

INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

April 2014 examinations

Subject ST7 – General Insurance: Reserving and Capital Modelling Specialist Technical

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 ST7

Candidates who are well prepared generally appear to perform reasonably on ST7.

Candidates should consider the following advice :

- Lists are hugely valuable for breadth of point generation but candidates should always exercise judgement when applying them, in many instances questions will be specifically designed to render a number of the standard points inappropriate and marks (often generous multiple marks) will be available for identifying and articulating these nuances well.
- Calculation questions will come up on a regular basis in ST7, as candidates will observe from past papers. Candidates should always be prepared for such staples as balance sheet preparation, triangle manipulations and projections and reinsurance layer calculations (along with being able to carry out any necessary adjustments including inflation, exposure, earning distortion and time period issues).
- Capital questions should be expected on every paper and represent a sufficient proportion of the course content that candidates should not expect to be able to pass on their reserving knowledge alone. Those who do not encounter capital work in their professional lives should be particularly careful to ensure that they take time to familiarise themselves with this element of the course.
- Candidates should aim to be able to give near exact glossary definitions as incoherent or vague descriptions will be marked harshly. If candidates struggle to remember definitions verbatim they should take the time to properly analyse the glossary definition to ensure they have fully absorbed all the nuances of the definition.
- It is important to always read the question properly. Failure to read the question properly remains the single most important driver of failure in this exam.

Comments on the April 2014 paper

A number of candidates appeared to be somewhat thrown by the comparative weight to larger questions, although the content balance was in line with normal weightings.

Overall, student performance was poor and the subsequent pass rate low. Detailed comments can be found under the relevant sections.

- Q1 – Many candidates failed to extract the relevant information from the question. The question specified the model was stochastic; many candidates suggested deterministic methods or spoke about reserving rather than stochastic modelling.
- Q2 – again many candidates did not seem to read the question properly. The report was to consider policyholder issues whereas many candidates considered it from the shareholder point of view. Ironically many of the same points could apply (a financially robust company is after all more likely to survive long enough to pay policyholder claims) but many candidates did not explain this before going off on a tangent.

- Q3 – many gave this a reasonable go; those who approached the question in the order it was asked (i.e. thought about the risks of the venture and then about what insurance might be suitable) generated more points.
- Q4 – many candidates gave extensive descriptions of the risks in spite of a “list” command word, and most made few if any efforts to highlight those particularly relevant to a company of this type, in spite of the question wording being split into two sections to make it clear that there were marks available for doing so (a lot of marks). Many candidates offered generic reinsurance content only in the second half, rather than tying it to the company in question.
- Q5 – this is a very typical ST7 application question. However, many candidates seemed confused by the calculation questions and even the opening bookwork question was poorly (and often tautologically) answered. There was often an odd balance within answers between spurious accuracy (applying an inflation adjusted chain ladder method when it would have been perfectly reasonable and significantly easier to state the necessary assumptions that meant inflation adjustment was not needed) and inappropriate simplification (assuming, often implicitly, that earnings were even in spite of the guarantee element clearly not earning evenly). Many candidates also basically gave up on the final section if they struggled on prior sections, but should have been able to salvage some marks if they paused to think about the issues afresh (even if they no longer had time to go back and rework their calculation)

- 1** The two approaches are to model premiums and claims net of reinsurance and recoveries and to model the reinsurance programme directly.

First approach: modelling net of reinsurance

The first approach is simpler, cheaper and quicker to implement..
...simplicity of model building is the principal advantage of this approach.

Only one set of claims would need to be modelled and there would be no need to develop a modelling approach to the reinsurance programme itself.

This may be sufficient if the company has a very simple outwards reinsurance programme that has not changed in recent years, e.g. a quota share.

The principles of materiality and proportionality should be applied, e.g. if reinsurance recoveries are not expected to be significant then the first approach may be appropriate.

This approach would also be more suitable if the inwards business has been stable over recent years as this will affect the stability of the net data.

One disadvantage is that it may be difficult to compile suitable statistics to calibrate appropriate distributions.

For example, if the reinsurance programme has changed significantly over the years then recent business may behave differently from older business in all aspects, for example the shape of the distribution of loss ratios and the timing of cash flows.

Another disadvantage is that the model is less flexible.

It may be possible to use it to estimate current capital requirements, but it will not be possible, for example, to use it to assess the effect of changing the reinsurance structure.

