

INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

September 2010 examinations

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

Introduction

The attached subject report has been written by the Principal Examiner with the aim of helping candidates. The questions and comments are based around Core Reading as the interpretation of the syllabus to which the examiners are working. They have however given credit for any alternative approach or interpretation which they consider to be reasonable.

T J Birse
Chairman of the Board of Examiners

January 2010

- 1** (i) *Groupings within claims and premium data*
Class of business
E.g. casualty split by subclass: aviation, marine, property etc
Claims cohort
- Short tail vs long tail
Run-off vs ongoing
Type of reinsurance contract: fac, treaty, finite
Type of cover: quota share, surplus, risk excess, per event excess, aggregate excess, stop loss etc.
Basis of cover: losses occurring, risks attaching, claims made
Territory, e.g. USA, W. Europe, Asia-Pacific, South/Central America
Currency, e.g. US\$, C\$, EUR, GBP, Other
Type of cedant: small, large, pools/associations, regional, multinational
Reinsurance vs retrocession
Attachment point
Peril
- Specials – known losses or contracts that distort the claims development
e.g. WTC, natural catastrophes such as Hurricane Katrina, or any other alternative relevant example
- Expenses v claims payments
Paid claims v incurred claims
- Gross of retrocession, retrocession (split by type), net of retrocession

Comments on Q1(i): *Many students did reasonably well though not all were able to generate a wide enough range of ideas given the number of available marks. Some wasted time by listing the same points for claims data and premium data in separate lists, rather than simply acknowledging that the splits would need to be consistent, while a few gave completely different lists for claims and premiums which is obviously incorrect. A few candidates listed data requirements which isn't what the question was asking for.*

- (ii) *Why may not be able to use these subdivisions*
The information available to the reinsurer may not permit data to be subdivided by these groupings
Because of heterogeneous nature of the business, the reinsurer's IT system may not capture all the contract details
For proportional business, an insurer may report losses on an aggregate basis.
For reinsurance contracts covering more than one class of business it may be difficult to split reinsurer's inwards premiums to line of business even if the claims information has been categorised by class
There may be sparse data for a particular grouping and so it may not be credible to project at that level
For non-proportional business, e.g. if not many claims have arisen, it may be difficult to derive development patterns.
There may be insufficient benchmark information available

There may simply be too many categories to make it cost-effective to select assumptions and do separate valuations for every category

Comments on Q1(ii): *Although most students were able to identify either the issue about credibility per cell or the issue about data even being available in the appropriate format, relatively few covered both ideas well, linking clearly to the fact that this is reinsurance/retrocession data.*

(iii) *Deciding which subdivisions*

Consider the purpose of the review

Consider the impact of different sub-divisions on the results (e.g. perform sensitivity analysis)

Consider the volume of data that is available

Consider the homogeneity of the data that is available

e.g. if a particular grouping is only available for some of the business it might be easier not to use it

Consider outwards reinsurance programme structure and whether it is necessary to match gross projections to reinsurance contracts

Review volume/materiality of premiums, claims and reserves in each potential grouping

Review stability of claims development patterns within a category e.g. there may be no noticeable difference in patterns between fac and treaty business

Review changes in mix of business over time (e.g. if mix of territories has not changed over time, even if development patterns vary, may be okay to continue to combine territories)

Discuss with other business areas (e.g. underwriters, management, claims team or pricing team)

Consider subdivisions for previous reserve reviews or for booked reserves against which you might want to compare

Consider reporting requirements e.g. to market analysts

Plan time available for your review and priority areas for focus

Consider the need to produce estimates by legal entity and whether it is acceptable to project business from several legal entities and allocate reserve back (e.g. where producing reserve estimates for different entities within a group).

