

**Faculty of Actuaries**

**Institute of Actuaries**

# **EXAMINATIONS**

*April 2000*

**Subject 403 — UK Fellowship General Insurance**

*Paper One*

## **EXAMINERS' REPORT**

*Overall, most candidates scored well in respect of the bookwork and calculation questions. However, most candidates could not demonstrate their understanding of general insurance when it came to the application of their basic knowledge to demonstrate the higher skills required in order to pass this subject and proceed to become a qualified actuary.*

*1 This straightforward question was reasonably well answered by most candidates. Many points could be made with the best candidates scoring well over half marks. Additional valid points were given credit*

(i) The following are possible reasons:

- Different reinsurance arrangements. The net positions of the two could be quite different.
- The classes of business written may be quite different. Different classes of business can have quite different capital requirements because of the uncertainty and variability of the risks.
- One may write a single line of business, and the other a number of different classes, or in different geographical areas.
- The investment strategies of the two companies may be quite different.
- They may have different assessments of the acceptable probability of ruin or the term under consideration. These would lead to different assessments of the capital requirements of the business.
- Different growth prospects.
- Different Statutory requirements.

(ii) For each line of business (and for each country if business is written overseas):

- gross and net written premium.
- claims ratio and expense ratio,
- changes in reinsurance,
- type of reinsurance,
- failure of reinsurer or other third parties,
- details of any exceptional expense items,
- details of exceptional claims,
- claims accumulation,
- material changes in cover offered and policy wording,
- reserving policy,
- changes in reserving. A material change in reserving policy would not affect the mean results but it would affect the volatility.
- investment strategy regarding the investment of technical reserves,
- rating agencies' assessment,
- premium risk.

**2**      *This standard bookwork question about reinsurance caused very few problems.*

- (i)      (a)      A proportional reinsurance  
The proportion ceded varies for each risk and is decided by the insurer (cedant)  
The treaty will specify the maximum cession as a multiple of the cedant's retention in each case, which will have a maximum value  
An insurer may require several layers of surplus reinsurance to cover all its risks  
For example, a 3 line surplus with \$1 million retention allow the cedant to retain up to \$1 million on any risk, and it may cede up to three times what it retains.  
The reinsurer will pay commission to the cedant that reflects the cedant's commission to the insured, possibly plus overrider and/or profit commission.
- (b)      A non-proportional reinsurance  
Relates to losses arising from a single policy risk at one time  
It will refund the insurer the amount of a claim above a retention  
Up to a limit (usually)  
The retention and/or limit may vary according to a particular inflation index  
Cover will usually be limited to a certain number of claims for the full amount  
After a full loss to the layer, it may be necessary to pay to reinstate the cover for further losses  
A company will normally need several layers of excess of loss cover.
- (ii)      (a)      Reinsurer  
May produce more income than non-proportional cover  
Insurer  
May give attractive profit or ceding commission  
Provides unlimited reinstatements at no extra cost (apart from loss of profit commission)  
May give significant catastrophe cover
- (b)      Reinsurer  
Can set pricing for layer  
Can limit downside risk by limiting reinstatements  
Only involved in large losses, which reduces administrative burden  
Insurer  
Cedes only part of risk, which reduces cost.

**3**      *This question was generally well answered with the better candidates scoring very high marks.*

- (i) Insurance premiums are exempt from value added tax but are subject to an insurance premium tax (IPT) of 5%  
Insurance sold with a basic product that is subject to VAT is taxed at the same rate of VAT.  
For example: extended warranty with white or brown goods  
Travel insurance is taxed at 17½% for IPT  
Premiums for corporate policyholders are paid from pre-tax income  
Premiums for personal policyholders are paid from after-tax income  
Claim payments indemnify policyholders, and are not subject to tax  
Except consequential loss, because it replaces profits and some types of income replacement  
Insurance premiums paid may be taxable income for an insurance company
- (ii) Underwriting profits and losses are regarded as arising from mutual trading  
and are exempt from tax  
Realised investment gains are subject to CGT  
so indexation relief applies  
Franked investment income does not apply for mutual companies  
as they do not pay ACT (note ACT has now been abolished)

