INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

April 2012 examinations

Subject SA2 – Life Insurance
Specialist Applications

Purpose of Examiners' Reports

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 who are 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. Although Examiners have access to the Core Reading, which is designed to interpret the syllabus, the Examiners are not required to examine the content of Core Reading. Notwithstanding that, the questions set, and the following comments, will generally be based on Core Reading.

For numerical questions the Examiners' preferred approach to the solution is reproduced in this report. Other valid approaches are always given appropriate credit; where there is a commonly used alternative approach, this is also noted in the report. For essay-style questions, and particularly the open-ended questions in the later subjects, this report contains all the points for which the Examiners awarded marks. This is much more than a model solution – it would be impossible to write down all the points in the report in the time allowed for the question.

T J Birse
Chairman of the Board of Examiners

July 2012

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 2012 paper

In general, candidates showed good knowledge of the core reading.

1 iii), iv), 2 ii) and iii) served as good differentiators, with the better candidates applying their knowledge to question. Those that scored particularly well were able to tailor their answers to the specific product/company described in the questions.

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

1 (i) Shows the financial effect of differences between actual experience and that assumed in the valuation.
Shows the financial effect of writing new business.
Reconciles the opening and closing surplus, which can be used to help explain the change in free assets/working capital.
Provides a check on the valuation process if performed independently.
Provides information required for remuneration schemes.
Provides information to aid understanding of where the surplus arises from, for example identifying if there are unprofitable contracts so that remediating actions can be put in place.
If the company is a realistic basis with profits firm then is a regulatory requirement to produce an analysis of surplus.

This bookwork question was generally well answered.

(ii) The data available split by surrenders, mortality etc. may not be reliable. This may be due to the markers set on the policy data by the customer services team (to indicate whether the policy left due to surrender etc) not being accurate.

The data may be available at a more detailed level but cannot be run through the reporting model, as the model won't allow expected assumptions to be overwritten. For example, would need to replace surrender rate over 1st projection year with actual surrender rates.

It may be difficult to differentiate a surrender from a paid-up decrement. Some of the unit-linked products may have more complicated decrements, such as temporary premium holidays or premium reductions, and it may be difficult to analyse each of these separately.

The data may be reliable, but not available in the required timeframes. E.g. the company may perform decrement analyses over the year to spread the work, and so some products won't have been analysed for up to a year at the point of the analysis of surplus work.

Lack of time and resources required to produce the analysis of surplus meant that short cuts had to be made.

On the other hand, since surrenders do not affect the immediate annuities, and mortality may not be significant for the unit-linked products, the company might have decided that the level of detail obtained by splitting by broad product type gave a sufficient level of information.

The purpose of the analysis of surplus needs to be considered; it may be required only for very high level management messages.

Most candidates made the more "standard" points (e.g. data reliability, relevance of different types of decrement) but few explored the wider practical issues such as modelling and time constraints.

(iii) **Investment return on immediate annuity business**

Annuities are likely to be backed by fixed interest assets, for example gilts and/or corporate bonds. Yields falling will increase the value of bonds backing annuities and also increase the value of liabilities. A loss over the period suggests that the increase in assets is lower than the increase in liabilities. This implies a mismatch between liabilities and backing assets and in particular, it implies that the average duration of assets is shorter than that of liabilities. This could be due to difficulty in obtaining assets of a sufficiently long duration to match immediate annuity liability cashflows.

The loss may also be driven by the type of corporate bonds held. If spreads have widened, then the allowance for credit defaults in the realistic valuation rate of interest may have increased and so the yield used for liabilities would fall by more than the yield on assets, thereby creating a loss as liabilities would go up by more. There may also have been defaults of the corporate bonds held.

Decrements on immediate annuity business

This must be due to mortality as persistency won't be applicable. Actual mortality experience has been more favourable for the company than expected, which suggests that people died sooner. This may have been due to a poor winter which impacted mortality rates of the elderly, a pandemic, an incorrect assumption used in the realistic basis or just a random variation in actual experience.

Investment return on unit-linked pensions without guarantee

Assuming unit reserves are fully matched then no investment profit or loss should occur in relation to the unit funds, but there will be a second order effect on non-unit reserves.