May want to model separately each aggregate stop loss or non-proportional business that is close to an aggregate deductible or limit

Consider stability of development factors at different groupings of origin or development periods (month / quarter / year)

Consider the ability to adjust for known changes (e.g. change in regulatory environment or other relevant example)

Consider any relevant professional guidance

Consider recommendations from consultancies

Consider market practice for the classes involved in the review

Consider any IT limitations that may impact data availability

Comments on Q1(iii): *Generally students did not cover a sufficiently wide range of ideas here, often omitting practical considerations.*

- 2** (i) Diversification effects arise because the various risk exposures from a company's operations are partially independent
It allows for the fact that different adverse risk outcomes would not be expected to occur simultaneously
Therefore the aggregate capital charge can be less than the sum of individual charges

Comments on Q2(i): *Although some students were able to explain this adequately, not everyone did so "in the context of capital modelling", and a number of students appeared to be confused, e.g. suggesting that diversification only happens if risks are negatively correlated (i.e. correlation < 0, rather than correlation < 1), or instead that it occurs "because risks are correlated".*

(ii) (a) ***Assessing solvency capital requirements***

The sum of capital charges from individual risks / elements of the model would generally be lower than the overall required capital charge

The assessment of solvency capital requirements is a ground-up exercise, and could be at product, class of business or whole company level

In quantifying the diversification adjustment, we would need to make suitable assumptions about the extent of applicable correlations

A company may be exposed to operational risks associated with its corporate structure and policies.

.....these risks may be a source of negative diversification, requiring more capital to be held

Correlation can occur between risks in the same class, or between risks in different classes

Allowance for correlation can either be implicit or explicit

(b) ***Allocating capital held between classes, products or policies***

Allocation for performance measurement

Typically a top-down exercise

May require a different risk measure to overall determination of capital

May also require the allocation of excess capital (which is not considered in the overall determination of the economic capital requirement)

Many methods available (e.g. Marginal, Shapley from core reading, potential others)

Must have regard to the purpose of the results, and desirable properties of the results (e.g. stability over time etc.)

May need to use multiple methods in different situations

Requires judgment to set final allocation

Allocation for Pricing

Technical benchmark price should include a loading for the cost of capital

This should reflect the relative risk profiles of individual policies

Needs to consider the duration of the capital requirement (i.e. capital must be held until liabilities are fully run-off) – this may differ from allocating reserving risk charges

May or may not consider diversification benefits

Business planning

A company will typically look to optimise return on capital via changes in business mix to improve diversification credit

Consider the potential diversification achievable by writing new lines of business

For all these investigations, it is important that we quantify the diversification effects as accurately as possible, and allow for interactions between classes and products as well as economic and geographical correlations

(c) ***Reinsurance purchasing***

Different reinsurance strategies will have different impacts on capital requirements

Type and amount of reinsurance purchased may change diversification between classes:

Tail diversification in insurance risks

Mix of risk types (e.g. purchasing more reinsurance lowers insurance risk, but increases credit risk)

(d) ***Asset allocation studies***

ESG can be used to study the impact of different asset allocations

Ensuring sufficient liquidity in the portfolio

Investigating investment in bonds to back longer tail liabilities

Investigating different balances between expected returns and investment risk on the portfolio

Investigating the impact of investing in equity/property

(e) ***Studies of enterprise-level risks*** (e.g. credit risk, operational risk)

In addition to insurance risk, consider market, credit, liquidity and operational risks

Need to understand joint behaviour of these risks to assess impact of individual elements on capital requirements, and hence to plan business response to risks

Comments on Q2(ii): *Students who knew the Core Reading thoroughly were able to do well on this question part. Some students did not relate their answer to "applications of capital modelling" as required, instead describing how the company could diversify its business which does not answer the question.*

(iii) ***Between risk types***

E.g. a very large insurance loss (insurance risk) may also cause multiple losses for a reinsurer and therefore increase the chances of a credit loss arising from reinsurance failure (credit risk)

Or: E.g. in an economic downturn, increased fraudulent claims (operational risk) may be accompanied by increased valid claims (insurance risk)

Between lines of business

E.g. lines of business may share given risk exposures, such as a new type of latent liability claim may cause losses in both Employers Liability and Public Liability

Between underwriting / accident years

E.g. reserve deterioration due to the emergence of a new type of latent claim could affect multiple years of reserves (and underwriting risk for business that continues to be written)

Between loss types (i.e. attritional / large / cat) within a line of business

E.g. a driver such as poor underwriting controls could increase the exposure to each type of loss simultaneously

