturity value with the guaranteed minimum amount, i.e. the sum of premiums paid (allowing for decrements). This is done for each scenario and for each model point.

If the projected value exceeds the guaranteed minimum amount then the cost for that particular scenario and model point is zero. If it is less than the guaranteed amount then the cost is the difference between the two.

These projected costs are then discounted back to the present, model points scaled up, and summed across all model points.

If investment returns are simulated under the risk-neutral probability measure, the appropriate discount rate for each projection interval is the simulated risk-free rate of return for that interval.

Otherwise, the appropriate discount factor is the state-price deflator for the particular simulation.

The average across all scenarios is the expected cost of the guarantee.

The variability of the cost should also be considered, e.g. by looking at the quartiles and 95% percentiles.

The model may be adapted to include future new business for balance sheet projection and pricing purposes.

### Model checks

It is important to check that the code of the model is correct and to validate all the assumptions used to determine parameters.

If model points are used, the company should check for model point error. For example, the calculations could be performed using a different choice of model points, checking that the results do not differ significantly.

A full (policy by policy) run could be performed on a selection of the policies and compared against the associated model point results.

The scaling up and aggregation of model points or data should be checked. For example, check that the total number of policies and total unit value at outset is consistent with in-force valuation data.

To check that the cash flow projections are being performed correctly, run the model using deterministic investment assumptions. One can then check that the cost is zero for high investment returns, and that the cost increases as the future investment return assumption reduces.

The model could be run using deterministic assumptions to ascertain the “breakeven” future investment return, which could then be checked for reasonableness.

To check the code, a simple projection spreadsheet could be used to perform a parallel check on the results for a single model point using a deterministic investment assumption. The deterministic assumptions can be replaced by a stochastic scenario to compare against the model results.

The stochastic results should be checked for reasonableness. For example, is the expected cost a sensible proportion of total premiums?

The outcome of an individual stochastic scenario could be checked for reasonableness, e.g. an extreme scenario in which future investment returns are very poor.

Check the simulated returns for reasonableness, e.g. the consistency of the different asset returns, inflation and nominal returns etc.

Sensitivity analysis should be performed, e.g. by varying the asset model parameters. Any results from these analyses and reasonableness checks that are not intuitive should then be investigated further, as they may reveal coding or parameter input errors.

Compare the results of the new model to the results of the previous model. Identify which products or individual model points have different results and investigate the reasons for the differences (e.g. by comparing the cashflow projections). Any differences in results should be clearly explained and quantified.

Results should be tested against the market price of a suitable derivative if one exists.

**The product development team is developing a new unit linked product. The product will be similar to the existing unit linked products, except the guarantee at maturity is equal to the sum of the allocated premiums, there is no bid-offer spread and there are different investment fund options available for the new products, i.e.**

- **Option 1: The target return is the risk free rate, but the target return is not guaranteed.**

- **Option 2: The target return is inflation + 3%, but the target return is not guaranteed.**

**Other key product features are as follows:**

- **The fund charge is a fixed percentage of the underlying accumulated fund.**
- **There is no guarantee on death or surrender.**
- **The policy terms and premium sizes may vary.**
- **The policyholder can also opt for automatic annual premium escalations at a fixed rate.**

**You need to report to the board of directors on the aspects of Treating Customers Fairly (TCF) for this product.**

**(iii) Describe the items you expect the report to include with regards to TCF.**

*This question was answered reasonably well. Many candidates just listed a number of TCF points, most of which were irrelevant and as such probably wasted time. The question specifically asked the candidate to set out the **items** that should be considered in a **report** from the **product development team** perspective.*

*Marks were awarded where the candidate referred to the evidence that is provided by the **product development department** to demonstrate that they have considered and addressed the 6 TCF outcomes.*

**Target market:** The report should include some evidence that the product design and benefits meet the needs and financial capability of a specific target market (e.g. provide results from market research, from a market survey or from feedback from customers).

**Marketing literature:** Provide evidence to indicate that the literature is clear and fair and that the right style and language are used for the target group, e.g. reports from communication experts, the sales department and feedback from a sample of target customers.

The feedback should confirm that the information provided enables customers to make informed decisions about transacting with the firm, its products and services.

Confirm that the policy document clearly points out the product risks, commitments, limitations and charges.

The funds options and charging structures are transparent and not ambiguous (e.g. in a fund fact sheet).

The guarantees are clear, e.g. The return on the funds are not guaranteed, but only an indication of the target returns. The actual returns might still vary.

The guarantee is a return of allocated premiums and not of gross premiums.