For this product, it is likely that the non-unit reserves will overall be negative on the best estimate basis, as they represent the ability to take credit for the present value of future profits expected to arise. Yields falling and equities increasing will increase the value of the unit funds, and hence increase the income from management charges and reduce the expected cost of any guaranteed benefits payable on death that are expressed as the excess of a fixed amount over the unit fund. These effects would increase the expected future profits and hence the magnitude of the negative non-unit reserves. This reduces the overall liabilities and thus increases the surplus.

Furthermore, yields falling will reduce the discount rate applied to the non-unit reserves. If these are negative, as would be expected, this will increase the magnitude of the negative non-unit reserves which further reduces the total liabilities and thus also increases surplus.

Decrements on unit-linked pensions without maturity guarantees

As already noted, the analysis doesn't split decrements out, so could be related to surrenders and mortality, as well as other drivers such as pups or even changes in premium levels. It is hard to analyse when it contains so many items.

A loss implies that actual experience in the year is worse than the best estimate assumption. For a profitable contract with no maturity guarantees, as noted above, it is most likely that a best estimate non-unit reserve will be negative so the total reserve held (unit fund plus non-unit reserve) will be lower than the surrender value. Therefore a loss would be due to higher surrenders than expected, particularly early on in the contract .e.g. policyholders could be moving to a more attractive product from a competitor or due to recent bad publicity for the company. [*Marks were given for any sensible examples*].

A loss could arise if there is a timing mismatch between the date the assets are sold and the date the payment is made to the policyholder.

Similarly, more policies could have been made paid up. The extent to which the resulting reduction in future charges (on paid-up business) exceeds the fall (if any) in future expenses could also have contributed to the loss.

If the policies pay out a death benefit in excess of the unit fund, then it may have been due to higher mortality than expected, e.g. due to incorrect underwriting. However, as this is a unit-linked savings product this will be less likely to be the reason. For example, mortality charges might apply and could have been amended.

Investment return on unit-linked pensions with GARs

There will be similar impacts on the non-unit reserves to those described above for the pensions without GARs. However, this is likely to be more than offset by the impact of the lower yields on the reserves for the guaranteed annuity rate option. The lower bond yields will increase the cost of providing guaranteed annuity rates (which are guarantees on interest rates) since the gap between the yield offered in the open market and the guaranteed yield will widen.

In addition, interest rate volatilities may have increased which will increase the cost of providing the guaranteed annuity rate.

Yields falling will reduce the risk discount rate and hence increase the cost of providing the guaranteed annuity rate, but this will be a second order effect.

The impacts will be increased further due to the higher unit funds to which the guarantee will be applied due to the other market movements. And it may have been amplified by more people actually taking up the option over the year, if it has been "in the money", than was expected in the valuation basis.

A good differentiator question with the better prepared candidates scoring reasonably well by considering the impact on both assets and liabilities, where appropriate, as well as possible drivers. A disappointing number of candidates did not correctly consider how yields falling on bonds affected both the non-linked liabilities and the assets backing them, and so it is the result of any mismatching between asset and liability cash-flows that would impact the surplus. For the unit-linked business, some candidates made the assumption that an increase in the market value of the assets would fall entirely into profit (i.e. ignoring the fact that unit liabilities would also increase). Many candidates did not consider that it was likely that the non-unit reserves were negative and so a reduction in yields used for discounting in this case would reduce overall reserves. The best candidates expanded on their answers, for example giving details of why an increase in surrenders would reduce surplus, rather than simply stating the fact.

(iv) **General**

Have strong controls and governance in place.
Strengthen the assumptions where necessary.
Improve the analysis.

Immediate annuities – investment return

Attempt to match assets and liabilities more closely by duration.
Invest in corporate bonds with high credit ratings.
Use credit derivatives to protect against defaults.
Restrict exposure to each individual bond.
Use a wide spread of different corporate bonds, for diversification.

Unit-linked fund – decrements

If persistency is the issue then options include the following:

Only deal with agents with good persistency.
Ensure that the commission structure rewards persistency, e.g. clawback of initial commission or use fund-based or level commission.
Ensure that products offer features that are comparable with those offered by competitors.
Ensure that charges are similar to or lower than those of competitors.
Offer bonus units for those who stay for a significant term.
Ensure that investment performance is comparable with that of competitors; employ more experienced managers if necessary.
Set up a retention team that can talk with customers who are thinking about surrendering and offer alternatives.
Rectify any company specific issues relating to reputation or financial strength that might be causing higher surrenders.
Collect premiums via direct debit.
Improve customer service standards, if this is felt to be a cause.
Introduce surrender penalties, whilst acknowledging that product terms can only be amended on new business.
Improve training for sales advisors.

