

INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

April 2014 examinations

Subject SA2 – Life Insurance Specialist Applications

Introduction

The Examiners' Report is written by the Principal Examiner with the aim of helping candidates, both those who are sitting the examination for the first time and using past papers as a revision aid and also those who have previously failed the subject.

The Examiners are charged by Council with examining the published syllabus. The Examiners have access to the Core Reading, which is designed to interpret the syllabus, and will generally base questions around it but are not required to examine the content of Core Reading specifically or exclusively.

For numerical questions the Examiners' preferred approach to the solution is reproduced in this report; other valid approaches are given appropriate credit. For essay-style questions, particularly the open-ended questions in the later subjects, the report may contain more points than the Examiners will expect from a solution that scores full marks.

The report is written based on the legislative and regulatory context pertaining to the date that the examination was set. Candidates should take into account the possibility that circumstances may have changed if using these reports for revision.

D C Bowie
Chairman of the Board of Examiners

July 2014

General comments on Subject SA2

The Examiners' Report covers more points than would be expected to get full marks. This is so that alternative approaches to questions by different candidates can be accommodated within the marking scheme. Whilst candidates are expected to show knowledge of the relevant content of the Core Reading, it is much more important in this exam to tailor answers and apply that knowledge to the specifics of the question than it is in earlier exams.

Comments on the April 2014 paper

This proved to be a difficult paper and the pass rate was lower than in previous years. Candidates who applied their knowledge and understanding in a way targeted to the question scored well. There was a greater inclination than usual for some candidates to write down a list of points without considering whether they applied to the question.

Unusually, some of the bookwork questions were poorly answered such as Question 1 part (vi) and elements of Question 2 part (iv).

The calculations in Question 1 parts (ii) and (iii) served as a good differentiator. The key was a reasonable understanding of smoothed payouts, guarantees and asset shares, and hence their impact on smoothing costs and guarantee costs. Candidates with this understanding scored well.

For Question 2 parts (ii) and (iii), cross marking was applied so that candidates were given credit if they made a valid point, but in the different question part to the marking schedule.

Candidates approaching the subject for the first time should use this Report, and previous Examiners' Reports, to practice the application of knowledge.

- 1
- (i) Cost of guarantees, cost of financial options, cost of smoothing and cost of planned future enhancements not already allowed for.
 - (ii) Projected asset share = $10,000 \times 1.05^2 \times 0.9 = 9,923$
Projected smoothed asset share = $11,000 \times (1.01^2 \times 1.05)^{1/3} \times (1.01 \times 1.05^2)^{1/3} \times 0.9 = 10,499$
Guaranteed maturity benefit = $8,000 \times 1.03^2 \times 0.9 = 7,638$
Payout = 10,499 on maturities
The asset share is greater than the guaranteed benefit so cost of guarantees = 0
Cost of smoothing = SAS – MAX(Guaranteed Benefit, Asset Share) = 10,499 – 9,923
Cost of smoothing = 576 (or 640 if made no allowance for withdrawals)
 - (iii) Fund earned rate in 2014 and 2015 = average of –50% and 0% = –25%
No cost of smoothing or guarantees for withdrawals
Projected asset share = $10,000 \times 0.75^2 \times 0.9 = 5,063$
Projected smoothed asset share = $11,000 \times (1.01^2 \times 0.75)^{1/3} \times (1.01 \times 0.75^2)^{1/3} \times 0.9 = 7,499$
Guaranteed maturity benefit = as per (ii)
Payout = 7,638 [Or 8,487 if no allowance for withdrawals]
Cost of guarantees = 7,638 – 5,063 = 2,575 [Or 2,862 if no allowance for withdrawals]
Cost of smoothing = 7,638 – 7,638 = 0
 - (iv) The company may have assumed that reversionary bonuses would reduce since the guarantees are biting. This action would have reduced the cost of guarantees (any excess of the guarantee over the basic asset share), and also may have contributed to the increase in the cost of smoothing, because the cost of smoothing is based on the payout less the higher of the guarantee and asset share. So if the payout were based on the smoothed asset share and the guarantee was higher than the asset share when the guarantee decreases, the cost of smoothing increases.

The company may have suspended or reduced smoothing, which only helps where the smoothed asset share is higher than the guarantee. Although this wasn't the case before any management actions were applied, it could be the case if (say) reversionary bonus rates were reduced, which would reduce the cost of smoothing which is now contributing to the FPRL, i.e. it *offsets* the impact described above. This would have no impact on the cost of guarantee as this is independent of the smoothed asset share.