Between or within different geographical areas

E.g. different European countries may be exposed to similar social, economic or regulatory changes

Between asset classes, and between individual assets within an asset class

E.g. an economic downturn may cause losses on corporate bonds to occur due to credit spread widening, at the same time as triggering a downturn in the equity markets

Between reinsurers or other counterparties (for credit risks)

E.g. large catastrophes are likely to cause underwriting losses for many reinsurers. This would increase the probability of default from multiple reinsurers simultaneously

Between different sources of operational risk

E.g. resource stretch may lead to simultaneous failures in many areas, such as fraud, processes

Between group risk, reinsurer default risk and concentration risk

E.g. in the case of a captive of an insurer

Other valid sources with valid examples even if different to suggestions above.

Comments on Q2(iii): *The examiners were looking for a wide range of different types of dependency here, and students with good knowledge of the Core Reading were able to suggest such a range. However, many students focussed on one or two types of dependency (commonly: between risk types) and listed several example drivers for that case, which did*

not demonstrate sufficient breadth of understanding to gain full credit. Many students tended to list factors that were functions of each other (e.g. inflation depends on economic conditions; premium depends on claims) rather than thinking about dependencies in the context of a capital model.

- 3** (i) *Losses occurring policy:* A reinsurance policy providing cover for losses occurring in the defined period no matter when they are reported
Risk attaching policy: A policy under which reinsurance is provided for claims arising from policies commencing during the period to which the reinsurance relates.

Comments on Q3(i): *Most students gained full marks here, but a number were not able to describe the distinction sufficiently accurately or clearly.*

- (ii) *Recoveries for Smith Foods and Yellow Plastics*

Yellow Plastics

February 2009 flood claim must have occurred on the policy that inceptioned on 1 January 2009 so falls under 2009 quota share treaty

$\text{£}12.0\text{m} \times (1 - 30\%) = \text{£}8.4\text{m}$ net of quota share

Claim is protected by 2009 risk excess of loss treaty

Apply $\text{£}8.4\text{m}$ to first layer. We know that the aggregate retention has not yet been used by another claim as the next largest claim is $\text{£}3.2\text{m}$ and after quota share reinsurance this would not be large enough to hit the $\text{£}2.5\text{m}$ xs $\text{£}2.5\text{m}$ layer

=> Retain $\text{£}2.5\text{m}$ retention and $\text{£}2.5\text{m}$ aggregate deductible

Apply $\text{£}8.4\text{m} - \text{£}5.0\text{m} = \text{£}3.4\text{m}$ to 2nd layer

As only 80% of this layer is placed with reinsurers, recovery will be 80% of $\text{£}3.4\text{m} = \text{£}2.72\text{m}$

So retain $\text{£}(2.5 + 2.5 + 0.68)\text{m} = \text{£}5.68\text{m}$ and cede $\text{£}3.6\text{m}$ to quota share reinsurer and $\text{£}2.72\text{m}$ to excess of loss reinsurer, i.e. recover a total of $\text{£}6.32\text{m}$

Smith Foods

Policy inceptioned on 1 December 2008 so falls under 2008 quota share treaty

$\text{£}8.5\text{m} \times (1 - 50\%) = \text{£}4.25\text{m}$ net of quota share

Fire was notified in November 2009. Assume fire event occurred in 2009 as fire claims are generally notified quickly and the policy only had 1 month exposure in 2008

Therefore claim is protected by 2009 risk excess of loss treaty

Apply $\text{£}4.25\text{m} - \text{£}2.5\text{m} = \text{£}1.75\text{m}$ to first layer and retain first $\text{£}2.5\text{m}$

Aggregate retention on that layer has already been used by Yellow Plastics, which occurred in February 2009

So retain $\text{£}2.5\text{m}$ and cede $\text{£}4.25\text{m}$ to quota share reinsurer and $\text{£}1.75\text{m}$ to excess of loss reinsurer, i.e. recover a total of $\text{£}6\text{m}$

Additional assumptions

Assume no IBNR losses to the 2009 XoL treaty occurring before the Yellow Plastics loss

Assume no sideways exhaustion of risk excess of loss cover i.e. that if there are limited reinstatements they have not all been used up, e.g. by IBNR losses on earlier events