It is possible that the insurer has some reinsurance protection that has never been used but that might be used for some of the more extreme gross claims that should be modelled, e.g. excess of loss reinsurance at very high layers.

The data on which the model has to be parameterised will not allow for the existence of this reinsurance or for significant changes in the reinsurance programme.

For a net analysis by class reinsurance covering more than one class unless very simple would be difficult to allow for.

A model that does not generate separately claims from different causes, different size bands and those that arise from catastrophes will be of limited use:

It may provide a reasonable estimate of capital requirements but it will provide less insight into the events that could cause insolvency.

One particular method is to derive a gross distribution and scale down the distribution such that the mean equals the net best estimate.

This will usually overestimate the uncertainty surrounding net reserves as reinsurance protection tends to dampen down volatility.

Using net triangles to derive the predicted distribution will understate volatility if for example reinsurance retentions are increasing for more recent origin periods *and vice versa*.

Second approach: modelling reinsurance explicitly

Modelling reinsurance explicitly will allow recoveries such as those from reinsurance protections which have not been used.

Conversely, a disadvantage of the second approach is that it will make the model more complex to build and understand, and the complexity will be increased the greater the complexity of the programme.

It also has implications for the complexity of other parts of the model: e.g. if the company has an excess of loss protection then it will need to model separately the gross claims that exceed the excess of loss retention and those that do not, *or other relevant example* or to model all claims individually.

This will mean that the model will take longer to build, will be more prone to error and will be harder to verify.

If the reinsurance programme is modelled explicitly then differences between the programmes in different past years can be allowed for.

An advantage of modelling the reinsurance programme directly is that recoveries from reinsurers can be directly calculated.

We will need to model the elements separately if we are to explore cash-flow implications, credit risk from reinsurance recoveries and liquidity risk.

Directly modelling the reinsurance programme enables allowing for features such as exhaustion of cover and reinstatements.

Directly modelling the reinsurance programme enables allowing for explicitly specified dependencies such as increased propensity for reinsurance credit default risk when there is a very large catastrophe.

However, the time and resources spent on developing and using a complex approach may mean that less time and resources are available for development of other parts of the model.

Overall

The two approaches are not entirely mutually exclusive.

Reinsurance programmes can be very complicated and it may not be necessary to model every single aspect to get a reliable idea of capital requirements, e.g. it may be necessary to model explicitly the effect of some more-complex part of the programme but treat a simpler part net, or use a separate catastrophe model to estimate recoveries on possible catastrophes.

Other generic points, e.g. 2nd approach allowing for risk of cover being exhausted, or vertical cover being breached, or requiring detailed knowledge of current and historical covers, order of operation of contracts etc.

Conclusion

Unless a reinsurance programme is very simple and has been consistent for many years the arguments in favour of modelling reinsurance explicitly seem to be very strong.

There was overlap between advantages/disadvantages with disadvantages/advantages under the two approaches and this was allowed for when marking if considered appropriate.

*A few candidates gave stochastic and deterministic as the two approaches despite the question specifying that the model is stochastic. A large number of candidates gave two simplistic approaches rather than one complex, one simple which might have been the answer if the question said "Discuss two approaches...." or, more likely, "Discuss two methods..." but not with the actual request which was "Give **the** two approaches...." Many candidates answered a question effectively about reserving methods rather than stochastic modelling. Generally more detail was needed.*

2 *The actuary needs to consider whether the merger will disadvantage the policyholders of either company.*

General insurance policyholders' main interest is in having their claims paid, so the most likely disadvantage to them would be if their claims were less likely to be paid in full if the merger takes place.

There are other possible disadvantages of the merger to the policyholders.

For example, there may be competition implications:
with fewer companies competing in future, prices may rise.

One of the two companies may give notably better service to its policyholders than the other, and it may be that the poorer company's standards will apply in future to all policyholders.

One of the two companies may take a more restrictive attitude to claims payment than the other and it may be its standards that prevail in future, to the disadvantage of the other company's policyholders.

Anti-selection could take place post-merger if the underwriting criteria of one company are implemented post-merger whereas some risks would have been avoided by the other company which could create problems in the future.

Timing of payments could be an issue if one company takes notably longer than the other to assess and make payments which could negatively impact policyholders e.g. liquidity risk.

Short-term considerations e.g. changes to systems and processes may cause disruptions and delay claim payments.

The score given by rating agencies before and after the merger should be considered.