Review customer communications to make the proposition clearer to customers.
Consider changing sales channels/target market.

If mortality is the issue then the company can remove (or reduce) any guaranteed death benefit on new business, and/or have tougher underwriting, introduce/increase variable mortality charges or consider reinsurance, if it can be obtained at a reasonable price.

Guaranteed annuity rates – interest rates

Can use derivatives to protect against falls in yields which would increase the cost of GARs. In particular could achieve this via a swaption: an option to take out an interest rate swap on a pre-determined basis at the guaranteed annuity option date.

Can reprice the guaranteed annuity rate regularly, to reflect changing expectations of future yields.
Could have variable guarantee charges, which could be increased if interest rates fall, or revise them if already in place.

Generally not answered well, with those that struggled on part (iii) also scoring poorly here. Many students did not think widely enough; for example consideration was often only given to a few possible drivers, and solutions, behind poor persistency. Few candidates considered the more general points such as strengthening the controls in place. A number of candidates did not restrict their answer to the question and, for example, considered longevity swaps for annuities despite there having been no loss on decrements for that business. Many candidates could have performed better by demonstrating consistent thinking between parts (iii) and (iv). For example, some *candidates correctly mentioned mitigating actions, such as investing in derivatives, but hadn't mentioned the corresponding event resulting in a loss in (iii).*

2 (i) The unit and non-unit components must be unbundled for the purposes of determining the technical provisions. The best estimate liability for the unit component will be the value of the unit fund, using unit prices as at the valuation date.

Data used should be of sufficient quality for valuing technical provisions

For the non-unit reserves cashflow projections will be required, which should ideally be performed on a policy by policy basis. There is dispensation available to group data under certain conditions. However, this may not be given for this kind of business, as there is little reason not to value on a policy by policy basis for a contract of this type.

All assumptions should be best estimate, with no prudential margins. The projections should allow for all expected decrements, which here will be: deaths, partial withdrawals and full surrenders. The assumptions must reflect the characteristics of the underlying insurance portfolio. They need to take into account all relevant available internal data, e.g. recent experience

investigations and relevant external data, such as published industry surveys. Surrender assumptions should be term dependent to reflect the structure of the surrender penalties.

The non-unit liabilities will be calculated using the following projected cashflows:

- The additional benefit payable under the money-back guarantee.
- Plus the guarantee cost, which is the greater of zero and the premium less the value of the fund on the tenth anniversary. An assumption would be needed about the proportion taking partial withdrawals as those taking partial withdrawals will not benefit from the money back guarantee.
- Plus the expenses incurred by the company and the additional 1% benefit payable on death.
- Less the charges (the 1% per annum, the x% per annum and the surrender penalties).

In order to determine the charges and additional benefits, the unit fund (allowing for charge deductions and decrements) also needs to be projected in each future time period.

Because a closed form approach is unlikely to be able to capture customer behaviour in an appropriate way, it is most likely that a stochastic approach would be used. It would be appropriate to carry out many simulations (probably in the thousands), taking the average to give the best estimate. The key stochastic variable would be investment returns.

The best estimate liability must be "market consistent". Therefore future projected investment returns will have their expectation calibrated to risk-free rates irrespective of the underlying backing assets. Volatility assumptions will be required. These should be calibrated to market observations (for example, implied volatilities within traded market options), and will vary depending on the underlying assets, hence will differ according to the unit fund(s) chosen by the policyholder. Correlations between asset types would also be allowed for when generating economic scenarios.

If policyholders are allowed to switch between investment funds, the model projections may need to make allowance for this. For example, policyholders may switch in or out of higher volatility funds under different economic conditions and this can also be influenced by the existence of the guarantee.

The stochastic model should also have dynamic surrender rates that vary according to the scenario. In particular, it is likely that a *higher* number of surrenders will occur at the tenth policy anniversary when the guarantee is in-the-money, and a *lower* number of surrenders may occur in the period approaching the tenth policy anniversary if the guarantee looks like it will be in-the-money at that date

Charges can be valued by taking the appropriate percentage of the projected unit fund. It is most likely that the expenses will be valued by taking a current per policy cost. This should take into account all directly attributable costs, and include an appropriate loading for all fixed and overhead expenses. Consideration should be given to the extent that the per policy cost may change in the future should the balance between fixed and variable costs change. Investment expenses should be taken account for, and where appropriate should vary by unit fund. However, no allowance needs to be made for possible closure to new business.