Assume that the factory flood was not as a result of a catastrophe event with catastrophe excess of loss cover protection

Assume the event limit on the quota share treaty has not been exceeded when combining the Yellow Plastics with other commercial property losses arising from the same flood event

Assume no bad debt on reinsurance recoveries

Assume all claims are valid (e.g. policies are covered by the terms of the treaty in respect of location of risk, nature of risk)

Assume gross incurred amounts do not develop

e.g. assume no recoveries from subrogation that have not been taken into account in the case estimates

Assume there is no other available reinsurance cover

Assume there is no stability clause in the XL treaty

Comments on Q3(ii): *Although well answered by the stronger students, common mistakes in this calculation part included: not using the right treaties (some students answered part (i) correctly but then did not go on to apply these definitions correctly in this part....), incorrect application (or complete misunderstanding) of the aggregate deductible, incorrect application of the excess levels, often ignoring the 80% placing. Some calculations that gave incorrect answers did not include enough explanation or intermediate workings to be able to award partial credit for methodology. Not all students listed assumptions as explicitly asked for in the question. Some students made incorrect assumptions as to the order of the losses which was unnecessary as this information was given in the question. A number of poorer students tried to pro-rata the quota share percentage for Yellow Plastics between 2008 and 2009. A surprising number who allowed for quota share and XL for the two largest property losses did not allow for quota share when assessing the effect of the next largest loss and hence assumed it ate into the 2009 aggregate deductible which it did not, this despite the question clearly stating that the figure for this loss was gross.*

(iii) *Advantages of quota share*

It spreads risk

It can enable the company to write larger portfolios of risk

It can encourage reciprocal business

.....which may be useful as the company is growing.

and it may allow the company to write larger sums insured on individual policies

It directly improves the solvency ratio and helps the insurer to satisfy the statutory solvency requirement. This may not be significant for a large company such as this where the property book is relatively small.

It is administratively simple, but a large company such as this may not consider this such an advantage.

The commission may help with cashflow.

Technical assistance may be available from the reinsurer

....although note this is usually available from brokers, and may be of limited use for a large company

It can reduce the cost of XL protection

....although the impact may not be sufficient enough to justify the cost

Disadvantages of quota share

A large, established insurer will be far less dependent (if at all) on quota share as a means of spreading risk than a small, new insurer, so unnecessary.

It cedes the same proportion of each risk, irrespective of size or variability

The insurer may, however, wish to cede a greater proportion of the larger factory risks than the smaller retail ones owing to their greater loss potential.

It passes a share of any profit to the reinsurer

It does not limit the variability of the property results.

Comments on Q3(iii): *Most candidates answered the question “list the pros and cons of quota share” although the question actually asked was to “discuss” the main advantages and disadvantages of quota share “to the company”, a large general insurer, so, to match the lack of discussion, very few noted that a number of the advantages given in the bookwork list are not relevant for a large company.*

(iv) *Alternative protection: two of the following*

Use a surplus reinsurance treaty.

This will enable the insurer to choose, within limits, the size of risks that it will retain.

This is particularly useful for this account where there is a wide variation in the size of risks. Surplus can be used to restrict the proportional cessions to the largest risks and will avoid ceding premium (and therefore profit) on the smaller retail risks.

It enables an insurer to write larger risks, which might otherwise be beyond its writing capacity

Like quota share it can enable the spreading of risk but is more flexible

Use facultative reinsurance.

This will allow the company to choose the risks that are most advantageous to cede or retain in order to maximise profit subject to retaining an acceptable level of risk

E.g. facultative can be used to cover only those policies with large sums insured or those policies with high variance risks

Facultative reinsurance can be used to cover risks that fall outside scope of the treaties

The company may be able to take advantage of favourable terms and shop around for the best rates

Use Aggregate XL protection

Can protect accounts against major attritional losses or accumulations of risk

Reduces the risk of insolvency from a large aggregation of claims

Can reduce the variability of claims payments

Use Stop Loss protection

...which would give overall protection

...although note this is unlikely to be available at acceptable cost

Comments on Q3(iv): A small number of students suggested using risk excess of loss apparently having forgotten that the company already has such a treaty in place.

