

EXAMINATIONS

September 2000

Subject 303 — General Insurance

EXAMINERS' REPORT

Candidates are reminded that under the current examination system the answers have to be provided in a hand written form and therefore the examiners can only take into account solutions to the extent that they are legible.

The examiners are required to test the candidate's knowledge of the subject and also to a limited extent, the ability of the candidate to apply the knowledge and principles in practical situations. Most candidates do not succeed in obtaining a pass as a direct result of not being able to demonstrate to the examiners that they are able to apply the knowledge and principles of the subject in a practical situation. At first glance it may appear that examiners go out of their way to contrive situations and contracts that are so unusual that most candidates may never meet these situations in practice. However these situations are the ones where the well-prepared candidate can demonstrate that he understands the principles of the subject and is not just regurgitating bookwork

1 *The bookwork component of this question was answered well by the majority of candidates, however very few candidates were able to apply the knowledge in a particular situation. The number of marks for a given question does provide an indication of the number of points that are required for full marks, against this criteria the majority of candidates provided a superficial solution for part (ii).*

(i) Advantages

Discounted reserves give a more realistic value of assets required to meet expected liability

More useful for assessing solvency

More useful for pricing and comparing profitability of classes

Releases profit earlier (if no additional security margin is introduced)

Reserves smaller, appears more solvent

Disadvantages

Removes margins which would help if experience is worse than expected

Difficult to derive payment pattern for some classes

Complex and difficult to determine rate

Need to allow for amounts not invested (for short tail classes difficulties may outweigh any small benefit of discounting)

Earlier release of profit also leads to earlier crystallisation of tax liability

(ii)

As Company A has set up lower reserves for the same premium income, it will appear to be more profitable on an inception-to-date basis. However, the position in any particular year will depend on whether the companies are growing or shrinking. If they are growing then the reserves will increase, and Company B's will increase by more than company A's. As the companies will have the same earned premium, but Company B will have a higher claims cost, it will appear to be less profitable. Conversely, if the amount of business being written is reducing, Company B will appear to be more profitable.

Company B will have a higher amount of reserves for the same premium. The analysts may deduce that its business is longer tailed than that of Company A. However, with higher reserves higher investment income will be allocated to its technical account, which will make its insurance business appear more profitable than Company A's. In a year when premiums are rising this will offset, partially or totally, the premium effect; if premiums are falling, it will exacerbate Company B's apparent greater profitability.

One consequence of appearing to be more profitable, at least on an inception-to-date basis, is that Company A is likely to pay more tax on its profits than Company B, assuming that that is the taxation basis under which they operate. It may also have released more in dividends. If it has, and its retained profit is equal to Company B's, the companies will appear to be of equal solvency strength on the most widely used basis. However, in that case its assets will be lower than Company B's and it will generate less investment income.

On the other hand, if it has maintained its total assets at the same level as Company B, then, with a higher tax bill it must have released lower dividends to its shareholders despite its higher apparent profitability, since both companies must have paid out the same amount in total to achieve this. In that case, although its underlying strength is the same as Company B, it would appear to be more solvent, as more of its assets would be accounted for as capital and less as liabilities. The investment income of the two companies will be the same, but Company A will appear to be generating more from the investment of shareholders' funds and Company B more from its insurance business.

Effect of tail of business

Effect on smoothness of profit

2 *This question was answered well by the majority of candidates*

- (i) Experience rating is a system in which the premium for an individual risk depends, at least in part, on the claims experience for that risk.
- (ii) With prospective rating the premium at the renewal date depends on the experience of the risk prior to that date.
The insurer takes on all of the underwriting risk in the next policy period. With retrospective rating the premium for the current policy period is adjusted, based on the experience of that period of risk.
A deposit premium is paid at the start of the period of cover.
And will be followed by an adjustment premium or refund at the end of the period.
- (iii) Number based systems:
Systems based on claims frequency are normally used for small individual risks with relatively low expected number of claims.
This is because the variability of the claim cost in any one policy year would be too great to judge the relative severity of the underlying risk.
The accumulation of a sufficiently credible experience would take too many years.

Cost based systems:

These systems tend to be used for larger risks with numerous claims.

In these cases, the aggregate cost of claims experienced in any one year is a more stable indicator of the relative level of that risk.

The large number of claims makes a number-based system impractical.