Plus quality of management of the two companies and quality of those likely to be managing post-merger.

The likelihood of classes of business being dropped, e.g. might be expensive if schemes of arrangement or novation are necessary

The business plans of each company should be considered and how these would likely change after the merger.

However, these questions may be outside the technical expertise of the actuary, who will need to obtain feedback from other experts in order to complete the report. The report should make it clear which areas have been investigated and those for which reliance has been placed on the opinions of others.

The question of whether or not the merger will make one company's policyholders significantly less likely to be paid will depend principally on its liabilities and its capital.

The actuary may make his own investigations of the companies' capital position or rely on the companies' own investigations.

These should be sufficiently detailed to determine that there is no significant probability of either company being unable to pay all claims arising from its business.

If this is the case then combining the two companies should not cause any problems in this regard.

The investigations should cover all aspects of the risks to the companies' solvency: insurance risk, credit risk, market risk and operational risk etc.

It may be that such investigations are required as a normal part of the risk-management process, for example if the country has standards equivalent to Solvency II.

The actuary will probably want to make an independent review of the reserves of each company to ensure that the comparison between the two companies is made on a consistent basis.

There should be an assessment of any margin in the reserves in the capital assessments but as reserves constitute a large proportion of any insurer's balance sheet this is likely to be a matter that the actuary will wish to verify.

Concentration risk should be considered if the two companies write very similar business

In this investigation it is likely to be particularly important to investigate areas such as large claims, latent and extreme long-tail claims such as asbestos, pollution and health hazards and the treatment of reinsurance recoveries,

It is possible that one company's capital is exposed in a way that the other's is not, e.g. to latent claims or catastrophes. This might affect the security of one company but not the other. The actuary should consider this possibility and investigate if necessary.

Even if the two companies are not both well capitalised the required opinion may still possibly be given, e.g. if one of the companies is very large and well capitalised and the other small and not well capitalised then the merger may improve the position of the smaller company's policyholders without significantly disadvantaging those of the larger one.

If both are relatively poorly capitalised then the diversification effect between the two may be sufficient to be able to give the required opinion.

However, these situations may require a more thorough investigation that examines the position of the combined company as well as the two separate companies.

In order to make these investigations the meaning of the word "significantly" needs to be formally defined.

It has been used here in two contexts: the policyholders must not be significantly disadvantaged by the merger and one of the criteria is that neither company should have a significant probability of not being able to pay its claims.

These may be defined in the legislation, but it is more likely that the actuary will have to set his own specifications for these.

Examples of such reports may already exist and there may accordingly already be understood definitions of "significantly disadvantaged" and even a report template with an outline of the issues to consider and this could be used as a starting point.

Professional guidance needs to be considered.

Any other generic points such as those related to valuation of assets, reinsurance programmes, benefits from synergy/diversification, expenses of the merger etc.

Many candidates failed to focus on the impact to the policyholder and digressed without then saying how the policy holder would be affected. A few were more concerned with the effect on shareholders rather than policyholders. Very few candidates commented on what “significantly disadvantaged” actually might mean.

3 *Risks/Considerations: not all insurable*

This is a long-term project.

It requires various stages: planning, building of space-rockets or purchase from governments with adaptation for deep-space mining and carriage back to Earth, testing and implementation, running and maintenance. The risks need to be considered for each of these stages.

If the rocket ships were bought from governments they would still need to be modified for mining purposes and would necessarily not be new and therefore have been subject to “wear and tear”, while if built by the consortium considerable expertise would be required including information which may well be classified.

Actually starting the project may be problematical if public opinion, possibly influenced by pressure groups, is that the environmental risks are too high e.g. fracking and green organisations could be considered mild in comparison.

Also some of the billionaires may pull out e.g. if insurance costs are too high or insurance is not available.

The technical challenges of the project are very significant. There is a high risk of escalating costs and delays in realising profits.

Need very long-term insurance which may not be available..

Jurisdiction is a major consideration:

If insurance claims are made for operations in space under which country's legal system would they apply?

The ground operations will be subject to the jurisdiction of the relevant country but what jurisdictions apply to operations in space is difficult to say and may well also change over time.

Taxes and fees may be imposed on operations making the scheme unprofitable also governments may change hence changing legislation, taxes, fees etc.

It may be considered that the consortium would have free access to the asteroids/minerals. But things could change: governments may lay claim to the asteroids and either charge high fees to mine them or deny access.

