

INSTITUTE AND FACULTY OF ACTUARIES

EXAMINER'S REPORT

April 2012 examinations

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

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 ST7

Candidates who are well prepared generally appear to perform reasonably on ST7, with the more challenging questions tending to occur on SA3. Candidates should consider the following advice however (if they are not already):

- Lists are hugely valuable for breadth of point generation but candidates should always exercise judgement when applying them.
- Calculation questions will come up on a regular basis with ST7, as candidates can clearly observe from examination of historical papers. Candidates should always be prepared for such staples as balance sheet preparation, triangle manipulations & projections and reinsurance layer calculations (along with being able to carry out any necessary adjustments including inflation, exposure 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.

Comments on the April 2012 paper

This was a fairly standard paper and none of the questions should have been unexpected for well prepared candidates. Performance however was disappointing, reflected in the lowest pass rate observed since April 2006.

Key areas of poor performance were:

Q1 – straight bookwork that most candidates clearly had not learnt.

Q4 – candidates should be entirely prepared for balance sheet questions yet many made obvious and avoidable mistakes.

Q5 – candidates did not take the time to question what the underlying business might be or comment accordingly. Many missed the purpose of the loss ratio required.

Q6 – few candidates made any effort to tie their answers to the specifics of the question.

Q7 – as in previous papers, few candidates seemed to understand capital or even to have learnt the bookwork. Candidates should note that capital modelling is a key part of ST7 and unless they perform extremely strongly on reserving questions they will struggle to pass ST7 without some understanding of capital modelling.

- 1** (i) A copula is a mathematical relationship between the individual distributions of random variables
 ... and the joint distribution of those variables.

Copulas allow greater flexibility when multiple dependencies are modelled than single correlation factors allow or, alternatively, enable a greater level of dependency in the tail

E.g. a cat event or similar affects the tail of the distribution and will impact a number of classes and hence give correlation in the tail

- (ii) Given two variables X and Y .

Let $F_X(x) = P(X \leq x)$ and $F_Y(y) = P(Y \leq y)$ be the respective cumulative distribution functions.

X and Y are not independent so the joint distribution function needs to be considered

$$F_{XY}(x,y) = P(X \leq x, Y \leq y)$$

A copula function (C) is a function that allows calculation of the joint distribution function from the values of the marginal distributions so that

$$F_{XY}(x,y) = C[F_X(x), F_Y(y)]$$

$$\text{Define } C(u,v) = F(F^{-1}(u), F^{-1}(v))$$

$$\text{Hence } C(F_X(x), F_Y(y)) = F(F^{-1}(F_X(x)), F^{-1}(F_Y(y))) = F(x,y)$$

The function $C(u,v)$ is known as a copula.

- (iii) The Gumbel copula function is commonly used in insurance applications.

$$C(u,v) = \exp[-((- \ln u)^a + (- \ln v)^a)^{1/a}]; a \geq 1$$

The Gumbel copula gives a strong tail correlation

.. and is also non symmetric/skewed, giving more weight to the right of the distribution

This is useful for GI since, for example, large losses within a class and across different lines of business are often strongly correlated or other relevant example e.g. that it is the right of the tail that we need to model most accurately for capital modelling.

Despite all being bookwork very few answered this question correctly, particularly the formulae.

- 2** (i) Changes in the (paid or incurred) loss ratio
Overall claims frequency
Frequency by claim type
..as some claim types (e.g. whiplash) may be more prone to fraudulent claims or other relevant example
Number of claims arising from a single incident
Excessive claims cost inflation in particular areas
Increase in claims handling expenses
Nil settlements may indicate that claims are withdrawn after challenge
Benchmark or market data (analysis) or any other relevant external factor
Any other reasonable relevant factor e.g. average claim size, high renewal rates, change in mix of business, low retention because fraudster changes insurer to avoid detection

Generally reasonably answered.