3 *This question was answered well by the majority of candidates*

- (i) Administration
Accounting
Statutory returns
Investment
Financial control
Management information
Risk management
Reserving
Experience statistics
Premium rating
Product costing
Marketing
Reinsurance
- (ii) Claims data: frequency and average cost, by location and class of business
Exposure data
Portfolio movements
Expenses
Persistency and profitability by source
Investment performance
Solvency
Reinsurance
Run-off experience

4 *This question, though requiring some thought and application to the scenario given, was largely bookwork in nature. However, given this background, it was answered well by very few candidates. Candidates on the whole did not provide sufficient breadth or depth in their answers.*

Cost structure changes will include:

IT development costs — recruitment and equipment costs.

Overheads may fall as efficiency gains are achieved.

Advertising costs may increase in the short term to help achieve the desired target level of business, though may fall in the longer term where less expensive means are available on the internet.

Cheaper claims handling may become possible where smaller claims are handled over the internet and by use of e-mail.

Brokers fees may fall overall as less business is put through them.

However, the costs per policy may rise where less cost effective deals are struck (i.e. the costs fall less than the business going through the brokers). Effect on broker relationship. Capital efficiency should improve as the balance of premiums with the brokers should fall. This will free up a portion of the insurers assets which were otherwise tied up. Shift to fixed expenses from variable.

The cost structure will change as more of the expenses (maintaining an infrastructure) are fixed and less (commission) are variable.

Premiums calculation:

Another complete set of premium rates will be required.

Different rating structure

It should be easier and more cost effective to update these periodically to take account of new experience.

More frequent updates will become possible.

More sophisticated premium calculation system may be possible.

More extensive policyholder information can possibly be captured via this medium by developing easy to use system.

Also greater flexibility in data collection enables potential new rating factors to be collected and tested.

Test the market with the rates

Take account of competitors rates

Business mix and volumes:

The mix of business will change as those purchasing insurance via the internet will have different characteristics.

Likely to be more sophisticated.

Different geographical spread

Possibly increased proportion of policyholders in the 20–40 age range.

Thus an increase in the concentration of risk is likely.

The projected volume of business is highly uncertain.

A lot will hinge on advertising

the design of the website and

social trends towards the increasing use of the internet at home.

Renewal rates may increase due to the ease of renewal via this medium.

This in turn may help to reduce costs per policy and thus premiums.

With this sales medium likely to become more popular in the future, early entrance to this potential market may reap rewards in the longer term through generating customer loyalty.

Reinsurance arrangements:

Premiums may need to be negotiated where reinsurers perceive an increase in risk — perhaps due to potential increased concentrations.

New aggregate excess levels may be desired due to the increased concentrations.

Any quota share arrangements may need to be renegotiated as the reinsurer may be less comfortable with the change in approach.

There may be increased risk of fraud early on as the system developed will still be in its infancy.

Technical help from reinsurer

- 5** *This question, though not completely bookwork, was fairly straightforward, requiring a systematic approach to consideration of the liabilities and corresponding appropriateness of the asset in question. As a result it was answered reasonably well. However, many candidates did not describe the nature of the liabilities for which the asset was being considered, and even when described the description was often incomplete or inaccurate. This led to candidates not concluding whether the asset was a “good” or “bad” match for the liabilities in question.*

Product liability covers faulty design, faulty manufacture, faulty packaging and incorrect instructions.

Property damage / bodily injury

Usually on a claims incurred basis (rather than relating to year of sales).

There are some long reporting and settlement delays.

Where time is taken to attribute physical conditions to the correct cause and where claims relate to rogue drugs causing settlements to continue for some years.

Possible accumulation of claims.

The suggested asset purchase is appropriate by reference to the real nature of some of the liabilities caused by the delays.

However, the term of the asset is considerably longer than the likely term of the liabilities.

And the volatility of the suggested asset (long term, low, index-linked coupon) is less suitable where the liabilities are uncertain rather than fixed in nature.

May be a suitable purchase for part of the free reserves.

However, expected return on this asset is likely to be lower than that which can be earned on equity.

However, part of the free reserves must cover the SMSM, so may be suitable for part as less volatile than equities.

Does this asset fit in with the portfolio currently held?

Other classes of business

Percentage of total business

Currency

Type of inflation link
Marketability in respect of accumulation of claims
Regulatory needs
Value for money

On balance, argue whether or not worth bidding.

- 6** *Given the bookwork nature of most of this question, it was for the most part poorly answered. Candidates, on the whole, failed to cover the full range of items requiring consideration. In particular, many candidates failed to provide adequate explanation of the points in part (i) (as asked by the question). Particularly poorly answered were parts (ii)(b) and (iii).*

- (i) Office premium = risk premium + expenses + commission + reinsurance – investment returns + loading for profit and contingency

Risk premium = obtained from reinsurer.

Possibly adjust risk premium.

Calculate risk premium for home business from claims data.