4 (i) *Graph*

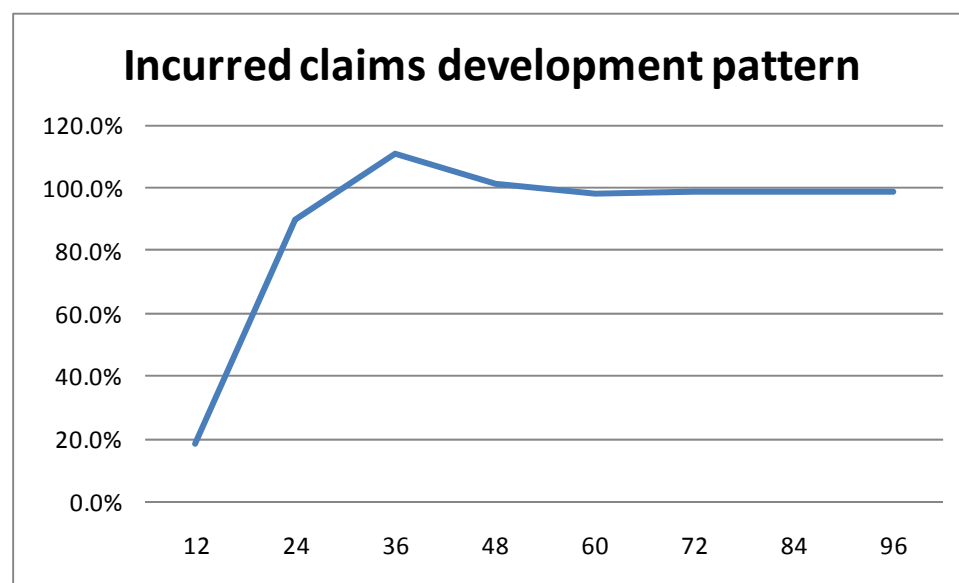
Calculate percentage developed at each development point as $1/\text{cumulative df}$:

Months	12	24	36	48	60	72	84	96
% developed	18.6	89.7	110.9	101.2	98.3	98.6	99.0	99.0

Method

Correct calculation

Graph having same data points and similar shape to that shown below



Comments on Q4(i): Some candidates had correct underlying calculations but then did not translate them sufficiently accurately to the graph scale (e.g. incorrectly plotting the hump at about 101 rather than 111), which can go on to cause problems in the next question part. Some gave the co-ordinates for the x-axis as 1–2; 2–3; 3–4, .. years or 12–24; 24–36; 36–48, ... months which shows a lack of understanding as the incurred claims are clearly at specific times.

(ii) *Comment on pattern*

At the end of the first 12 months there is still only a small proportion of claims incurred / there is a lot of development still between 12 and 24 months

At this point it is likely that there is still a lot of unexpired risk. Assuming policies are written throughout the underwriting year, new claims events may occur until 24 months

It is likely that most claims are reported by 24 months

The development pattern is medium to long-tailed with some claims still moving after 6 years.

....e.g. due to late claim development or the existence of latent claims

This is not surprising as public liability will be longer-tailed than most property classes but probably shorter tailed than Employers' Liability (*or some other comparisons*)

PL may also contain damage claims and small injury claims that would settle more quickly

It may take time for claims to be notified.

Initial incurred claims estimates may increase or decrease once more information about the nature of the claim and the injury has been established.

The incurred claims for an underwriting year reduce on average after the third development year.

At this stage some of the claims may go away with no liability due to successful challenges in court or out-of-court settlements.

Liability may be shared with third parties

Or there may be successful subrogation claims

....and case reserves may be reduced to reflect this.

There may be some small deteriorations in some of the claims that settle later, perhaps due to inflation or deterioration in medical conditions.

The timing and extent of the "hump" will have been dependent on the company's case reserving process.

The incurred claims development pattern appears fairly stable for liability business

which may be because the data are net of reinsurance, so that the impact of large claims are smoothed out

or it may be because the company writes lots of small lines.

Note that the fall in the 12–24 month development factors

Any other reasonable observations on the development pattern.