Expenses would be projected into the future allowing for inflation, which should be modelled as a stochastic variable and correlated to investment conditions for each scenario.

Tax should be modelled if the product is written on a BLAGAB basis.

All projected cashflows would then be discounted using the risk-free yield curve which is likely to be term dependent. The risk-free yields will be based on government bond yields or swap rates *(precise requirements were not known at the time of writing the Core Reading, so either was accepted).*

At the time of writing of the Core Reading, the extent to which any illiquidity premium could be allowed for in the best estimate liability was not yet clear; however for this particular product where the policy can be surrendered at any time, and hence the liability is highly liquid, it is unlikely to be relevant.

Generally answered reasonably well by those with good knowledge and understanding of this part of the Core Reading. However, several candidates did not demonstrate understanding of the concept of a market consistent valuation and the implications for the investment return, including volatility, and discount rate assumptions.

(ii) The risk margin would be determined using the "cost of capital" method, i.e. based on the cost of holding capital to support those risks that cannot be hedged.

For this product this will include:

- Insurance risk
- Operational risk

It is unlikely that the mortality risk is reinsured and so it is unlikely that a risk margin for reinsurance credit risk will be required. It is also unlikely that there will be any "unavoidable market risk" associated with this product and so no resulting risk margin.

The company will first need to identify the capital that it is required to hold within the SCR for the insurance and operational risks. Allowance for diversification between the risk types can be made.

The company will project this subset of the SCR forward each year for the whole period of run-off of the existing book. These projected capital amounts are then multiplied by a cost of capital rate. For Solvency II it is currently proposed that it is a fixed rate of 6% per annum. The product of the cost of capital rate and the capital requirement at each future projection point is then discounted to give the overall risk margin. Discounting is done using risk-free rates.

Since the projection of the SCR is potentially complex, various simplified approaches can be used. This could involve selecting a driver which has an approximately linear relationship with the required capital or its components. For example, the mortality risk could use the unit reserves as a driver, the expense risk might use policy count, the operational risk could use unit or total reserves.

The initial capital requirement can be expressed as a percentage of that driver, and the projected capital is then approximated as the same percentage of the projected values of the driver. In practice, more sophisticated methods using a combination of drivers and correlations may have to be used.

The risk margin for the product may be reduced to take into account diversification between other lines of business that the company might be writing. For example, the diversification benefit might be apportioned according to the (subset of) SCR used at the start of the risk margin projection.

Answered reasonably well by the well-prepared candidates, who considered both the detailed calculation and the approximate approaches. Only the better candidates tailored their answer to the specific scenario given in the question, by considering which risks could be not hedged for this product. A number of candidates answered the question by assuming the risk margin and the SCR were the same.

(iii) The standard formula uses standard prescribed stress tests or factors and correlation matrices. Therefore, it requires less analysis and decision-making than using an internal model.

Calibrating an internal model is difficult, since historic data available to calibrate extreme events is limited. Setting correlation factors that apply under extreme conditions is also challenging. The calibration also has to be tailored to the specific features of the company, which can be difficult.

The internal model is also likely to take much longer to build, and to check and validate. The company may not have the necessary expertise in-house to achieve this, particularly since it is a small company.

It may be difficult to explain the model to senior management/board.

The approval process for the internal model is also onerous, so therefore will be costly both monetarily and in terms of management resources. This is at a time when resources are already stretched through the general implementation of Solvency II and the timetable is tight – with the approval process

potentially adding more delay to the implementation plan. The company may have incurred all of the development costs, only for the model to be "failed" by the regulator.

The "use" test is particularly onerous. This requires companies to demonstrate that their internal model is widely used throughout all relevant areas of the business and that it plays a significant role in the internal governance, risk management and decision-making processes. This requirement places a significant ongoing management cost in both doing it and evidencing it, including documentation. However, the ORSA also requires significant documentation of processes and evidencing of use, so the company needs to put these into place anyway.

So overall the standard formula is much more straightforward to implement.