Governments may impose restrictions or ban operations completely if the environmental risks are considered to be too high.

At the moment the consortium may be the only likely player in the game but this may not be the case in the long term, e.g. if costs drop considerably in the future possibly because of technical innovation then prospects may well change.

It is stated that Earth's resources are being depleted but in the long-term there may be cheaper substitutes for these resources or new discoveries of the minerals on Earth, lessening requirements.

Mining has not taken place yet on asteroids so the problems involved can only be guessed at. The difficulties involved may be considerably more than envisaged thus making insurance costs inestimable.

Such an enterprise would be high profile.

If anything were to go wrong e.g. rocket crashing to Earth or exploding with loss of lives public opinion could well mean that the enterprise would have to be terminated.

Market considerations: if countries are in recession demand for precious minerals may be low.

It is stated that the asteroids contain immense quantities of precious minerals but this can only be based on limited samples and therefore may not be true.

If the rocket were to fall from space to Earth there could be cataclysmic consequences: loss of many lives, considerable property damage, including climate effects equivalent to that from impact by a reasonably sized meteorite.

Any catastrophic events could lead to punitive damages e.g. as per the BP Deepwater Horizon oil spill. Punitive damages may or may not be insurable.

Possible insurance required:

Liability Cover.

Workers compensation (WC) or employers' liability (EL)

It is unclear which of these would apply (WC in which losses merely have to be suffered in the course of employment; EL requiring employer's negligence) as this depends on whose jurisdiction would apply.

Stress associated with space travel is an unknown factor which could be covered under EL.

There is the possibility of latent claims as all the problems of space travel are not known.

Some problems are known about such as muscle and bone deterioration and radiation damage which as known about may not be insurable.

Directors' and Officers' Liability (D&O)

Because of multiple jurisdictions, innovation and the massive size of the project increases the scope for possible D&O claims.

Professional Indemnity

Could be large sums involved e.g. if projected profits are based on professional advice.

Key Person Insurance

The project may rely on expertise e.g. from space engineers, rocket scientists etc.

Public Liability

This is a legal requirement in many jurisdictions.

Motor third-party liability

The company will own cars used by employees and lorries used inter alia to transport the minerals.

Aviation/Spacecraft liability.

Bodily injury caused by space craft: high risk and possibility of large numbers..
Plus damage to property caused by the space craft: high risk and possibility of extensive damage.

Marine Insurance

Recovery of space craft and minerals may well be at sea.

Environmental Liability

There is the possibility that matter brought back from space could cause pollution ... and also from rocket fuel.

It is not known if governments of countries where the minerals are landed would impose quarantine restrictions on the minerals or returning crew in case of unknown contamination and whether insurance is required for any possible contamination.

Property Damage

To the Space Craft

The individual rocket-ships will need to be insured both for physical damage with the cost of replacement being high and repairs in space e.g. requiring another rocket to access the damaged one and make the necessary repairs plus rescuing any crew.

Physical damage or total loss may be caused by either failure of equipment, human or computer error or by impact e.g. from natural space debris such as small asteroids and meteors or from space debris left by previous space flights.

Sabotage and piracy are possible risks e.g. from possible rival companies, terrorist organisations, rogue countries or extra-terrestrials!

The company's infrastructure will need insuring for property damage including offices and plants for processing minerals and building/maintaining space craft.

Business interruption insurance

e.g. for postponing of launches because of bad weather, public actions if considered "wrong", sun-spot activity etc.

Goods in Transit

Required for when minerals are in space ships and movement in lorries, ships etc.

Personal Accident

The benefits payable under PA are likely to be pitched high for space pilots etc.

Project Insurance

Should be considered i.e. multi-class multi-year insurance for the whole project if can be purchased

Are there sufficient data available for the assumptions made to enable insurance against the assumptions being wrong, or is the project of too large a size and complexity to be able to be insured unless considerably over-priced?

Considering all the risks involved insurance cost may be higher than the market will stand, or at least will require very large excesses.

Self-insurance via a wholly owned captive is one possibility with reinsurance above a large deductible, again if reinsurance is available.

Any other generic risks or types of insurance not given above if explanation is reasonable e.g. fidelity guarantee, creditor, construction.

This question was generally answered reasonably. However, very few noted that jurisdiction would be important. The candidates who did worst were those that started with a list of insurance types and therefore missed many project risks. Those who started by writing about risks for the company, as suggested by the question, did better but still often did not manage to relate types of general insurance to the particular risks of this company.