Comments on Q4(ii): *The better answers here were from those who methodically worked through the main features of the pattern (years 1–2, hump/reduction, stability, tail), describing and then suggesting reasons for each feature in turn, relating clearly to the type of business written. Some students made points that appeared to be more relevant to cashflows than to reserve development. Many stated that the low development for years 1 and 2 was due to slow reporting for the class of business without noting that for business on an underwriting year basis there is a lot of unexpired risk.*

- (iii) *Appropriateness of actuary's reserving methodology*
She has chosen results based on incurred claim projections for 2008 & prior years. This is reasonable as paid claims will be a lot less developed than incurred claims
...and the outstanding case reserves on the older years are likely to still be quite large for this type of business

However, it is still worth considering the results of paid projections as a check in case the case reserving strength or process has changed.

It is reasonable to rely on chain ladder from months 24 onwards as factor to ultimate is not too high/the claims are well developed.

It appears that she has mainly chosen average incurred development factors. This avoids bias, but does not allow for the incorporation of judgment (e.g. to smooth the pattern, or to react to trends).

As 12–24 factors seem to have reduced in recent years, possibly because case reserves are being established sooner, it might be appropriate to take an average factor for 12–24 from recent underwriting years rather than from 2002–2008.

Choice of tail factor is subjective.

It would be good to do some analysis to support the choice (e.g. find a benchmark, curve fitting or other relevant example)

For 2009, it is appropriate not to rely on the chain ladder method as incurred claims are less than 17% developed according to the actuary's selected pattern. The Bornhuetter-Ferguson method would be a good choice to use here as it gives only partial weight to development to date.

The B-F would need adjustment on the 2007 or previous underwriting years as the cdf is less than one.

The choice of IELR may need some validation.

It is appropriate to start by using the expert judgment of the underwriter, although it would be useful to try to make an independent selection for the 2009 underwriting year, which could be discussed with the underwriter. Suggest she obtains a rate index and adjusts the ULRs on the previous years based on that index.

The actuary is projecting data that are net of reinsurance. This may make the projections easier but the appropriateness will depend on the extent to which the reinsurance programme has changed over time or how much reinsurance recoveries (such as excess of loss) have influenced historic development.

Other methods should be considered, e.g. ACPC, inflation-adjusted methods, projected case estimates or stochastic methods.

Comments on Q4(iii): *The better answers here were from those who considered each component in turn and discussed its appropriateness (incurred claims not paid, use of chain ladder, use of net data, tail factor, 2009 loss ratio, use of underwriter's plan), including suggestions for improvements.*

Although it should be clear from the question that the method used for 2008 and prior underwriting years used is chain-ladder and for 2009 is underwriter's ULR applied to ultimate premium for 2009 several candidates interpreted the method as for all years being a combination of the two methods, in some cases stating that this is effectively a Bornhuetter-Ferguson approach. This is incorrect (in particular with one part being specifically based on 2009 ultimate premium and ULR which can only be used for the 2009 year) and should have been recognised as such.

(iv) *Benefits in quantifying uncertainty*

Assess reserve adequacy in absolute and relative terms and provide management with information as to the strength of the booked reserves.

It may support better management decisions
Monitor accuracy of best estimate of reserves over time
Compare the reasonableness of different sets of reserve estimates.
It avoids the impression that there is one “right answer”
Compare different datasets.
Monitor performance to see if claims movements are material.
Determine capital. Quantifying reserving risk is a key component of insurance companies' capital models.
Provide information to investors and comply with accounting rules.
Inform discussions with regulators on solvency.
Assist in pricing insurance and reinsurance policies.
Assist in reinsurance purchasing decisions
To meet the requirements of professional standards
It may support tax discussions (e.g. transfer pricing)
It may assist in determining investment strategy

Comments on Q4(iv): *Those students who knew the Core Reading well were able to do well on this question part.*

(v) *Suitable reserve variability methods*

Mack

This is an analytical method based on the chain ladder
No prior distribution assumptions are made, only assumptions about the first two moments.

A standard chain ladder method is applied to the cumulative triangle to determine the incremental development factors.