The company may have reduced the EBR. It would be unusual for the EBR not to have changed given that, after the first 50% fall in equities, the model would have to assume that equities were bought in order to get back to a 50% EBR. This would increase the fund earned rate, and so both the asset share and smoothed asset share. It would reduce the cost of guarantees since asset shares would increase. It would increase the asset shares more than the smoothed asset share due to the three year averaging, and hence would reduce the cost of smoothing.

The approach to MVRs may have been changed. It may be against policyholders' reasonable expectations to have such large MVRs under these extreme investment conditions. If this were the case then there would be a positive cost of smoothing on withdrawal. Note that this action would be unlikely to result in a cost of guarantee; it is more likely to increase the cost of smoothing. There may be a management action to change charges.

For all the above actions, the changes would have to comply with the following:

- PPFM
- Policyholders' reasonable expectations (PRE) / TCF
- Delay in implementing the management actions, for example due to: systems constraints, delays in selling equities in a depressed market, or PRE with regard to how fast bonuses can reduce

The company may have also assumed that fewer people withdraw in this extreme scenario, and that they wait for the next two years for the policy to mature. This would increase both the cost of guarantee and the cost of smoothing. Alternatively, the company may assume that more people withdraw in this scenario, but this is counter to the quoted cost of guarantee.

- (v) The most likely situation is where it may be in the interests of the policyholder to choose to exercise (or not to exercise) the option, without it incurring a higher cost to the insurance company. However, the allowance must still be sufficiently prudent allowing, in particular, for possible future changes in experience. Examples include where the tax benefits of taking some of the lump sum as tax free may be worth more to the policyholder than the GAO (even when it is "in the money") and so the company may make a prudent assumption as to how much tax-free lump sum may be deducted.

Similarly, the policyholder might prefer to take the maximum lump sum (when the GAO is "in the money") due to preferring to take the benefit in cash form rather than as an immediate annuity in payment, perhaps due to needing to pay off a significant liability or due to other personal plans.

Open market options for immediate annuity rates might be cheaper than the GAO, even when it bites. For example, this could be due to the impact of gender neutral pricing which could make market annuity rates for males cheaper than the GAO in place. Alternatively, the policyholder may be in ill health and may get better rates on the open market by purchasing an impaired life annuity. However it is unlikely that the company will know the situation of an individual policyholder. In addition, the company would then also have to assume lighter mortality for those remaining.

- (vi) The prospective approach must take account of all guaranteed benefits and the need to meet TCF requirements. It is important to ensure that the projection

period used is long enough to capture all “material cashflows” arising from the contracts or group of contracts being valued.

- (vii) The company could start basing the final payouts on the whole life asset shares, but they can be unreliable at old ages. They may use specimen rather than actual policies, or use a prospective method. The company would need to consider the assets currently backing the reserve and the asset shares. If, however, the whole life asset shares are very different to the current implied assets required for the expected payouts, these may need to be rebased. This investigation could highlight inconsistencies in what the whole life policies are being paid and what is supportable by the asset shares, either in total, or by cohort. Any such inconsistencies should be addressed before a new approach is adopted.

The company will need to ensure the approach is consistent with the PPFM, or make changes as necessary, and are in line with TCF and PRE. The latter may be based on past payouts and so any changes will need to be implemented gradually.

The company would need to set rules for how the bonuses should increase with duration, as there is no natural maturity date on which to equate asset shares. The company may consider creating a new bonus series for whole life policies going forward.

The company could convert the whole life policies to without profits. However this may be against PRE and would likely require independent advice. The company will need to seek the views of the AFH and the WPA

- (viii) The company must first determine how many scenarios to use in order to calibrate the model. Too many scenarios may mean that it is too difficult to fit, whereas too few would not give a good enough fit. Care needs to be taken to consider sensible scenarios for the business in question. The number of parameters in the polynomial also needs to be considered as well. Too many may make the fitting process too lengthy, and give spurious accuracy, whereas too few means that a good fit cannot be achieved. They will need to consider scenarios which combine particular stresses. A tolerance limit will need to be set to guide whether the fit is adequate.

They will need to ensure the scenarios chosen cover all the management actions, as it is the management actions which make the fitting of models complex. The company must choose scenarios which give a good fit in both the base scenario and in a range of stressed scenarios. Overall they will need to ensure that the different stressed risk drivers selected would result in an overall 1/200 stress. Ensuring a suitable fit in the tails is important, but difficult. The company is likely to use a goodness of fit tool to help, but trial and error is also likely to be required. They will need to review the output for sensibility, but some pragmatism may be appropriate.