4 (i) Insurance risk

Gross underwriting risk

Very important as will be very large variation in gross claims and pricing risk as there is a lack of data for a new product.

If mentioned business mix, terms and conditions, lack of data/experience, etc.

Gross reserving risk

This will only become a factor after the company starts operation and may not be a large problem as claim-triggering events should be known at the time reserves are estimated unless, e.g. the risks have been underestimated and there is a slow build-up to the excess point.

Net/Reinsurance insurance risk

This is important as there could be disputes and exhaustion and high variability in reinsurance results (assuming reinsurance has been obtained)

Aggregate insurance risk

There will likely be high correlation between results for the different insurers as they will probably be affected by the same catastrophe events.
Alternatively: catastrophe risk, accumulation risk, latent claims risk

Other considerations of insurance risk:

It is likely that multi-year cover would be offered.

The underwriting cycle will probably affect all the insurers covered.

There may be gaps in the preceding coverages of the insureds or preceding reinsurance layers may have been exhausted.

Selection risk

The information available to the insured will be much greater than that for Stop Loss Re.

Market risk

It is likely that there will be correlation between asset values and claims.

Examples: weather events will produce claims and affect the infrastructure of companies whose stocks and non-government securities Stop Loss Re is invested in.

Credit risk

Investment credit risk

Example: Non-government bonds may decrease in value if issued by companies affected by catastrophic events.

Counterparty credit risk

Example: catastrophic events may affect the reinsurers of Stop Loss Re leading to defaults.

Operational risk.

Administration risk

Not important assuming correct expertise.

Moral Hazard

This would be high for a Stop Loss reinsurer e.g. the insured will have little incentive to control claims once the deductible has been breached.

Fraud

May be scope for fraud as distinct from moral hazard if claims not controlled once deductible breached.

Compliance/Regulatory risk

Should not be important.

Event risk

.. not important unless a catastrophic event were to affect the operations of the company e.g. a terrorist event affecting the head office.

Governance risk

Should not be a problem if have correct people.

Technological risk

Should not be a problem although there may be initial problems for a new company.

Pension scheme risk

Should not be a problem as a new company.

Liquidity risk

..should not be a problem as should be allowed for.

..claims would be incurred at the end of an insurer's financial year and the amounts of any loss should be anticipated based on Stop Loss Re's analysis when writing the business and knowledge of events affecting the insured thereafter.

Although the exact amount could be subject to considerable fluctuation and amounts involved are very large.

Currency risk

The business reinsured will likely be in various currencies but converted to one currency for the operation of the Stop Loss cover.

Group risk

The results for Stop Loss Re are likely to be highly correlated with those for the group as affected by the same catastrophe events.

Reputational risk

Depends on the reputation of the group and being able to pay claims so would be affected if other risks lead to problems with payments.

Group reinsurance risk

Depending on group reinsurance arrangements there may be a risk if these are not subject to the same contractual terms and conditions as reinsurance agreements available in the market.

..or a concentrated credit risk.

Centralised function risk

Probably not a problem.

Other risks

Strategic risk

There is a risk that Stop Loss Re is unable to implement its business plan and strategy, or adapt to changes in the business environment.

Political risk

Could be important e.g. as catastrophic events could affect the regulations in particular countries, *or other example*.

Enterprise risk

Important for Stop Loss Re to provide a framework for risk management, identifying the events relevant to its objectives, their likelihood and size of impact, determine response strategy and monitor progress.

Any other risk and rationale.

Note: there can be overlap between some risk categories. Also the opposite viewpoint may be given e.g. saying that a risk is important whereas the answer given says unimportant, if reasonably justified.

- (ii) Because the business covered is whole account the **only** traditional types of reinsurance available are stop loss and quota share.

However, quota share is also effectively stop loss as it is a proportion of stop loss policies.

The data would not be available to allow any other types of reinsurance.

Stop Loss Re's rationale is based on stop loss being difficult to purchase/over-priced so to the same or possibly greater degree Stop Loss Re will find it difficult to get retrocession cover.

Stop Loss Re will have to make extensive examination of the companies it reinsures in order to write the business and establish a price. This is even more difficult for a reinsurer of Stop Loss Re being one step removed, is likely to contain a substantial proportion of retrocession making the business covered even less transparent, and because of the large amount of business written assuming Stop Loss Re were successful.