4 *This question produced a very wide range of marks. The better candidates showed that they could apply their basic knowledge of risk to a new situation. Many candidates however failed in this respect and gained most of their marks in part (iii) – although some candidates even here showed that they had not thoroughly read the question.*

- (i) Opportunities  
Diversification  
Exposure to an expanding market  
Exposure to an international market  
Extending company standing  
Access to potentially profitable business  
  
Risks  
Lack of knowledge of the market/requires specific expertise  
Potentially unprofitable as market soft  
Low number of high value policies - high variability of claims/profit  
Small market, so may be difficult to attract business.  
Difficulty in finding reinsurance
- (ii) Buy in expertise: either employ specialist underwriters or buy an existing company  
Do not follow market rates, but underwrite for profit - but may not get much business  
Buy reinsurance / coinsurance  
Use policy exclusions or restrictive policy language  
Limit the income written and so limit the downside risk

- (iii) The payment is triggered if there are at least five losses since  $4 \times \$210 \text{ million} < \$1 \text{ billion} < 5 \times \$210 \text{ million}$ .

<i>Number of Losses</i>	<i>Probability</i>	<i>Probability</i>	<i>Running Total</i>
0	$0.9^{50}$	0.5154%	0.5154%
1	$50 \times 0.1 \times 0.9^{49}$	2.8632%	3.3786%
2	$2.8632\% \times 49 \div 2 \div 9$	7.7943%	11.1729%
3	$7.7943\% \times 48/3 \div 9$	13.8565%	25.0294%
4	$13.8565\% \times 47/4 \div 9$	18.0905%	43.1198%

Hence the probability of a loss under the contract is  $100\% - 43.1198\% = 56.8802\%$

The expected loss cost is  $\$5 \text{ million} \times 0.568802 = \$2,844,010$

- (iv) Not all vehicles will have a value of exactly \$210 million. Hence, although the method may understate or overstate the expected loss cost, it will certainly understate the variability of the result.  
 Not all launch vehicles will have the same failure probability, so the method will understate the variability and the loss cost.  
 The launch schedule is normally disrupted following a failure, so there may be fewer than 50 launches, and the method may overstate the expected cost.  
 Binomial may not be appropriate, if the success of launches is not independent, which may well be the case. Variation is likely to understate variability and loss cost.  
 There may not be enough losses on our own account to collect the full amount, so the method overstates loss costs.  
 Larger risks may have a higher or lower failure frequency than smaller ones.  
 Project overspend may increase the value of launches and possible loss cost.  
 Failure rate of 10% not valid in the future, if lower then overstates cost.

**5** *Most candidates scored well in part (i) – bookwork, and most made a good attempt at the calculation in part (ii) with the occasional numerical error which did not lose many marks. Only the better candidates scored many marks in part (iii) which required thought about this particular situation.*

- (i) The premium for an individual risk depends, at least in part, on that risk's own experience.  
 Therefore risks gravitate naturally to higher or lower premium levels according to their own experience, thus reducing heterogeneity in the rating structure.

Prospective: the premium at renewal depends on the experience prior to that renewal, so the insurer takes on all the underwriting risk, in the event of non-renewal.

Retrospective: the premium for the current period of cover is adjusted, based on the claims experience in that period. A deposit premium is paid initially with an adjustment premium at the end of the period, based on the claims experience. The insurer takes on less of the underwriting risk. Combinations of these two systems are possible.

Systems may be numbers-based or cost-based.

A numbers-based system alters premium according to how many claims there are. This is generally used for small risks with a low frequency of claim. For example, NCD systems for motor and, less frequently, household insurance.

A cost-based system alters premium according to the total cost of claims, and is generally used for larger risks with numerous claims, such as fleet rating or employers' liability.

The extent to which a risk's own experience is taken into account is termed a credibility factor. Full credibility - a 100% credibility factor - implies rating a risk solely on its own claims experience.

