

INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

September 2010 examinations

Subject ST8 — General Insurance: Pricing 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.

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Chairman of the Board of Examiners

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- 1 (i) The solution below uses a base-level parameter β_0 . Other equivalent formulations are valid, provided that they have the correct number of parameters.

$$(a) \begin{pmatrix} \beta_0 \\ \beta_\alpha \\ \beta_M \\ \beta_A \\ \beta_B \\ \beta_C \\ \beta_D \end{pmatrix}$$

$$(b) \begin{pmatrix} 1 & 18 & 1 & 0 & 0 & 0 & 1 \\ 1 & 55 & 0 & 1 & 0 & 0 & 0 \\ 1 & 92 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Here, the examiners were looking for correct allocation of rating factor values to the vector in (a).

- (c)
- Column 1 is the base level
 - Column 2 is age attained
 - Column 3 means “Is male?”
 - Columns 4–7 mean “Is employment A?” and so on through to D

Few candidates remembered to include the base level (intercept term), despite there being a similar example in Core Reading. Over-parameterisation was also a common error (e.g., five employment types).

- (ii)
- Replace employment type categories with a variate and fit a curve,
 - Using this method, each level of employment type is assigned an x-value and a polynomial is fitted.
 - Group employment types together.
 - In particular, D and E look good candidates (E has low exposure and they have similar frequencies).
 - Remove employment type from the model completely.

Most candidates mentioned grouping, but few considered the other alternatives. Candidates who mentioned curve fitting often went into too much detail.

- (iii)
- Group together young ages,

- and also old ages,
- ...fitting a constant frequency within each.
- Retain the linear fit where there is sufficient data.
- Join to the grouped values in a piecewise-continuous fashion.

Many candidates did not mention that the linear fit should be retained over the mid-age range.

2 **Allocating expenses**

- For an accurate expense analysis, accurate cost data is required.
- This needs to be split by activity/function.
- ...and whether costs depend on volume of business, premium size or some other element.
- However, accurate data may not be available at this level.
- Many functions are central or there is no obvious way of splitting costs.
- Approximations may be needed, such as time-sheet sampling and pro-rating by headcount/floor space.
- These allocations can be inaccurate...
- ...and become out-of-date quite quickly.

Loading into the rates

- If the expense splits are not accurate, the modelled costs may not reflect actual costs if the balance between new and renewal business changes.
- The expenses for new business are likely to be higher than for renewals, so the theoretical premium is probably higher for new business.
- However, this may mean that new business premiums are uncompetitive.
- So, renewal business may need to subsidise new business.
- This requires assumptions on sales and persistency, which introduce uncertainty.

Most candidates had a grasp of the concepts involved, but many struggled to generate a wide enough range of points.

3 (i)

- Risk excess of loss covers an insurance company against the cost of individual large claims.
- If a single large claim occurs then the reinsurer reimburses the insurer for the amount above a stated excess point, usually up to an upper limit.
- The excess point and upper limit may be fixed, or indexed, as specified in a stability clause.

Many candidates stated that the cover was for a single risk, i.e. facultative. Only a few mentioned the stability clause.

(ii)

- The restoration of cover following a claim.
- There is often a limit to the number of times that cover may be reinstated,

- ...which means that there is a limit to the total recovery under the reinsurance.
- The terms of reinstatement will be specified in the contract.
- Once agreed, they are automatic and obligatory on both parties.
- To restore cover it may be necessary to pay a reinstatement premium.
- This will usually be equal to the original premium of the reinsurance, multiplied by the proportion that the reinsurance recovery bears to the cover
- The amount of the premium may be pro-rated to the remaining term of the contract.

Some candidates stated that reinstatement is a form of retrospective experience rating, which is not strictly true because it is replacing cover that has been exhausted, rather than recalculating the premium per unit risk. Some students seemed to be confused about the distinction between the reinstatement and the reinstatement premium. It is not correct to say that the reinstatement is the amount needed to restore cover after a claim.