Some reinsurers may be reluctant to provide cover as there could be a spiral effect whereby reinsurers themselves are looking to purchase cover from Stop Loss Re.

Obtaining reinsurance cover is also difficult for any new company with no track record.

As many of the losses that could arise would be because of large catastrophic events such as tsunamis, earthquakes, hurricanes, Stop Loss Re could consider industry loss warranties (ILWs) with triggers based on the total loss for such events or other such financial arrangements.

An ILW would not be a perfect match for the losses from such events and would not cover losses from events for which such warranties are not available such as general deterioration in results from (possibly changed phasing of) the underwriting cycle, earthquakes in non-standard areas, terrorist activity such as 9/11 (*or other examples*).

Reinsurance could be purchased from the parent group but as the size of any claims are likely to be huge the parent group would still have problems.

Part (i) – Many candidates gave full descriptions of each risk while the question only asked for a list, thereby wasting time. Although many candidates gave all or most of the possible risks they were generally unable to specify, where appropriate, how these were of particular relevance to a whole account stop loss reinsurer.

Part (ii) – Most candidates just trotted out a standard list of the standard types of reinsurance which could be used by a standard insurance company, without considering that this company's inwards business is solely whole account stop loss for which reinsurance such as surplus and excess of loss are not possible as there is no way in which the data could be obtained to use them. Very few stated that the only types of reinsurance that could be used are stop loss and quota share (which is also effectively stop loss). Some candidates explained the problems the company might have in obtaining reinsurance cover. A few candidates suggested non-standard reinsurance cover such as ILWs. In general marks were very low for this part.

5 (i) UPR: Unearned Premium Reserve

The amount set aside from premiums written before the accounting date to cover risks incurred after that date.

URR: Unexpired Risks Reserve

The reserve required to cover the claims and expenses that are expected to emerge from an unexpired period of cover.

AURR: Additional Unexpired Risk Reserve

The reserve required to cover the excess of the URR over the UPR, if greater than zero.

(ii) *For standard contents part of business*

Development factors

Year to yr	2.1142	1.0478	1.0000	1.0000
Cumulative	2.2154	1.0478	1.0000	1.0000

Ultimates and outstanding claims

<i>UwYr\Dyr</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>Ultimate</i>	<i>Claims Reserve</i>
2010	1,210	2,625	2,756	2,756	2,756	0
2011	1,817	3,938	4,121	.	4,121	0
2012	2,121	4,321	.	.	4,528	207
2013	2,075	.	.	.	4,597	2,522

CL assumptions

Regular development

Future inflation same as past inflation

Fully developed over 4 years: no tail

Alternatively, candidates could use an inflation-linked chain-ladder methodology (although this is a lot more work and probably would not give a more accurate answer i.e. probably not worth the effort). The future inflation assumption above would need to be changed and an assumption made about future inflation with 1.5% p.a. being one possibility.

Other assumptions

Assume 10/11'ths of premiums are for the standard contents policy, based on the 10% loading given, and 1/11'th for the return guarantee

DAC ignored

No reinsurance

For standard cover part of business, adjusting from an underwriting year to an accounting year basis

Assuming that for the standard cover part:

Annual policies

Written evenly throughout the year

Earned evenly over policy year

$$UPR = \frac{1}{2} \times 10/11 \times 3,174 = 1,443$$

$$URR = \frac{1}{2} \times 4,597 = 2,299$$

$$\text{Claims reserve} = 2,299 - 2,075 + 207 = 431$$

(Or, alternatively, if reasonably argued,

$$\text{Claims reserve} = \frac{1}{2} \times 2,522 + 207 = 1,468$$

$$URR = \frac{1}{2} \times 2,522 = 1,261)$$

For return premium guarantee part of business

For premiums still being renewed:

Total written premium for policies still being renewed = 9,851

All of one eleventh of this premium is allocated to the premium return and is assumed to be unearned as the benefit is not paid until the end of each 10 year period.

$$\text{UPR} = (1,375 + 2,175 + 3,127 + 3,174)/11 = 9,851/11 = 896$$

The UPR can be calculated without considering the breakdown of tranches of business as it is just $1/11^{\text{th}}$ of the total of the still being renewed column in the table. However, to calculate the URR we need to know how much premium is expected to be returned at the end of the 10-year periods and to do this we need to calculate the amount of premium still being written for each tranche of business by start underwriting year. For this we consider the amounts written for each tranche in the start year and the amount in each subsequent year up to 2013 which we know has increased by inflation as stated in the question because we have been informed that no claims have been paid for these policies. Hence, considering for each tranche of still renewing policies, by start year, the amount written in each underwriting year:

For tranche of business started in underwriting year 2010 and still being renewed in 2013:

WP for uwyr 2010 = 1,375 (from table)

WP for uwyr 2011 = $1,375 \times 1.0572 = 1,454$ (inflated as per RPI table)

WP for uwyr 2012 = $1,454 \times 1.0617 = 1,543$ (inflated as per RPI table)

WP for uwyr 2013 = $1,543 \times 1.015 = 1,566$ (inflated as per RPI table)

For tranche of business started in underwriting year 2011 and still being renewed in 2013:

WP for uwyr 2011 = WP for business started in 2010 and 2011 still renewed in 2013 less WP for business started in 2010 still renewed in 2013
= $2,175 - 1,454$ (from table and previous calculations respectively)
= 721

WP for uwyr 2012 = $721 \times 1.0617 = 766$ (inflated as per RPI table)

WP for uwyr 2013 = $766 \times 1.015 = 777$ (inflated as per RPI table)

For tranche of business started in underwriting year 2012 and still being renewed in 2013:

WP for uwyr 2012 = WP for business started in 2010 to 2012 still renewed in 2013 less WP for business started in 2010 and 2011 still renewed in 2013
= $3,127 - 1,543 - 766$ (from table and previous calculations)
= 818

WP for uwyr 2013 = $818 \times 1.015 = 830$ (inflated as per RPI table)

WP for tranches of business started in 2010 to 2012 still being renewed in 2013 = $1,566 + 777 + 830 = 3,174$ which is the WP for 2013, thus confirming that the company has ceased writing new business for this class as of 2013 as per the table in the question for which for 2013 written premium total = written premium for policies still being renewed from previous years.

In table format:

<i>Uwyr</i>	<i>Written Premium</i>	<i>From Policies 1st started in</i>			
.	.	<i>2010</i>	<i>2011</i>	<i>2012</i>	<i>2013</i>
2010	1,375	1,375			
2011	2,175	1,454	721		
2012	3,127	1,543	766	818	
2013	3,174	1,566	777	830	0
Total	9,851	5,938	2,265	1,648	0

Assuming that, as per previous years, no policyholder who has sustained claims renews.

Assuming a lapse rate of 20%, either because this is the lapse rate for a standard policy or because annual lapse rate for policies initially started in 2010 is:

$$1 - (1,375/2,675)^{1/5} = 19.9\%$$

For policies started in 2010, for guaranteed premium return in 6 years time:

$$\text{URR} = (1,375 + 1,454 + 1,543 + 1,566) \times 0.8^6 = 5,938 \times 0.2621 = 1,557$$

For policies started in 2011, for guaranteed premium return in 7 years time:

$$\text{URR} = (721 + 766 + 777) \times 0.8^7 = 2,265 \times 0.2097 = 475$$

For policies started in 2012, for guaranteed premium return in 8 years time:

$$\text{URR} = (818 + 830) \times 0.8^8 = 1,648 \times 0.1678 = 276$$

$$\text{Total URR for guarantee element} = 1,557 + 475 + 276 = 2,308$$

$$\text{Overall total UPR} = 1,443 + 896 = 2,338$$

$$\text{Overall total URR} = 2,298 + 2,308 = 4,607$$

$$\text{AURR} = 4,607 - 2,338 = 2,268$$

Answers from above.

Outstanding claims reserve = 431; UPR = 2,338; AURR = 2,268.

- (iii) The lapse rate assumed of 20% is that for standard contents insurance so is unlikely to be applicable to this class, for which lapses will almost certainly occur where claims have been made, particularly early in 10-year period as the value of the guaranteed return benefit will have reduced so it may be more beneficial to buy a standard policy, and will be very few lapses towards end of period when guaranteed return is large relative to renewal premium.

This may also affect the claims experience as policyholders may not claim for losses towards end of policy because of the guarantee.

This is not likely to affect current claims development figures as only up to 4 years through period for any policy.

The lapse rate shown for policies started in 2010 works out at $1 - (1,375/2,675)^{1/5} = 19.9\%$ which stacks up with the 20% assumed for standard contents policies but this is an average and it is more likely that lapse rate will decrease each year so lapse rates for later years will likely be less than 20%.