- (ii) Sharing data with other insurers to identify multiple claimants.
Invest in technology such as voice stress analysis systems to identify fraudulent claims
Using software solutions to identify suspicious patterns of claims.
Increase the proportion of claims that are investigated prior to payment/ tightening of claims handling procedures/ specialist fraud unit
Publicity to highlight cases where policyholders prosecuted for fraud.
Enhance data analysis to provide indications of areas of portfolio/policyholders more prone to fraud
..and either discontinue cover or increase premiums in these areas.
Education of policyholders e.g. if don't disclose risk fully, claims will not be paid
Encourage the public to report insurance fraudsters by setting up anonymous phone lines etc to make reports.
Better staff training to help spot signs of fraudulent claims.
Lobbying government (directly or through industry bodies) for tougher penalties for insurance fraudsters.
Fund police operations to target insurance fraud.
Tighten policy terms and conditions e.g. to demand a police report.
In time of recession/economic downtime fraud will increase and more work needs to be done to combat it

In general candidates placed too much emphasis on increasing deductibles which would deter most prospective customers, not just fraudsters.

3 Liabilities

General investment principle: to maximise investment return
... subject to meeting all contractual obligations
...and recognising the uncertainties involved.
The nature of the existing liabilities: whether they are they fixed or "real" in monetary terms.

The majority of general insurance liabilities will be real in nature.

Currency of existing liabilities:

many domestic, personal and commercial insurers may have portfolios mainly denominated in their local currency,
however, international insurers and reinsurers have portfolios that contain a range of currencies.

Term of existing liabilities:

most general insurers' portfolios are likely to contain a significant proportion of short-term liabilities (one–three years),
with a smaller proportion of medium term (four–ten years)
and long-term liabilities (ten years and above).

Whether the insurer has been subject to recent large losses
whether it is growing or shrinking
the position in the insurance cycle

Level of uncertainty of existing liabilities: both in amount and timing.
Reinsurance programme, backed up by reason/rationale

Estimated future liabilities arising from the portfolio of business planned: this will depend on the volume and classes of future business written.

Assets may be required to be located locally to match local liabilities
Whether the liabilities are discounted.

Liquidity requirement
e.g. to pay claims as they arise
or for expected large losses

Need for diversification (*should have rationale*)

Assets

Size of assets, in relation to the current liabilities: the larger the quantity of free assets, the more the company has freedom to invest widely.
And how much can move from principle of matching assets to liabilities by term, currency etc.
Availability of assets

Expected long-term return from various asset classes.
Expected volatility within the various asset classes.
Existing asset portfolio.

Non-investible funds: not all the assets will be available for investment, for example, moneys held by brokers, policyholders or reinsurers.

Economic outlook.

External influences

Tax treatment of different investments and the tax position of the general insurer.

Statutory, legal, ethical or voluntary restrictions on how the insurer may invest.

Statutory valuation requirements.

Solvency requirements: most territories have a step-wise process of intervention and therefore the strategy for maintaining solvency is targeted at a much higher level than the pure statutory minimum margin.

Rating agency constraints on capital required to maintain the insurer's desired rating.

Competition: strategy followed by other insurers.

Regulatory constraints, for example, those imposed by Lloyd's and the Financial Services Authority (FSA).

Insurer specific considerations

Risk appetite: each general insurer will differ in the amount of risk it is willing or able to accept

Company specific investment objectives (for example, ethical investment).

Internal expertise

Risk analysis: market risk, credit risk, operational risk etc. (with rationale)

Usually well answered. Some candidates took the word constraints in its most literal sense of limitations but Constraints is the word used as the heading for this bookwork in the Core reading.