Variability between the actual and expected development at each point in the triangle is calculated.

Then the variability across the rows is aggregated to produce a standard error for each underwriting year.

Can extend to derive a standard error of the overall reserve estimate.

Key assumptions are:

The run-off pattern is the same for each origin period (as for the chain ladder)
Future development of a cohort is independent of historic factors (for example, high factors in one period do not imply high or low factors in the following period)

The variance of the cumulative claims to development time t is proportional to the cumulative claims amount to time $t - 1$.

Assume that the causes of uncertainty will be captured within the historic data (e.g. possible latent claims).

Bootstrapping the ODP

Bootstrapping involves calculating the expected values and residuals from each point in the claims triangle.

Repeatedly re-sample with replacement from the residuals to produce a large number of alternative pseudo-triangles.

Refit the chain ladder method to each alternative pseudo-triangle to give an alternative reserve estimate.

Incremental claims are modelled on the assumption that they follow an ODP distribution.

By repeating this process thousands of times we can generate standard deviations and confidence intervals.

Key assumptions are:

The run-off pattern is the same for each origin period (as for the chain ladder)

Incremental claims amounts are stochastically independent

The variance of the incremental claims amounts is proportional to the mean.

Incremental claims are positive for all development periods.

Assume that the causes of uncertainty will be captured within the historic data (e.g. possible latent claims).

Comments on Q4(v): *Another bookwork based question, showing clear differentiation of those who understood these two methods well. A number of candidates effectively gave some assumptions for the Mack method without actually describing it.*

(vi) *Recommendation with reasons*

Answer 1

Recommend Mack method

This is an easier method for the company actuary to start with as it requires limited judgement

and the formulae required for deriving the Mack standard errors are quite straightforward to implement in a spreadsheet.

With Mack a tail factor can be incorporated as a deterministic multiple whereas bootstrapping does not make allowance for a tail factor without adjustment

The Mack model can handle negative incremental incurred claims movements whereas bootstrapping the ODP does not without some adjustment.

Alternative answer

Recommend bootstrapping ODP

This makes it easier to produce percentiles in order to produce a range

Bootstrapping can be adjusted to make allowance for a tail factor

Bootstrapping the ODP does not immediately allow for negative incremental incurred claims but can be adjusted to do so.

Alternatively, bootstrapping the ODP could be applied to paid data to overcome the problems with negative incremental incurreds.

Comments on Q4(vi): *A number of candidates failed to make a recommendation and therefore did not gain the marks for this despite correctly stating the pros and cons.*

- 5** (i) *Economic capital*
The level of capital required to achieve management objectives
It would typically be the output of a risk based capital modelling exercise

Available capital

The excess of assets above liabilities (or free reserves)
Note that would typically be on either a statutory balance sheet or an economic balance sheet (although could be on other bases), and the valuation for both assets and liabilities might differ depending on the basis (e.g. in valuing assets on a statutory basis, inadmissible assets might be excluded)

Excess capital

The excess of available capital over required capital, on either a regulatory or economic basis

Comments on Q5(i): *Several students seemed confused here with a number unable to define Available Capital, despite correctly calculating the Available Capital in part (ii).*

- (ii) Changes in market values of investments
Variation in interest rates
As this will potentially have an impact on the value of investments and liabilities, and on investment income levels
The level of investment income may be lower than that assumed in the pricing basis / business plan
Counterparty or issuer defaults
Severe economic / market downturn
May cause extreme movements in interest rates
And losses on multiple asset classes (e.g. equity, property)
Inadequate valuation of assets
Mismatch of assets and liabilities
including reinvestment risk, where reduced yields may be available on future investments
Fluctuations in exchange rates

Comments on Q5(ii): *No specific comments*

- (iii) Available capital = (Assets – Liabilities)
= 275 – 200 = 75

Comments on Q5(iii): *No specific comment other than amazement that not everyone got this easy mark.*

- (iv) Each section of part (vi) assumes that changes happen in isolation, and have no knock-on impact on other variables
- (a) *Equity fall 20%*
Will impact the market value of the equity holding, but will not impact the value of the liabilities
Stressed market value of equities is 60