Once the best curve is fitted, the company must choose scenarios which have not been used in the fitting to check the fit. Further iterations may be required if this shows that an inadequate fit is achieved.

If a full policy by policy run is not possible, then consideration needs to be given to the choice of model points to ensure these represent adequately the ungrouped policies in terms of, for example, the moneyness of guarantees. Large differences would require investigation, and possibly a recalibration.

TAS M should be followed and documentation is vital. The company may seek validation by an external party.

Part (i) – This bookwork question was generally answered well, but some candidates missed easy marks by not knowing the complete list.

Parts (ii) and (iii) – Most candidates made reasonable attempts on part (ii) and (iii) but few managed to account for withdrawals correctly. Candidates that used the arithmetic mean, rather than the geometric mean for the smoothed return (as stated in the question) did not score full marks. No marks were lost if students reduced the asset share for shareholder transfers.

Part (iv) – This question was a good differentiator with most candidates achieving marks for the key points, but only well-prepared candidates tailored their answers to the question and information provided in previous parts of the question, and gave sufficient detail for the number of points available. Candidates who did well considered whether the direction of movement in the cost of guarantees and cost of smoothing fitted with the potential impact of actions, and followed through the logic for the movements. A number of students failed to note that fewer lapses were likely to occur due to the guarantee biting, and instead answered more generically by stating, incorrectly, that lapses would increase. Some candidates did not recognise that question related to management actions built in the stochastic model rather the actual actions taken.

Part (v) – This question was generally answered poorly with a number of students not answering the question, and others not providing enough examples and detail for the marks available. The question required students to consider circumstance where it would be reasonable to assume that policyholders don't take the option which is most onerous for the company. Those who answered the question generally only considered the implications of the Tax Free Cash Sum.

Part (vi) – A bookwork question which was poorly answered by the majority of students.

Part (vii) – This question proved to be a good differentiator, with well-prepared candidates considering alternatives to using endowment assurances to derive bonuses. A number of students suggested the company start selling endowment assurances again, without considering that the duration of the new business would differ from the duration of the whole life in force contracts.

Part (viii) – This question was generally poorly answered with some students simply listing the Solvency II requirements rather than considering the actual question, which required applying knowledge and standard model tests.

- 2** (i) The Equality Act 2010 is the key anti-discrimination law for the UK. It states that an insurer is not allowed to discriminate directly or indirectly against someone on the basis of a protected characteristic. Gender is one of the protected characteristics.

The EU Gender Directive was passed in 2004. This is aimed at “implementing the principle of equal treatment between men and women in the access to and supply of goods and services”. There was originally an opt-out for financial services and insurance products provided that certain conditions were met. However, this opt-out was removed with effect from 21 December 2012 (following a ruling by the European Court of Justice) for new business written on or after that date. Reviewable premiums are not treated as new business for the purpose of this legislation.

Insurance companies need to be careful to avoid the use of proxy rating factors (i.e. highly correlated to gender) that might be deemed to be indirect discrimination and thus also not permitted. There was already a requirement to offer unisex premium rates in some areas, for example for annuities with protected rights.

- (ii) The company can no longer price on the basis of gender, so one price will apply for males and females. We currently assume that females will live longer than males as this is what our past experience and industry data shows. So, currently standard annuities cost more for females than for males. If one price is charged for both sexes then males may be worse off. Note that the effect will be less marked for joint life cases (with both genders).

We will need to consider how to price the annuities going forward, and in particular where in the range to pitch the combined rate, i.e. the worse price at each age across both sexes, the best or an average. We will need to make an assumption about the expected mix at each age between males and females, and monitor the mix actually achieved regularly and reprice if required. In particular, if an averaged rate is used then may see an increase in the business from the gender for which the price has improved (i.e. females), with the other gender (males) perhaps taking more advantage of drawdown products. The effect may depend on the distribution channel. If this possible shift in business mix is not allowed for then it would result in worse average mortality, and thus lower overall profitability. We may decide to add a “business mix” risk margin into the pricing basis initially whilst the market stabilises.

We may decide to target a particular sector/gender of the market. This could be through being more price competitive for this sector and less competitive elsewhere. Or it may be through other approaches to target a particular sector, e.g. marketing, to influence the business mix achieved. We may decide to target specific occupations which could be highly correlated to gender, unless this is deemed to constitute indirect discrimination.