4 (i) Balance sheet Assumptions

All yearly business
 No reinsurance
 Risks written uniformly across calendar year
 Risk is uniform across policy year (or premium earned evenly over year)

| Balance Sheet Assets | A | B |
|-----------------------------|----------|----------|
| Investments | 386 | 4,372 |
| Current Assets | 17 | 133 |
| Deferred Acquisition Costs | 29 | 128 |
| Total | 432 | 4,633 |

Liabilities

| | | |
|-----------------------------------|-----|-------|
| Outstanding Claims Reserve | 94 | 3,076 |
| Additional Unexpired Risk Reserve | 47 | 0 |
| Unearned Premium Reserve | 76 | 556 |
| Current Liabilities | 35 | 171 |
| Free Reserves | 180 | 830 |
| Total | 432 | 4,633 |

This was a straightforward balance sheet question, but many could not handle it adequately. Some put DAC on the wrong side of the balance sheet and some calculated the balance as free reserves including share capital either as an Asset or as a Liability, and candidates often included revenue items such as incurred claims or investment income in the balance sheet. A minor point: even when getting the number right most gave DAC to 2 decimal places and carried through in calculations, despite all data being given as whole numbers

(ii) Assumptions

Assume GWP = GEP (i.e. UPR b/f = UPR c/f)
 Assume AURR as at 31/12/2010 = AURR as at 31/12/2011
 Assume outstanding claims reserves include IBNR
 Other reasonable assumptions are possible but then have to be carried through in the calculations

| | A | B |
|----------------------|----------|----------|
| Incurred Claims | 144 | 520 |
| Acquisition Expenses | 58 | 256 |
| Total Expenses | 75 | 385 |
| Loss Ratio | 95% | 47% |
| Expense Ratio | 49% | 35% |
| Underwriting Ratio | 144% | 81% |
| Solvency Ratio | 118% | 75% |
| Return | –57 | 275 |
| Return on Capital | –32% | 33% |

Possibly more correct for Return on Capital to be based on Capital at start of year: need to assume no dividend paid so Capital would be A: 237; B: 551 and Return on Capital A: -24%; B: 50%.

A number of candidates took earned as half of written premium, even when assuming the same premium written in 2011 as in 2010 but were not sensitive to the fact that this gave very large loss ratios. Again straightforward, but many candidates were unable to complete this question.

(iii) Comments

Company A may have suffered from adverse claims experience as shown by its higher loss ratio compared to B.

Each company may be writing different classes or mix of business, each at a different point in their respective market cycle

Company A expense ratio is higher due to higher acquisition expense ratio.

...The company is smaller than B and it may be spending money to expand rapidly.

Company A solvency ratio is higher than B's.

...This may be the result of a recent capital injection to expand the business.

Company B has the lower solvency ratio, suggesting that the company is less financed than the other companies.

...Or it may have a stronger valuation basis for its assets/weaker for its liabilities

Company B return on capital employed is the higher supported by a larger relative investment return compared to A. and by good underwriting results

The results given would change if reinsurance was considered

The expense ratio is high for each of A and B

In general this question was not well answered: too much emphasis was placed on the obvious $x > y$ etc., not enough thought was given to why the relationships existed.

5 (i) Advantages and Disadvantages

a: Underwriters view

Underwriter has knowledge of terms and conditions, market conditions etc.

Information from pricing review

Subjective

Potentially not independent

May be optimistic

Good when material changes to business

b: Market loss ratio benchmark

Simple to use

Provides independent estimates
 May reflect market rate changes and inflation effects as well as trends in claims frequency and average cost
 Mix of business likely to be different for every company
 Need to check treatment of premiums is consistent (i.e. gross or net of commission) and of reserving and other inconsistencies
 Need to check consistency of reinsurance cover
 Market info may not be available or may be out of date
 If the benchmarks are up-to-date they must themselves be estimates and hence have similar drawbacks to those we are facing in providing estimates.

c: Adjusted average over 3 years

Not independent
 although expected loss ratio would be independent from claims on that year.
 Can make correct allowance for rate changes and inflation
 Reflects trends in own data
 Low loss ratios indicate cat data so three year average loss ratio may not reflect long term average
 May not take account of changes in terms and conditions, mix of business, underwriting cycle
 Own data may be lacking or not credible but is large so should be credible

Any generic point such as cats probably not being allowed for under any of these approaches