(ii) Step 1: Remove the effect of large claims

1998: 112.5 (= 120 - (27.5-20))

1996: 104.4 (=184.4 - (120 - 20\*2))

Step 2: Allow for grossing-up factor

1999: 139.92

1998: 135.00

1997: 103.68

1996: 125.28

1995: 102.48

Step 3: Allow for inflation, assuming that payment patterns have not changed

1999:  $139.92 \times 1.06 = 148.32$

1998:  $135.00 \times 1.06^2 = 151.69$

1997:  $103.68 \times 1.06^3 = 123.48$

1996:  $125.28 \times 1.06^4 = 158.16$

1997:  $102.48 \times 1.06^5 = 137.14$

Step 4: Divide by total exposure to get premium rate pre vehicle:

$718.79 \times 1000 \div 1700 = \text{£}422.82$  per vehicle.

Step 5: Use credibility factor to get a risk premium:

$422.82 \times 0.65 + 450 \times 0.35 = \text{£}432.33$

Step 6: Add 20% loading for office premium:  $\text{£}518.80$

Step 7: Renewal premium is  $\text{£}518.80 \times 370 = \text{£}191,955$

Step 8: Adjust the premium at the end of the policy year to take account of actual exposure.

- (iii) The total exposure during the period under review is 1,700 vehicle years. Assuming that about 20% of vehicles have a claim in each year, this means we would expect about 340 claims, with a standard deviation of about 16 claims. The 65% credibility factor may therefore be thought to be inappropriate.

It is assumed that the claims cost for a year relates to the policy year exposure in that year which may not be true.

The inflation rate will have distorted the calculation: there may have been some claims in 1995, for example, that were settled below £20,000, but would have cost more than that amount in 1999, and would have been capped. At the rate of inflation indicated, a 1995 claim of just under £20,000 would have cost more than £25,000 in 1999. Ideally the cap should have been adjusted in line with the inflation rate.

The basis of claims cost is not defined and may not make an allowance for IBNR claims. Such claim costs may or may not be suitable for rating, and if they are taken from reserves calculated for a different purpose, it is possible that they contain prudential margins.

There may be a cover change from base period.

Types of vehicle may have changed from base period.

Changes in legislation from base period e.g. Ogden.

A loading of 20% is made for expenses and profit for all fleet business. As some costs associated with insurance business are irrespective of the size of the risk, this loading is not appropriate for all such business and hence the resulting premium is not appropriate.

It is not clear as to whether claims handling costs are included in the claim costs.

Need to allow for reinsurance costs if appropriate.

Need to look at market rates to see if the derived rate is competitive.

Grossing up factor of 20% may not be appropriate for this risk, so should look at experience.

- 6** *This question was not answered well by most candidates. Credit was given for alternative valid approaches to the solution but most candidates showed that they could think of only a few points as to how to assess the appropriate level of the cash offer.*

Main areas of assessment:

Performance ratios and trends over last 5–10 years

Projections for next 5–10 years  
Synergies  
Market considerations

Market considerations:

Will depend on whether the take-over is hostile or friendly.  
Internal company information may be available if not hostile.  
Current share price.  
Market information including credit rating.

Are there any other bidders?

What other opportunities exist.  
How does the target company compare with others and the cost of setting up something similar from scratch?

Synergies:

The insurer should see a reduction in reinsurance fees — profit element no longer required.

A reduction in office space and other fixed overheads may be possible.

Any non-essential or support departments can be merged with likely efficiency gains.

Increased spread of risk as more types of business underwritten.

Will obtain useful data in respect of business already written by the reinsurer, possibly in respect of competitors or new classes of business into which it could expand.

Unlikely to continue to underwrite types of reinsurance risks which it underwrites as a direct writer.  
Cost of combining systems.

Performance Ratios and Trends:

Need to look at these to make a reasonable assessment of business still outstanding and likely future business performance in the short to medium term.

Assess the brand image / goodwill of the company.

Need to look at relatively long period due to reinsurance cycle.

Limit to how far back is worthwhile due to distant past being less relevant as a guide for future performance.

Data can be obtained through Published accounts and any Statutory returns.

Valuation Basis in the above returns and accounts are likely to contain margins.