Expenses = loading for variable and fixed expenses (i.e. per policy, per \$ premium, per claim and per \$ claim)

Must also allow for expense inflation over the period until all claims arising are fully settled.

Anticipated changes in office efficiency.

Renewal / lapse rates to determine how many policies to average the costs over.

Commission — will depend on the proposed method of sale and average anticipated future rate.

Reinsurance — may vary by risk — perhaps a variable and fixed component — depends on the reinsurance arrangements set-up.

Investment return — will need to allow for current investment conditions, inflation, tax and late receipt of premiums.

Unlikely to be significant as the business is relatively short-tailed.

Profit and contingency loading should allow for desired return on capital and risk reward, risk free rate of return, inflation, degree of uncertainty, market conditions and tax.

Variable expenses will automatically vary by size of risk through the different premium paid and different expected claim amounts.

Fixed expenses — may wish to vary this loading by size of risk.

Commission likely to vary by size of risk to some degree.

Reinsurance – Quota share / Surplus will vary per premium:

Risk XL premiums should be based on the characteristics of risk.
Aggregate XL / Cat XL should vary by degree of risk and uncertainty.

Profit and contingency should vary by perceived degree of risk and uncertainty.

Risk free rate of return, inflation, degree of uncertainty, competitiveness and tax.

- (ii) (a) Quota share with maximum size of risk
Or surplus reinsurance treaty
Or Risk XL working layer with maximum size of risk
Or combination

There are likely to be limits to business volumes in the first few years.

Aggregate XL to cover against accumulations of risk.
Cat XL to cover against widespread storm damage, etc.

Perhaps stop loss for commercial property or for whole business to protect against insolvency.

May also include limits to the size of risks, number of each type of risk, volumes of risk by location.

- (b) Owner, location, type of business.

Size (floor area), type of property, age of property, method of construction, number of floors.

Security systems, fire prevention systems.

Policy number, value, premium, EML, SI, Period of cover.

Date incepted, underwriter's name. Expiry date, if policy not annual.

Previous insurer, claims in last five years for whole company insured.

- (iii) Proportional reinsurance arrangements simple – relevant proportion of premiums + commissions / loadings, etc.

In theory:

Risk and Aggregate XL covers will need to be modelled by frequency and average cost from ground up though the reinsurer will have to base this on data available from its existing book of similar reinsurances.
Use different sets of assumptions to see how results may vary.

Base on assumed business volume with adjustment clause for significant deviations from expected.

Premium will reflect expected claims outgo + contingency loading to reflect the expected variance in the results.

In practice:

The theoretical rate will need to be assessed.

In practice though the rates charged will be largely dictated by market conditions.

However, in this case since the insurer has asked the reinsurer for technical assistance the market rates are of less relevance.

Cat XL — look at past experience on other similar Cat covers offered.

Likely to reflect market rates more than actual experience.

7

This question relating to a less common type of insurance was very poorly answered. Even though the table was headed "Claims paid in year...", many candidates proceeded to assume that the table related to cumulative costs. Practically all candidates showed little understanding of the term "long-tailed", which was irrelevant in this question given that the earliest exposure periods were still incomplete. Part (ii) was especially badly answered, with practically all candidates suggesting that the usual chain-ladder methods could be applied to this class of business.

(i)

It is a long-term policy and claims will be affected by inflation. At present, the earliest years are not fully run off.

Costs are highly variable between calendar years, underwriting years and duration.

Earlier years are more volatile than later ones in their development.

Policy is long term in terms of claims, but we cannot tell whether or not it is long-tail.

Most claims are long delayed from inception towards end of policy term.

Relatively low cost per policy. Fixing houses is expensive, as claim frequency is almost certainly very low.

No obvious catastrophe.

Significant step up from year 4 to year 5.

(ii)

Pure risk premium per unit exposure

= expected claim amount per unit of exposure, or

= (no. claims / no. pols) × (no. pols / exposure) × (total claim amount / no. claims)

Office premium p.u. = Risk premium p.u. + Expenses p.u. + Commission p.u. +
Reinsurance prem p.u. + Profit p.u. + Contingency loading p.u. – investment
return

What period are the rates to be applied for?
What is the mid-point? Ok for short term agreement
Or should they be indexed? Ok for long term agreement.