Generally well answered

(ii) **Calculations:**

1. Roll forward 2007/8/9 LR's for Rate and Inflation
2. Average the 3 ratios
3. Use this ratio in BF calculation

$$\text{BF Ultimate} = \text{Incurred Claims} + \text{IELR} \times (1 - \text{inc dev factor}) \times \text{Premium}$$

| <i>U/wtg Year</i> | 2007 | 2008 | 2009 |
|----------------------|--------|--------|--------|
| <i>ULR%</i> | 24.60% | 23.60% | 27.70% |
| <i>Inflation</i> | 1.1576 | 1.1025 | 1.0500 |
| <i>Rate Change</i> | 1.1130 | 1.1130 | 1.0500 |
| <i>Adjusted ULR%</i> | 25.59% | 23.38% | 27.70% |

$$\begin{aligned} \text{BF Ultimate} &= 9,000 + 0.2555 \times 0.781 \times 82,100 \\ &= 25,386 \\ \text{ULR} &= 25,386 / 82,100 = 30.9\% \end{aligned}$$

As question is not specific could use premium weighted averages, also could use ultimate premiums and ultimate claims rather than the ULR's given:
answers are all similar and correct to at least 3 significant figures

Most candidates just calculated the adjusted average loss ratio and not the BF ultimate, when the question specifically asks for the ultimate loss ratio with the average adjusted loss ratio "for use within the Incurred Bornhuetter-Ferguson method". Also some overcomplicated things, for example by calculating indices or by working on incurred data and then projecting. This level of complexity was clearly not needed with only 3 marks available.

- (iii) Reasonably high levels of downward development
Risk of being under-reserved if downward development does not materialise

May consider using paid development for 2006 to 2008 if danger of savings not being produced but note that paid development is immature with percent of ultimate varying from 77% to 50% across these years

But could consider paid BF for these years

And may consider incurred BF for 2009

But cannot use incurred BF for 2006 to 2008 without adjustment because selected percentages of ultimate are greater than one

Ultimate loss ratios appear to be increasing and this needs to be investigated: possibly should use trended loss ratio from years 2005 to 2009 to give a-priori ratio for 2009: straight trend gives 28.3%

Should always use a number of different reserving methods before selecting ultimates

If relevant such as considering completely different methods such as Cape Cod, Mack etc. but probably not different forms of data such as accident year or reporting year basis and probably not for suggesting chain ladder for incurred claims as this is most likely to have been the method used to obtain the selected incurred development

Very few candidates commented on the very low loss ratios and hence that this is likely to be catastrophe-type business, in fact often stating that the loss ratio for 2009 is high. Some suggested using chain-ladder as an alternative and hence did not realise that this is presumably the method that the alternatives are required to be made to! Generally poorly answered.

- 6** (i) Case estimates can make use of qualitative information on claims.
This can be important for unusual liability claims where data are scant.
Case estimates allow for the judgement of a skilled and experienced assessor

This can be particularly useful for large claims.

Reinsurance recoveries can be calculated explicitly using case estimated gross claims.

Case assessors can assist in picking up trends more quickly than they emerge using statistical methods.

Case estimates may be the only available method when statistical methods are unreliable

Such as in the early years of experience for liability and BI covers, when there are insufficient data available.

Even when statistical methods are suitable, case estimates can still help to review the appropriateness of the rating structure or a check on statistical methods.

This is important for a new product.

Case estimates can be difficult to verify because they may be subjective.

Particularly for BI claims, where the financial state of the company may be unclear.

And for long-tailed claims, where the rate of inflation assumed can be significant.

Statistical methods are needed for estimating IBNR and reopened claims.

Case estimates are more resource-intensive than statistical methods.

Particularly for this product, where there is a wide range of different covers.

This makes it expensive and impractical to estimate small property and liability claims individually.

Case estimates needed to be updated constantly as new information emerges.

Case estimates may have lack of consistency between assessors, due to individual judgement or bias.

Case estimates may have lack of consistency over time.

Statistical methods allow the production of estimates on a range of different bases.

The need to subdivide data for statistical methods to obtain homogeneous data is a problem for this company as is small.

If a case estimate is used for negotiation with claimants, it may have a bias towards the low end.