We need to consider what the competition is doing, both in terms of when they plan to comply with the new regulation and how they are planning to change

their rates. We don't want to be left behind or left open to greater anti-selection by being too far out of line. Volumes changing significantly would have implications for per policy expenses. We are likely to seek to meet requirements of ECJ ruling as late as possible in order to minimise anti-selection risk of joining early. Or, we may decide to smooth the female rates in early to avoid a significant discontinuity. We will need to consider the impact on pipeline cases which were in the proposal stage before the change was effected. Will the firm be able to honour the original terms for such cases? There may be a rush by males to complete sales before prices change or females may defer purchasing an annuity. There may have a short-term impact on pre-retirement products as people advance or defer retirement.

We may consider using other rating factors which aren't excluded under the new regulation. For example, postcode, occupation, policy size. However, we will need to consider if there is sufficient data to support the approach and ensure that it cannot be considered a proxy rating. We may decide to introduce medical underwriting and offer more tailored, impaired life annuities (if do not already do so). If the firm already sells such enhanced annuities then need to consider the implications on sales of these products as well as on standard annuities. But the ruling may have a less significant impact on impaired life annuities as the medical impairment may have a greater impact than gender on expected lifetime. Overall still need to ensure that a gender neutral approach is taken on underwriting

Will need to consider the impact of the changes on any existing reinsurance terms and consider whether any new reinsurance should be put in place. Reinsurers may still be able to price according to gender.

We may consider writing a with profits product where the mix of business risk can be allowed for in the bonus rates. Or we may consider selling business more into non-EU markets, where the ruling does not apply. Alternatively, if annuities are not a significant product line for the company, we may decide to stop writing annuities.

It should be noted that there is no impact for existing business, only for new business sales. Gender data should still be captured on new business proposal forms for monitoring purposes. Reserves can still be set according to gender. However, overall capital requirements may be higher, at least initially due to the greater uncertainty in relation to new business mix and the cost of this additional capital could reduce annuity rates.

There will also be additional costs that need to be recovered due to the changes that need to be made to pricing and quotation systems and a change in literature.

(iii) General points:

The company needs to reassess all of its key risk areas in light of the ruling. The company may decide to introduce more frequent monitoring of risks and more frequent risk reporting to senior management.

Market Risk:

If the company does not rebalance investments held for the impact of changes in business mix on the liabilities (i.e. an ALM exercise) then there may be implications for market risk. For example, if more annuities are purchased by males then the average duration of the liabilities may reduce which should be reflected in the choice of assets. Or there may be mismatching risk which will increase the exposure of the company to changes in interest rates. Controls will be needed to ensure that asset selection reacts quickly and appropriately to changes in business mix.

Liquidity Risk:

There may be short-term implications for liquidity if policyholders decide to advance or defer their retirement around the implementation date of the change.

Controls will need to focus on monitoring and anticipating changes in these retirement patterns ...
... and ensuring that there are adequate liquid asset holdings to cover any temporary uncertainty.

Operational Risk:

The company will need to assess the impact of any changes in new business volumes on its operational risks. For example, more than expected may result in risk to new business servicing. Controls may be introduced on new business volumes i.e. limits. There may be mis-selling risks in respect of new business written just prior to or after the change, with corresponding reputational risks.

Similarly there may be risks relating to the servicing of related complaints. Project risks may occur in relation to implementation of the changeover. For example, revised annuity rates may be incorrectly determined or applied, or marketing material may be overlooked or updated incorrectly. Good project management controls systems testing and staff training will be vital. There may be a risk of legal challenge on “proxy” grounds.

Longevity risk:

May increase as the target market may change both in terms of mix by sex and the social class (e.g. due to anti-selection), so many consider increased underwriting/monitoring/reinsurance.

Expense risk:

Will need close control on expenses in relation to the development costs and the operational changes noted above. There is a risk that overall new annuity business volumes fall by more than expected as a result of the change and hence fixed expenses may no longer be covered.

New business mix risk:

As described in the previous question part.

Credit/counterparty Risk:

If the company introduces more reinsurance as a result of the ruling, the reinsurer(s) will need to be added to the counterparty exposure list and monitored appropriately. The company will need to assess the likelihood of default of any new reinsurers, and also assess if any existing agreements will be impacted by the change.