Need to allow for inflation from time point at which risk premium estimated to mid point of base period for future rate to be charged and claim payment date

To calculate risk premium need to analyse claims data.
None of the insurance years in the current book of business are fully run-off or even the risk period expired
Therefore need to find external sources of data if available,
Otherwise need to estimate run-off pattern by some other means

Data in respect of other builders may also be helpful for identifying trends

Chain ladder methods useful as a cross-check,
but fail to provide sensible answers because;

Triangle at later durations is highly uncertain,

The run-off pattern is not necessarily consistent over time,
Due to variation of weather conditions, economic conditions – homeowners may delay reporting claim if the policy has not yet expired, unless wishing to sell the home and move on

Because the policy term is 12 years very little is known about the more recent insurance years as most of the risk is as yet unexpired.
The quality of risk is likely to vary over time for a number of reasons. E.g. minimum building standards, quality of workmanship, mix of business (change in proportion of types of home)

Need to analyse the data at least making allowance for differences between underwriting year, development year and calendar year – Can use a multivariate analysis,
Model the data to estimate parameters for each of the three sets of variables, though information is limited with regard to most recent underwriting years. These can then be used for estimating the bottom half of the triangle

To what extent is the result from this builder credible? Should we rely on its own results or use industry-wide statistics?

This is a large builder (26,000 homes in one year). To what extent are there statistics on the probability of such a builder going bankrupt.

Need to allow for any underlying calendar year trends believed to exist – apparent within the data
E.g. Social inflation and the effects of global warming
Expected changes in the quality of the building work
Assume average run-off pattern, unless there are clear reasons for a change to occur in the future.
E.g. changes in the types of home constructed so that different types of claim which appear at different durations become more likely to arise

Adjust for known catastrophe or rare claims within the data not expected to occur regularly

And add a contingency loading in respect of these items

The analysis of total claims paid per unit exposure (home) is unlikely to be very informative on its own.

Would help to analyse frequency per home and average cost per claim separately if possible to identify different trends therein

For example rising average costs may indicate rising inflation in rebuilding costs or a change in the types of claims seen

What profit margin should be allowed

perhaps base it on the degree of perceived risk, allowing for the very long term of the policy.

How do the calculated rates compare with those quoted by the competitor, Or those previously charged.

Does the recent analysis in any way indicate that a lower premium can be charged

Should the business be priced as a loss leader with a view to maintaining market share or expanding

Contingency loading should allow for the risk of catastrophe and the considerable random variation as demonstrated within the data shown

Due to the length of term of the policies written will need to allow for investment returns on net balance of premium remaining throughout the policy duration.

In calculation of the risk premium the assumed rate of return should be based on a matching portfolio of assets likely to be held as technical reserves.

Also the rate should not be chosen independent to the inflation assumptions used. There should be consistency between them – it is the difference between the assumed investment return and inflation rate that is most important

- 8** *This bookwork question provided the candidate with little guidance on the areas to be covered and therefore required a systematic approach to consideration all the potential areas. Probably as a consequence this bookwork type question was not answered well by the majority of candidates.*

Unusually heavy or light experience:

- Claims experience tends to go in cycles
- For some classes unusually heavy or light years may be experienced in isolation
- Especially if the risk is affected by climate
- If experience is untypical then choose another base year
- Or aggregate more years' experience
- Or apply an adjustment factor to the base year

- Which would obviously be subjective
- Although industry data may be available.

Large or exceptional claims:

- May be left in the data
- Or truncated and spread
- Or removed
- Depending on the extent to which similar claims are likely to occur in the future

Trends in claims experience

- If trends are detected in the base data, it is important to attach more weight to recent experience
- Allowance for inflation
- Trends should also be investigated to see whether or not they are likely to continue into the future
- Or of they are the results of a one-off change in company or market practice.
- If they are expected to continue then an assumption will be needed to allow for them.
- It may be necessary to adjust past data.

Changes in risk:

- Changes in risk can be difficult to deal with.
- They may show up as trends and be dealt with as such.
- Alternatively, major elements of the risk could be separated in the base data
- And projected separately
- And combined with an assumption about the future mix of risks.

Changes in cover:

- Changes in cover can be difficult to allow for.
- Major changes are likely to involve the perils covered
- Or the limits and excesses applied to each claim.
- They may also arise from changes to underwriting
- Or to claims settlement procedures.
- If a peril is no longer to be insured
- It may be possible to exclude these claims from the data.
- If a new peril is to be insured
- It may be necessary to use external data
- Such as market statistics, consumer or manufacturer data, government statistics.
- Changes to limits or excesses are more complicated.
- If there is a detailed database allowing all claims to be separately considered, it may be possible to adjust each claim to the original gross amount
- And project the gross data to the new rating period.
- Otherwise it will be necessary to make more approximate adjustments
- Based on any knowledge of the underlying claims cost distribution.
- Either way the information will be incomplete

- As many insureds will not notify claims below or near the excess points.
- Future changes in the risk environment other than normal trends will need to be identified.