It is desirable though to value the business on a best estimate basis.  
Will therefore need to attempt to understand business through variety of ratios and trends in order to produce valuation on best estimate basis.

Use ratios because monetary amounts are unreliable as a guide to performance because vary over time for a company due to inflation factors and between companies due different size and mix of business.

In using ratios care must be taken to ensure correspondence between the numerator and denominator.

Claims ratio –  $\text{Claims incurred} / \text{Premium earned}$

Gives a basic measure of the level of claims.

Increasing over time implies decreasing adequacy of premium, falling underwriting standards or reducing control of claims.

This is affected by the strength of the valuation basis used.

Claim frequency and average cost of claims unlikely to be available from DTI returns and Co Act accounts.

Outstanding claims / Paid claims

Outstanding claims / Premium earned

Will help give further insight into the claims experience such as, changes in the mix of business, changes in the valuation basis, and the latter two — changes in the settlement process.

Expense Ratio –  $\text{Total expenses (including commission)} / \text{Written Premium}$

Increasing over time suggests falling efficiency.

Commission Rate –  $\text{Commission} / \text{Premium written}$

Unlikely to be relevant as reinsurer will have its own underwriting team.

Proportion Retroceded –  $\text{Outward retrocession premiums} / \text{Gross premiums written}$

Changes may highlight a change in retrocession progress or changes in the mix of business.

Investment ratio –  $\text{Total investment return} / \text{Avg assets during year}$

Underwriting profit, Insurance profit, Total shareholders funds

Profit margin –  $\text{Insurance profit} / \text{Net premium earned}$

Affected by reserving basis

Return on Capital –  $\text{Total profit} / \text{Capital employed}$

Measures the efficiency of use of capital

Solvency Ratio –  $\text{Free reserves} / \text{Net written premium}$

Measures financial strength

Asset-liability Ratio –  $\text{Total assets} / \text{Total liabilities}$

Another measure of financial strength

Comparisons for the four ratios above with other similar companies and over time will provide a useful insight into performance.

Also useful, where possible, to speak with staff and management at all levels to get a feel for how well the company is managed and what the atmosphere and ethos is like within the company.

Model office projections

Should be performed over a variety of periods, say 5, 10, 20 years.

On a variety of bases, weak, best estimate and strong, though best estimate of most important. Need to do by class of business to assess exposure to catastrophes and latent claims.

**7** *This question tested the whole reserving process rather than listing uncertainties in the level of the reserves adopted. Very few candidates managed to mention more than the basic points about uncertainty in the assumptions made.*

- (i) The decision on what to publish in the accounts rests with the Board of Directors.  
The actuary's role is to provide the necessary advice to the Board in order to make an informed decision.

In framing the advice the actuary will make a number of assumptions regarding the model and parameters used.

Both of these sets of assumptions are subject to varying degrees of uncertainty.

The quality of the data has to be relied upon.

Also each of the assumptions used may contain margins of prudence.

Such margins include the discounting rate, reinsurance recoveries, inflation, tail factor and treatment of future premiums.

Due to the degree of uncertainty regarding the "true" model and parameters there is a range of values which can be considered reasonable and prudent.

Provided that assumptions made remain above the lower end of their respective reasonable and prudent level then their use is adequately justified.

Where the assumptions fall below a level deemed reasonable and prudent by the actuary then they should not be used in framing advice.

General accounting and actuarial guidance also indicates that arbitrary changes should not be made to assumptions.

Any proposed changes should be for reasons indicated by past experience or known future changes.

In practice, good reasons will usually exist to justify small changes to any assumptions made.

With reserves of £1bn a change in profit of £10m is relatively immaterial. There will undoubtedly be small margins in some of the assumptions which can be trimmed to produce the desired result.

However, in the unlikely event that all margins have already been set at the lowest level deemed acceptable to the actuary then any review of the calculation should make that conclusion clear.

- (ii) In the case where the level of reserves is only £50m a change in profit of £10m is material.

It is unlikely that the calculations that produced a profit of £10m will contain sufficient margins which when removed give rise to a profit of £20m.

Unlikely to be able to accede to the request.

Possibly seek a second, independent, opinion.