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(i)

- Assess performance of the business against the company's goals,
- ...in order to inform planning and decision-making.
 - Examples:
 - underwriting quality for different underwriters
 - business from different sources
 - profitability
 - expense experience
 - sales volumes
 - renewal/cancellation/movement experience
 - operational performance (staffing, expertise etc)
- Assess and manage the level of risk inherent in the portfolio,
- ...in order to inform capital requirements,
- ...and reinsurance strategy.
 - For example, to keep track of aggregation issues and ensure that the company is not overexposed to particular types of loss.
- Gain information about the state of the market and the company's competitive position.
- Satisfy regulatory requirements for monitoring and reporting.
- Influence the market (competitors, trade bodies and authorities) by publishing results of monitoring.
- As a by-product, to input to the reserving process.
- To compare actual with expected results from a model (as part of the actuarial control cycle).
- Gain exposure information for reinsurers.

The solution here was mainly from Core Reading and many candidates scored well.

- (ii) (a)
- Many factors affecting the expected loss can be taken into account, making the method quite accurate.
 - In particular, it allows for changes in the make-up of the book, such as business mix, lapses and new business.
 - For this reason, it may be required by reinsurers or regulatory underwriting standards.
 - As a spin-off, the absolute premium rate is calculated in addition to the rate change.
 - Data- and calculation-intensive, so could be laborious, or data may not be available.
 - It may be difficult to quantify the effect of “softer” factors, such as changes in the quality of risk management procedures.
 - Provides the best data for pricing and measuring profitability, particularly by source and type of business.
- (b)
- Less data-intensive than (a), so probably cheaper and quicker.
 - Relies on the rate change for the basket of risks being representative of the portfolio.
 - This may be an unsafe assumption for large commercial properties that are individual in nature.
 - The constituents of the basket or the weightings used will need to be adjusted over time.
- (c)
- Allows for “softer” factors in the rates.
 - The effect of various factors on the rates is subjective, depending on the particular business handled by that underwriter.
 - The definition of pure rate change might be misinterpreted or miscalculated.
 - This can lead to inconsistencies,
 - ...over time/across classes of business/between underwriters.
 - Open to possible bias.
 - Far cheaper/quicker to “compute”.

The better-scoring candidates structured their answers around the different options and explained their points (as required in the question).

- 5**
- (i) Y is independent of M.
- (ii) The rate will be higher using curve A because a greater proportion of claims fall into the band of losses that are covered.
- (iii) A has a greater percentage of smaller claims proportionally to risk size / sum insured.

(iv)

- Find out where the curves came from, that is who produced them and how. This will give us an idea to their credibility.
- Find out what the two curves have been built for (for example, occupancy, location etc.).
- This may match the type of property we are rating.
- If not, talk to underwriters/other experts to see which is the closest match in terms of claims distribution.
- It may be thought that none are that appropriate.
- If this is the case we may need to:
 - use curve from another similar exercise
 - adjust these using experience/judgment
 - build our own

(v)

- Exposure curves should be concave or the straight line $y = G(y)$.
- The straight line occurs where the only type of loss is a total loss.
- As we start to allow partial losses the curve will move above the diagonal.
- Hence it is impossible to get a proper curve below the diagonal.
- Therefore, C cannot be a suitable curve to use.

Most candidates failed to score well on this question. In (iv), a common error was to write in detail about how to construct a curve from claims analysis, rather than the factors that should influence selection of an appropriate one. In (v), very few candidates explained clearly why C is not an appropriate curve.

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(i)

- Because full postcode has a huge number of levels, a model that includes it as a factor will feature a great deal of random noise and lack of credibility.
- Spatial smoothing is designed to improve this by allowing the relativity for each postcode level to take account of neighbouring values.

(ii)

(a)

- Distance-based is likely to be better.
- Distance does not take into account whether an area is urban or rural.
- This means there is less danger of over- or under-smoothing urban and rural areas.
- It tends to be easier to understand and implement.