It can be seen that this class of business is running at a loss, which is presumably why no new business was written in 2013.

As there is a guarantee to continually renew current business and business is running at a loss it may be considered that there should be a reserve for future renewals on this business.

Assuming that only policies with zero claims will renew may not be correct particularly for policies 4 years through the guarantee period, but this may improve the reserves situation assuming keeping the same lapse rate assumption.

The assumption used for premium sub-division was that premiums (and sums insured) had increased in line with RPI, as per the guarantee stated in the question, but there may have been scope for changing this for individual policyholders with substantially changed circumstances (e.g. moving house to different rated area etc. *or other example*).

Although in that case unlikely, with the assumptions used, that the balancing item for premium for new policies in 2013 would be zero as the premiums would not have increased as per the calculations made.

No mention has been made of discounting.

If allowed to discount the URR this would also improve the results.

However, it should be noted that the decrease in RPI rate change could imply that discount factors could well be much less than they would have been at previous valuations.

A reduction in interest rates would also be one reason why the business is now unprofitable and no new business is being written.

However, this does mean that the assumption that one eleventh of premiums are applicable to the premium return guarantee may be an underestimate. This would increase the UPR but may not affect the URR depending on the other assumptions made.

The assumption that policies are written evenly over the year for 2013 may not be correct. As no new business was written in 2013 it may be that new business ceased sometime in 2012 so renewals for this business would be concentrated in the earlier part of 2013 *or alternatively that premiums written in 2010 may be bunched towards the end of the year.*

Any generic points on problems with estimation of reserves such as reserving philosophy, previous over-/under-estimates, inclusion of margins, non-homogeneous claims, future inflation not same as past inflation, legislative changes, errors in data, regulatory intervention, DAC should be included, using incurred claims rather than paid etc.

Part (i) – These are bookwork definitions but many candidates gave tautological definitions such as unearned premium reserve being the “reserve for premium which is unearned”.

Part (ii) – It was considered that the heading of the “Written Premium for Policies Still Being Renewed from Previous Years” column in the Premiums table, although specific, might be considered confusing or ambiguous. The exact meaning of this column was therefore described in detail below the table. Despite this very few candidates made anywhere near a decent attempt at answering the question. Most candidates in fact answered the question as a straight chain-ladder reserving exercise whereas the main point of the question was for candidates to consider how they would reserve for a product part of which was for a guaranteed return mainly contingent on continual renewal for a fixed number of years, and for which the question supplied all the relevant data to do the calculations, most of which was ignored by many candidates.

For the chain ladder part, a number of candidates made mistakes which they should not have done. Many candidates performed an inflation linked chain ladder calculation but a large number of those who did this did not adjust the future payments for inflation.

Many candidates did not get further than the chain ladder calculation. Those that did generally calculated the UPR as $3174/2$ i.e. assuming inter alia that the premium is earned evenly over the policy year. This is not true as the question effectively states that $1/11^{\text{th}}$ of the premium is for a guaranteed return of premium a few years hence and therefore this part of the premium (and also $1/11^{\text{th}}$ of premiums for previous underwriting years which are still being renewed) is therefore 100% unearned. Even though candidates calculated the UPR, which is effectively moving from an underwriting year to an accounts year basis, very few candidates attempted to do the same for outstanding claims, i.e. split the chain ladder

outstanding claims figures, which are on an underwriting year basis, into outstanding claims at the accounting date and URR.

Some candidates attempted to get further with varying degrees of success, with some attempts at calculating the cohorts of premium (often without allowing for RPI increases) but generally it was very difficult to work out exactly what candidates were attempting to do because of a lack of explanation and numbers written without justification.

Some candidates stated that there being claims for underwriting year 2013 contradicts the statement that the claims paid for policies that have been renewed from previous years were all zero at the 2013 renewal date. There is no contradiction. The claims paid for underwriting year 2013 are for policies after they renewed in 2013.

Part (iii) – Answers to this part generally just covered the standard problems with the chain ladder projection method. Even though candidates were unable to do the calculations in part (ii) they should have been able to present problems that would arise in trying to reserve for this class of business, i.e. problems with reserving for guarantees, the lapse rate for this class of business being different from that for standard business and varying over the duration of the guarantee term, the loading in the premium for the guarantee, etc. Very few candidates got these points.

END OF EXAMINERS' REPORT