Advantages given for case estimates may validly be given as disadvantages for statistical methods and vice versa

Many candidates gave a generic answer despite the question stating "for this product".

(ii) **Liability Covers**

The claims will be for bodily injury and damage to/loss of property.

Many claims would be quickly notified & settled.

However, there can be significant delays in the emergence, reporting and settlement of some claims.

This is particularly the case for larger claims and those involving bodily injury.

Latent claims are a particular feature of Employers' Liability.

There would be a wide distribution of claim costs and a high upper limit.

Claims inflation is an important factor for the long-tailed claims, particularly court award inflation for bodily injury claims.

Accumulations can occur, due to:

...concentrations of risk from one event

...court awards triggering similar claims

...several insureds in same industry or type of trade being exposed to the same cause

Property Covers

The main types of claim would be for damage to business premises and stock from perils such as fire, theft, water and weather.
Most claims occur suddenly and are quick to be notified, estimated and settled.

However, there are a few exceptions, such as notification of subsidence and delays in verifying stock value (or other reasonable example).
Claims cost can be variable due to the variety of different types of property and trade, but within each type the distribution of sizes tends to be consistent.

Accumulations can occur due to weather catastrophes.
There is an increased risk of fraudulent claims during an economic recession where more businesses are in financial difficulties.

Business Interruption Covers

Claims are for financial losses following damage (e.g. fire) to business premises.
Reporting delays are directly linked to any associated property claim.
However, settlement delays can be longer due to the need for additional verification of the financial position and the time taken to restore the insured to its pre-loss trading position (or other reasonable example).
Claim amounts can be very large due to the profits lost during a lengthy period of restoration to the pre-loss trading position.
There is a risk of the insured attempting to inflate the claim amount above the true loss, particularly in a recession where actual trading is depressed.

Many candidates outlined the different characteristics of each class but did not relate them to the product and hence missed points such as that business interruption claims would be related to property claim events.

(iii) Overall points

The choice of approach will depend on the reason for calculating the reserve.
...such as the granularity of reporting required (or other suitable example).
The choice of approach will depend on the statistical method to be used.
...because some methods may be more sensitive than others to stability of development patterns (or other suitable factor).

Combining Property and BI

Advantages

Adds a greater weight of data in each cell, which should increase the stability of the development patterns.
This is important for a new class of business where the company may not yet have much data relating to particular types of cover or types of claim.

It might be helpful for property and BI because claims will originate from the same event.

It could reduce the uncertainty associated with the estimate of outstanding claims.

Disadvantages

Development of claims costs could be distorted by the relative large size and long settlement patterns of BI claims compared with property claims.

Trends for some types of claims may be difficult to spot if they are masked by unusual experience for other types.

Loss adjustment expenses may be a very different proportion of the claims cost for BI compared with property, which could distort the analysis.

Not all property claims have BI.

Splitting Liability

Advantages

Results in a more homogeneous data set, which reduces distortion from different types of claims.

The allowance for future claims inflation can be more accurate (e.g., price inflation for property; earnings inflation for liability).

The effect of economic conditions can be allowed for more accurately in IBNR, since this will affect liability less than the other classes.

Liability itself should also be split if possible: PL different from EL.

Disadvantages

Data would probably be quite sparse for only 3 years of experience in a small company, making estimation more difficult.

However, the property data would not have helped much with estimation of liability claims anyway.

BF methods would become more difficult to use because the premium needs to be split.

Given that there were six marks available for this section candidates generally gave too brief an answer, missing many points.

- (iv) Exposure based reserving may be suitable if statistical methods are unreliable, such as following a one-off large loss (or latent claims)
...for example, a weather event, which would cause widespread losses in the property and BI covers primarily (or other sensible example of severe loss).
...or where there is limited historical data, as is probably the case for this new class.
It might not replace a statistical method entirely but would be useful as a cross-check.
The method can take the form of a top-down analysis, under which a proportion of the total market loss is attributed to the company.

But this would not be appropriate here because of small size of company, packaged product etc.
Alternatively, the company could take a bottom-up approach, which involves a policy-by-policy analysis of exposure to the event.
This is method is more suitable where the likely exposure is atypical and the exposure data are readily available and of adequate quality
...which is more likely in this situation.