Changes in reinsurance cost:

- It will be necessary to allow for changes in reinsurance cost.
- Maybe necessary to incorporate IBNR
- Margins in reserves (positive and negative)
- Errors in data
- Changes in claim definition including treatment of NIL cost claims

9 *Candidates are expected to be able to apply the knowledge and principles underlying the subject in various situations. This question required the candidate to apply his knowledge of technical reserves in the context of a particular type of contract. In setting out the formula for calculating the Unearned Premium Reserve most candidates made the appropriate assumption that the incidence of claims is approximately uniform over the period of cover, however many candidates failed to then allow for the reduction in the claim amount over the period of the contract, and merely stated that the usual formula could be used. Many candidates failed to observe that once a claim was made the claim amount payable could be calculated exactly and therefore an exact method should be used to calculate the outstanding claims reserve in preference to the usual triangulation based methods used for other classes of business.*

The technical reserves that might be required in respect of this product are:

- unearned premium reserve
- outstanding claims reserve
- IBNR
- Claims expense reserve
- Catastrophe reserve
- No need for UPR for policies already claiming

Unearned premium reserves cannot be calculated in accordance with the usual formulae since the term is not one year and the risk is not constant throughout the term. If a policyholder should die accidentally in the first month of the policy, the total benefit would be $€100 \times 60 + €1000 = €7000$, whereas if he should die accidentally during the last month it would be €1100. In general, if he dies in month n ($n = 0, 1, 2, \dots, 59$), the benefit will be $€100 \times (60 - n) + €1000 = €7000 - €100n$. The amount of premium earned each month should reflect this.

The probability of a person dying accidentally each month should not vary unless some extremes of age are included. If the most dangerous ages for young male accidental death are included then assuming a level probability will be slightly conservative, and might be acceptable. If older ages are included some adjustment to this assumption may be needed.

The premium earned in each month should be proportional to the risk, or to $70 - n$. ($n = 0, 1, 2, \dots, 59$)

The sum of these weights is $60 \times 70 - 60 \times 59 / 2 = 4200 - 1770 = 2430$
 After m complete months of the policy the proportion of the risk remaining will be

$$\begin{aligned} & \sum_{n=m}^{59} (70 - n) \div 2430 \\ &= ((60 - m) \times 70 - (59 + m) / 2 \times (60 - m)) / 2430 \\ &= (4200 - 70m - 1770 - 30m + 59m / 2 + m^2 / 2) / 2430 \\ &= (2430 - 70.5m + m^2 / 2) / 2430 \\ &= 1 - 47m / 1620 + m^2 / 4860 \end{aligned}$$

Hence the unearned premium per unit of policy for a unit taken out exactly m months ago is $\text{€}20 \times (1 - 47m / 1620 + m^2 / 4860)$. To hold this for a policy that had a curtate elapsed duration of m months would be slightly conservative. The correct value could be approximated by adding on half a month to get $\text{€}20 \times (1 - 47m / 1620 + m^2 / 4860 - (70 - m) / 4860)$. The exactly correct value for a policy that had had d days since its last monthly anniversary is, in a 30-day month, $\text{€}20 \times (1 - 47m / 1620 + m^2 / 4860 - (70 - m) / 2430 \times d / 30)$.

From this, 25% may be deducted to allow for deferred acquisition costs.

Setting reserves for outstanding claims should be relatively simple. We know exactly how many monthly payments remain on each claim. If this is t , then for each unit of the policy we should reserve $\text{€}100t + \text{€}1000$. We may need to add any unpaid payments between the date of death and the valuation date if payment has not yet started, for example if it is still not proved who is entitled to claim the benefit. If a claim is in dispute, for example if it is not clear whether or not a death was a result of an accident, then a proportion of a full reserve might be set up.

To estimate IBNR, the time taken to report claims should be investigated. The value of an IBNR claim is straightforward, along the lines of outstanding claims. We should calculate the claim amounts of all policies if they had become claims in each previous month, in the same way as outstanding claims, and get an average value across all policies for each individual month.

We may get the expected number from a delay table. This should be constructed from the record of past claims by month of occurrence and by number of months delay until reporting. This may be used to give the proportion of claims being reported by the n th calendar month end after the accident ($n = 1, 2, 3, \dots$). Let this proportion be p_n , let the number of claims reported in the n th month prior to the valuation be N_n , and let the average amount of claim on policies in force during that month be V_n . Then the IBNR is equal to

$$\sum_{n=1}^{\infty} (1 - p_n) N_n V_n / p_n$$

Claims expense reserve would most likely be a percentage of the claims cost or premium.