Stressed available capital is 60

(b) *Increase in risk-free rate*

As liabilities are undiscounted, their value will not change
All other things being equal, the market value of the gilts and the corporate bond are likely to reduce
Estimate the impact using a zero-coupon bond of 3 year duration:

Either:

Impact on gilts:

Current market value = 100

Approximate discount factor at 5% = $1/(1.05)^3 = 1/1.157625 = 0.8638$

Estimated nominal value = $100 / 0.8638 = 115.7625$

Revised discount factor at stressed interest rate

= $1/(1.1)^3 = 1/1.331 = 0.7513148$

Estimate of stressed market value = $115.7625 \times 0.7513148 = 86.974$

Impact on corporate bond

Current market value = 50

Approximate discount factor at 7% = $1/(1.07)^3 = 1/1.225043 = 0.8163$

Estimated nominal value = 61.25215

Revised discount factor at stressed interest rate (assuming spreads do not change) = $1/(1.12)^3 = 1/1.404928 = 0.71178$

Estimate of stressed market value = $61.25215 \times 0.71178 = 43.598$,

Available capital is therefore approximately 55

Or, May use a combined approximation if justification is included:

Impact will be similar on gilts and corporate bond

Approximate impact equal to an additional 5% discount applied over 3 years:

Additional discount factor = $1/(1.05)^3 = 0.8638$

Stressed market value is approximately $150 \times 0.8638 = 129.576$

Therefore available capital is approximately 55

(c) *Decrease in corporate bond spread*

Decrease in spread would lead to a reduction in the discount rate applied to the corporate bond

Nominal (from above workings) = 61.25215

Stressed interest rate is 5%

stressed discount factor = $1/(1 + 5\%)^3 = 1/1.157625 = 0.8638$

Stressed value = 52.9119

Available capital = 78

Or May use approximation if justification included

Decrease in spreads is approximately a 2% decrease in the discount rate for the corporate bond only

Impact is an increase in value of approx $((1.02)^3 - 1) = 6.12\%$

Increase in value is therefore approximately 3

(d) *Default on the corporate bond*

This would lead to a reduction in market value of the bond

However, it is likely that some value would be retained in the event of a default (as there is a market in distressed debt, or the debt may be converted to equity)

There would also be an impact on value if the debt was downgraded as a result of a technical default, even if the issuer continued to service it. Would therefore have to make an assumption about the potential recoveries in the event of a default.

Would also need to include any additional expenses associated with the default.

Therefore assume a reduction in value in the region of 50%–90%
(award mark as long as chosen value is justified)

E.g. if 90% selected, then residual value of corporate bond is 5
Available capital is therefore 30

Alternative valid approaches allowable.

Comments on Q5(iv): *Although well answered by some students, many showed poor grasp of investments, particularly bonds, and how yields and market values are related (i.e. seem to have lost knowledge obtained from early subjects). Many candidates were unable to identify correctly the direction of the impact of changes, in particular failing to realise that an increase in the risk-free rate would reduce the value of the gilts and bonds, seeming to think that the value would increase because more interest would be earned. Some students had ideas along the right lines about market value movements, but failed to use the information provided that the bonds each have duration of 3 years. Very few appreciated that it is unlikely that 100% of a corporate bond value is lost on default.*

(v) *Discounting*

Liabilities would reduce, all other things being equal, leading to an increase in available capital.

Stresses that impacted the discount rate would now impact the value of liabilities as well as assets.

This would include movements in the risk-free rate.

It could also include movements in bond spreads, depending on the methodology used to determine the discount rate.

Discounted liability values would move in the same way as fixed interest asset values (i.e. gilts and corporate bonds) in response to movements in the risk-free interest rate.

The reserves are backed by fixed interest assets (i.e. gilts and corporate bonds) which are matched by duration.....

..... so we would expect the impact of interest rate movements on the company's available capital to be greatly reduced.

If credit spreads are included in the discount rate, we would expect a similar reduction in credit spread risk, but this would depend on the method of inclusion.

Comments on Q5(v): *This was generally not well answered, with relatively few identifying both that the starting position will change and then how the liability values will vary under the various scenarios.*

END OF EXAMINERS' REPORT