Most candidates gave circumstances when exposure-based methods would be used and described top-down and bottom-up approaches, but did not relate to the product described and hence determine whether the methods were appropriate.

- (v) Accounting rules may influence the basis, such as the level of prudence and detail required for filing.
Timescales required for reporting results may influence the trade-off between rigour and time taken.
The level of scrutiny (e.g. by auditors) may influence the level of rigour, such as the number of cross-checks using different estimation methods.
Trading conditions in relevant industries may influence the level of IBNR in anticipation of changes in claims activity.
Market rates of return will affect the discount rate.
Tax rules may impact the extent of discounting and margins or prudence.
Regulations for demonstrating solvency may prescribe a basis and method.
Professional guidance is likely to influence the methods and documentation used.
Some methods such as BF may make allowance for position in underwriting cycle
Competition (*if reason given*)
Trends in data because of the recession/propensity to claim
Reinsurance (*if reason given*)
For discounting, market rates of interest
- The level of precision used will need to be proportionate to the quality of data provided by the insureds.

Generally poorly answered.

7 (i) When would we use the capital model in the business

Regulatory requirements to satisfy “use test”:

that is, the company must use the model to help manage the business, not simply to produce numbers for regulatory purposes.

Reinsurance: optimising the purchase of reinsurance
– types of RI and different retentions.

Investment: assessing the impact of a change in the investment mix.
Investment departments often use model output to match liabilities in terms of amount, timing, currency, etc.

Pricing:
assessing return on capital for pricing and performance measurement
used to form a view on how capital requirements should be allocated between different lines on business.

Reserving: quantifying the uncertainty in claims reserves for regulatory purposes

Planning:
Comparing different plans in terms of their risks
Comparing different plans in terms of their expected profits

Strategy:
Assessing the risks and diversification benefit of new strategies such as consideration for writing new lines of business
Sensitivity testing of key assumptions such as exposure to CATS/inflation shocks
Assessing the impact of using new distribution channels e.g. different credit risk profiles/broker balances etc
Assessing the impact of introducing new Terms and Conditions to policies – impact on pricing and capital can be assessed

Risk management:
identifying key risks and assessing the impact of mitigation.
Mergers and acquisitions

Generally poorly answered. All that is necessary is a slight amplification of a standard list with some reasons.

(ii) **Modelling UW and Reserving Risk for a new type of business**

Underwriting risk

As a starting point, we can consider the firm's business plan if this is prepared on a realistic basis.
If the firm uses an aspirational business plan for motivational purposes, this should first be adjusted to a best estimate basis.

For a new class we should be able to support the loss and expense assumptions by reference to market experience, after adjusting for any differences.

The capital requirement for the underwriting risk is the difference between the underwriting results at the firm's chosen level of risk tolerance for the business written/earned during the modelled period and the underwriting result on the realistic basis.

The realistic basis should not include any profit expected (we should deduct such baseline profit from the capital requirement as a separate item).

We should divide the firm's business into classes/currencies/territories of sufficient granularity (that is, small enough subdivisions) that we can consider distinctive features of the class, but not so fine that statistical methods become invalid (because of insufficient data in the subdivisions).
Lack of data may inhibit this process

We should then assess the variability of its claims and expenses, either by fitting statistical distributions or by simpler approaches such as stress tests.

Ideally, we should model large claims separately from attritional claims so that we can determine reinsurance recoveries directly.

However, for classes that are small or not subject to large claims it may be more practical to model loss ratios.

We should model catastrophe-type claims separately from either, especially for events that may impact more than one class.

We generally model large claims on a frequency/severity basis.

The Poisson distribution is often used for frequency, but is only appropriate where the claims are independent, since if there is any correlation between claims, this distribution will underestimate the tail risk.

For severity, sampling from revalued past claim sizes is sometimes used, but this omits the risk of a claim greater than experienced so it is preferable to fit a distribution.