- (iv) The mortality rates need to be determined for each age and any other rating factor used. Approaches includes:
- Expectation approaches to modelling future mortality involve expert opinion and subjective judgment to specific a range of future scenarios.
 - Extrapolation approaches are based on projecting historical trends in mortality into the future. Such methods also require some element of subjective judgement. E.g. in the choice of period over which such trends are to be determined.
 - Explanatory approaches attempt to model trends in mortality rates from a bio-medical perspective.

These are only effective to the extent that the processes causing death are understood and can be mathematically modelled. In practice, most mortality projections involve some aspects of each of the above.

May use industry mortality tables such as "00" tables as the base table. These should be adjusted for company experience starting from own data provided it is credible, and for the intended target market. Reinsurer data and/or assistance might also be used. Given that gender neutral pricing is now in place, an assumption also has to be made about the expected new business mix by gender and the actual mix observed over 2013 as a guide.

Need to allow for expected improvements in future mortality for the portfolio, which would also have to be averaged across the genders. Can use information supplied by the CMI on this but tailored for the company's own experience. CMI tables include a "cohort" effect which exhibit stronger mortality improvements than other birth years. This is due to underlying changes in lifestyles and habits being more marked within a specific cohort. The company will need to consider whether and how to apply the cohort effect to its own policyholders.

The company could use a stochastic mortality projection methodology. For example, using P-spline or Lee-Carter approaches. Perhaps using the CMI's library of mortality projections, but each of these again needs to be adjusted and appropriate to the company's own experience and situation.

Particular problems can arise with modelling mortality assumptions at the extreme ages. One way to deal with this is to use a limiting age approach.

If the company sells impaired life or enhanced annuities, then the mortality rates for this business would have to be modelled based on knowledge of mortality rates under different medical outcomes. The mortality rates for standard business would have to reflect the likely better than average health of those policyholders since they have not chosen to purchase an impaired life annuity.

More complex underlying statistical models could be used e.g. including postcode as a proxy to socio-economic factors. Cause-specific mortality rates could be modelled, although this is very difficult to do in a robust way.

Margins for uncertainty should be included in the mortality rates relating to model, parameter and stochastic uncertainty.

Pricing needs to project reserving assumptions as well as experience assumptions. The reserving assumptions need to be consistent with the projected experience basis mortality assumptions, and need to meet regulatory requirements i.e. contain sufficient prudential margins.

- (v) Longevity swaps can be used to hedge the longevity risk within the annuity portfolio. Future unknown annuity payments are converted into a fixed cost and so the longevity uncertainty is removed for the insurance company. This will reduce the company's solvency capital requirements e.g. under the ICA. The balance sheet will be more stable in future periods.

The company retains investment risk under a longevity swap arrangement but will increase its counterparty risk (i.e. risk of counterparty default), and there will be a cost involved (fee) to the counterparties. Any potential future profits arising from worse than expected future longevity will accrue to the counterparties.

The company may have to post collateral which could have implications for liquidity. There may be a residual basis risk if the transaction is done on a generic population index rather than actual annuity payments.

The company will incur costs administering the swap, including needing to change systems. Longevity swaps could be cheaper/pricier than reinsurance and so preferable/less preferable. Swap agreements on gender neutral policies may require the mix of business between male and female to be within a specific range for the counterparty to be able to assess expected future cash flows. There will be a risk that the new business mix targeted is not attained.

The company may have little experience of these arrangements and could accept inappropriate terms. It therefore may need to seek external advice on the arrangement. Changes in regulation may make these arrangements more or less advantageous.

Part (i) – A bookwork question which was answered reasonably well by most students.

Part (ii) – Candidates scored a wide range of marks on this question, with the well-prepared students considering the relevant issues for annuities. The majority of students correctly stated that females were likely to be better off after the change, but there were some that stated that males would be better off. Less well-prepared candidates took a more “scatter gun approach” using a generic list of potential implications for a marketing director, some of which were not applicable for annuities; for example lapse and re-entry risks.

Part (iii) – This question was generally not answered as well as part (ii), with many candidates not considering the full range of risks; for example market, liquidity and expense risk were only considered by the better candidates. Similar to part (ii) a number of student stated risks which were not relevant to the business.

Part (iv) – Candidates who performed well on this question recognised that they needed to consider bookwork points on setting mortality rates, plus make it specific to the question by considering gender neutral issues. Less well-prepared candidates did not pick up the bookwork marks.

Part (v) – The bookwork elements of this question were answered well by the majority of candidates. However, most failed to consider the (new) gender neutral impact or the logistical consequences associated with the use of longevity swaps for the first time.

END OF EXAMINERS' REPORT