**Distribution channels and advisors:** Evidence of the training programmes, assessments and product manuals for the distribution channels and advisors. The training programmes and manuals include information to ensure the distribution channels and advisors have a clear understanding of the needs of the customer groups and are equipped to provide advice (where relevant) that is suitable to the needs of the customer.

The commission and remuneration options are structured (where possible) to ensure a balance of the commercial objectives of the company and the TCF objectives to avoid conflicts of interest.

**After sale:** Confirm that the website, customer reports and other communication provide all the relevant information to customers so that they can monitor their investment and the overall fund's performance. Information on the wider environment that may affect their products and performance should also be included.

It should clearly be pointed out in the policy document or website what they need to do if they have any post-sale enquires or want to engage in further transaction (e.g. queries on the performance of their funds, if they want to switch provider, if they want to terminate their policy or make a complaint).

Show how the design of the policy address root causes identified in the complaints report.

**The company wants to calculate an appropriate charge to cover the cost of guarantees for the new product using the new valuation model that was used to calculate the guarantee reserve. The previous valuation basis is as follows:**

<b>Assumptions</b>	<b>Valuation basis</b>
<b>Renewal expense fee (fund deduction)</b>	<b>R20 p.m. increasing with inflation</b>
<b>Expense inflation</b>	<b>6.5% p.a.</b>
<b>Allocation rate</b>	<b>95% of all premiums are allocated to units</b>
<b>Total fund charges</b>	<b>1.8% p.a.</b>
<b>Bid-offer spread</b>	<b>5% p.a.</b>
<b>Investment returns</b>	<b>Risk neutral stochastic investment return</b>
<b>Take up rate of annual premium increases</b>	<b>85%</b>
<b>Decrement rates</b>	<b>Based on experience</b>

- (iv) Describe how you would calculate an appropriate charge for the guarantees using the valuation model and the adjustments you would make to both the valuation model and the valuation basis for this calculation.**

*This question was answered surprisingly poorly. Many candidates struggled with the application nature of the question. While the candidates were able to describe the stochastic model in part ii they could not set out how this would be used to calculate a charge.*

The only guarantee is the return of allocated premiums at maturity, based on a projected accumulated fund value.

Calculate the present value of the projected fixed fund charges that equates to the present value of the cost of the guarantee, where the charges are for example a fixed charge or a percentage of the underlying fund.

Using the stochastic model, calculate the cost of the guarantee and the guarantee charge as the average of say 1,000 simulations.

It will be a recursive calculation since an increase in the charge will increase the cost of guarantee (as the projected fund will be lower). The guarantee charges can be calculated by solving the charge in the calculation or to calculate the charge at fixed levels and then to interpolate the results.

The charges should be discounted at the appropriate rate, i.e. the same discount rate that is used to calculate the cost of the guarantees. Since this is a risk neutral model, this will be risk free rate of return.

Produce model points that represent the expected business volumes, business mix (by term, premium size, premium escalation take up rates) and the expected fund options.

Test the sensitivity of the results by varying the assumptions and other input, i.e. business mixes, investment funds etc. Also test the assumptions that are used to calibrate the stochastic investment returns.

The product is largely the same as the existing product so the valuation basis (ignoring margins) is a good starting point to set assumptions for this calculation. Update the best estimate valuation assumptions affecting the underlying fund (and as a result the guarantee charges) to allow for the following known or expected changes:

Inflate the renewal expenses fee to allow for the period of time between the valuation and the expected launch of the product.

Instead of using a deterministic inflation rate assumption, use a stochastic inflation rate that is consistent with the stochastically generated investment returns.

The fund charges and expense fee might have to be updated to allow for new profit targets, expected expenses of the new product and the different features of this product (i.e. no bid offer spread, different asset management charges for the new investment funds).

The fund charge will also have to be updated to allow for the cost of capital for the new product, i.e. cost of CAR and the risk margin after the implementation of SAM.

The stochastic investment returns will have to be updated and recalibrated to reflect the existing and expected future market conditions. Consider a longer term view of expected returns and volatility assumptions to generate the stochastic returns.

The model assumptions need to allow for the different asset mixes of the two fund options. The tax calculation should be a function of the underlying asset mixes.

No bid offer spread is required.

Decrement rates based on expected experience. Even though there are no guaranteed surrender or death benefits, the decrement rates will affect the run off of the unit funds, the guarantee (e.g. partial surrenders) and the number of policyholders in force at maturity.

Update the decrement rates to reflect expected experience of the new product with different product features, e.g. higher surrenders due to lower guarantee.

**END OF MARKING SCHEDULE**