A heavily skewed distribution such as the Pareto would normally be appropriate for severity,
Or a mildly-skewed distribution such as the lognormal may be appropriate
It should be derived from or tested against historic market data revalued to current claims costs.
We generally model attritional claims in aggregate.

If the standard deviation is a sufficiently small fraction of the mean, a normal distribution may be an adequate approximation.

We cannot model catastrophe events from the firm's experience because of their rarity and because a new business.
For natural catastrophes such as earthquake or windstorm, or for terrorist attack, a proprietary model can apply a set of simulated events to the firm's exposure to derive a distribution of possible costs.

Ensure that the model is suitable; for example, by allowing for demand surge, climate cycle, and so on,
and to test the results against the known impact of recent actual catastrophes and to resolve or adjust for any discrepancy.
For human-made catastrophes other than terrorism, the firm is likely to have to develop a bespoke model.

Gross reserving risk

New risk so potentially no immediate impact.

Firm could make allowance for 2 years of hypothetical reserves to avoid future capital strain. e.g. Lloyds

Lack of data and experience an issue so industry data needed – and associated problems

We should then assess the variability in the firm's claims settling, by statistical techniques such as bootstrapping or the Mack method, or stress tests.

New class/industry data so need to consider whether sufficient reserve shocks have occurred within the period of the reserve data to indicate possible future variability.

Possibly adopt a greater variability than the industry figure,
or we could model an explicit shock such as a future Ogden rate change.

To convert the capital impact of the gross insurance risk to that for net insurance risk within a class, we should deduct the reinsurance that can contractually be recovered on large and catastrophe claims
(and on attritional claims in the case of proportional covers and working layers).

We should allow for disputes or exhaustion of cover,
so it is preferable to calculate reinsurance recoveries directly, rather than assume that historic net to gross ratios will continue in the future
Need to make an assessment of the correlations and dependencies between classes/perils etc. based on historical and market data

Many candidates did not consider what was being parameterised e.g. splitting claims into attritional, large and cat claims and the parameters required for each of these.

(iii) Potential impact of inappropriate model

- It could lead to the incorrect decision on whether or not to start writing this line of business
- which has subsequent consequences on future profitability

- impacts all stakeholders including:
 - shareholders (returns),
 - employees (job security),
 - policyholders (claim payments)
 - Other stakeholders of the company (e.g. suppliers, competitors).
- If reserve risk parameters/model incorrect, all estimates of the reserves in the model (gross, net, undiscounted, discounted), at each point in time they are modelled (e.g. opening, end of year 1, etc.) will be unreliable both for the individual class and in total.
- If UW risk parameters/model incorrect, all estimates of profitability of business written in future years in the model will be unreliable both for individual class and in total.
- Because the projected balance sheet is unreliable, any view on capital requirements or surplus derived from this is also unreliable.
- The company is at risk of holding inadequate capital for its true exposures should it start writing the new class as it has an unreliable view on its liabilities. This poses direct threat to the security of policyholders.
- If errors lead to too much capital there is an opportunity cost representing the use to which the capital could otherwise have been put
- There are reputation risks to the company if it turns out that inadequate capital is held. This has second order impact on ability to write future business, borrow money, etc.
- Pricing: With incorrect allocations to classes of business the company is writing business at inadequate rate which causes further profitability issues.
- incorrect performance management results will be made based on inadequate model
- Investment management: If the payment pattern parameterisation is incorrect it is possible the selected asset strategy will be accordingly incorrect.
- Risk management If, the correlation assumptions in the model are incorrect, the insurer may think it has more diversification in its portfolio than it actually has.
- If the company models future premium growth incorrectly, it may not understand how its exposure to catastrophes or class specific inflation changes over time.

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- It is possible that the incorrect decision will be made in reinsurance purchases, which in turn will affect future profitability and exposure to risk.
- Has an impact on any further operational planning or M&A analysis carried out using the model, the results of which may be misleading if say the premium correlation assumptions are incorrect.

Generally poorly answered, with most candidates finding very few points on this part.

END OF EXAMINERS' REPORT