The company would also have to consider how well, or otherwise, the standard formula matches the company's risk profile. If the risk profile of the business differs materially from that covered by the standard formula, the company should use an internal model. For example, this may depend upon the specific target market.

The internal model may allow the company to hold a lower overall capital requirement. This has advantages for both capital management, for example pricing. The additional cost and burden of the internal model must be weighed against this.

The company may have a view on its ability to meet the SCR on the standard formula through its involvement in the Quantitative Impact Studies. The company will not wish to risk not meeting the SCR due to the regulatory intervention that will result.

If the company already uses an internal model for risk management and other decision-making purposes (e.g. pricing) then it may be more likely to use the internal model for SCR purposes.If it does not already have such a model, then it would be likely to benefit from the development of one as part of its risk management framework, which may improve risk modelling and decision-making within the organisation. This could give the company a competitive advantage.

Based on the balance of the above arguments, the company might decide to use a combination of the two, i.e. a partial internal model which would enable the guarantee to be modelled appropriately.

Reasonably well answered with most candidates considering areas such as the "use test". The better performing students covered a wide range of points in comparing the standard formula with an internal model, and considered the amount of work involved in the implementation of an internal model.

(iv)

- mortality YES
- longevity NO
- disability/morbidity NO
- surrender YES
- expenses YES
- revision NO
- catastrophe (e.g. pandemic) risk YES

Generally well answered by those candidates who knew what is included in the insurance risk sub-module.

(v) Pillar 2 sets out requirements for the roles and responsibilities of key functions within the business. The Board will have to accept overall responsibility for ongoing compliance with Solvency II.

The company will need to put into place (if not already there):

- risk management function
- actuarial function
- compliance function and
- internal audit function

The organisational structure must have clear segregation of responsibilities, the minimum levels of which are defined within the Pillar 2 framework.

In addition to the SCR and MCR, the company will be required to carry out an Own Risk and Solvency Assessment ("ORSA"). In order to do so, it will need to identify all the risks to which it is subject and the related risk management processes and controls. This will include some of the more qualitative risks that have not necessarily been assessed under Pillar 1, such as reputational risk.

It then needs to determine the own funds necessary to ensure that its overall solvency needs are met at all times, and quantify its ability to continue to meet the MCR and SCR over the business planning horizon (usually three to five years), allowing for new business. This does not have to be at a prescribed confidence level, but at a level that the company feels is appropriate. The company has set a target of a high credit rating and a low appetite for risk. The chosen confidence level must reflect this, and therefore it is likely to be fairly high.

In order to demonstrate continued solvency under Pillar 2 at this high confidence level, the company needs to ensure that it has defined and implemented processes that seek to achieve that aim. The processes should be designed around the specific risks associated with the business with the aim of keeping the risk within the specified tolerance.

With this product the key risk is likely to be that associated with the money-back guarantee. Key processes will therefore be:

- Pricing: determining when to change the value of the *x*% per annum charge for new business.

- Investment strategy: with a low risk appetite, the company may decide to hedge the investment risk underlying the money-back guarantee (if it does not already do so), accepting that there are likely to be some residual basis and counterparty risks. There may be constraints imposed on the types of unit fund on which the guarantee can be given (for new business). The company will also need to specify levels of cash within each fund to mitigate liquidity risk.

- The company may choose to outsource its administration to mitigate the expense risk, albeit again introducing counterparty risk and potentially increasing the reputational risk.

- Operational risks should be controlled through having clear and well communicated processes, data and systems controls, staff training and business recovery plans.

The company may decide to improve its management information, in order to provide clearer evidence of the embedding of good risk management processes. Risk management actions should have trigger points for escalation/action. Each process should have an identified owner who is responsible to the Board for managing the risk within the specified appetite and for producing the evidence that this is the case.

In assessing the Pillar 2 solvency requirements, the company will have to assess its ability to manage the risks as stated.

The company will also need to consider strategic decisions in the light of their impact on the ORSA and it will need to produce clear evidence to the supervisor showing that the ORSA is used by senior management.

Many candidates failed to provide enough detail in their answers (noting the fairly high number of available marks) and as a result failed to score well on this question. Many candidates did not cover how Pillar 2 requirements might impact the management of the product, and many did not consider how the information provided about the company's risk appetite might have some relevance . Candidates who performed well stated where the company's main risks lay and gave examples of how these could be mitigated to get a better credit rating.

END OF EXAMINERS' REPORT