(b)

- Adjacency-based is likely to be better.
- Location codes tend to be smaller in urban regions and larger in rural areas, so adjacency-based smoothing can sometimes handle urban and rural differences more appropriately for this type of peril.

- Can take account of physical barriers between regions (eg rivers).

Answers to (i) and (ii) often appeared to confuse the purpose of spatial smoothing with rate smoothing.

(iii) *Advantages*

- This would allow high flood risk areas to be more influenced by experience in nearby high flood risk areas than by low flood risk areas, which may be appropriate.
- In particular, height above sea level will help with riverine flood,
- ...and height and distance from the coast with coastal flood.

Disadvantages

- The method is more computationally intensive and complex to explain.
- The data will need to be collected and maintained for every postcode, which may be expensive and difficult.
- It may only be significantly valuable for household buildings, where location is fixed and claims amounts very high.

Clear statements about height and distance were often missing from answers to this part.

(iv)

- Test the model's predictiveness on out-of-sample experience, i.e. withholding a proportion of the data from the smoothing process.
- This involves comparing the model's predictions for the out-of-sample dataset with actual experience and examining whether there are systematic differences indicating a poor fit.
- A lift curve or similar examination of relativities could be used on the out-of-sample dataset to assess whether the model distinguishes adequately between high- and low-risk areas.
- The experience could be examined by time period to assess whether there is consistency over time in the areas identified as high or low risk (but this may produce excessive granularity).
- Residuals could be examined by location to identify any systematic location-based effects that have not been included in the model.
- Apply goodness-of-fit tests, as appropriate for the model used.

Many candidates concentrated on analysis of residuals and failed to pick up marks on the other points.

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- It has taken into account historic claims experience.
- Simple & easy to understand.
- It is not clear what the claims data is. It may be paid or incurred. If incurred, then what basis are the outstanding reserves on: realistic or pessimistic, for example.

- Is the data gross or net of reinsurance?
- Claims should be trended forward for inflation. This will be significant in liability business as the inflation rate is often high.
- There seems to be no projection of claims for paid/incurred to ultimate including IBNR. This is long-tailed business and so this may be significant, especially but not only on the last two years.
- There is no allowance made for large losses or accumulations of claims. We need to know to what extent they are included in the data.
- We have no idea of exposure over these years. We should consider claims/exposure. We would also need to know the projected exposure for the 2011 year of account.
- A sensible exposure measure might be revenue/turnover or headcount.
- There is no attempt to identify trends in claims. Or known changes to this risk. For example, change in legislation, claims environment, type of work.
- Three years are not really sufficient for a credible analysis. Five or more years are desirable.
- 2010 is missing.
- The approach to adjusting for the increased deductible is incorrect. Such an approach assumes we have had only have one claim in each year, which is untrue.
- We would require individual claims to calculate the effects of the new deductible.
- The underwriter is proposing charging the expected cost of claims. He should load up the premium to include profit/cost of capital, expenses, commission, reinsurance costs, premium tax etc. In particular, investment income because of the long tailed nature of the class.
- The contract is completely experience rated, which might not be appropriate. Ideally, we should use data from other similar risks as well.
- We might consider a frequency-severity approach, although this is not necessarily suitable for PI.
- We also need to know if terms and conditions have changed over the years.
- Competitors' rates and point in market cycle should be considered.
- There could be currency conversion issues.
- Use last year's premium (suitably adjusted) as a sense-check against the result.

Many candidates generated a wide range of points and scored well. However, there was no credit for belittling the underwriter's analysis.

8

(i)

- Closed claim amounts do not usually change.
- Open claims have an estimate of outstanding reserve. The final amount may be quite different,
- ...particularly when nothing has been paid.
- Some companies may reserve (case estimates) prudently, in which case the estimates may be biased upwards.
- Some companies may put an automatic reserve on all notified claims immediately without considering likelihoods.
- There seems evidence for that here with the 25k reserves.

- All claim amounts look to have been rounded, so not sure how reliable they are.
 - Incurred amounts for open claims might not contain anything for business interruption or if they do then they may be based on unverified loss of profits.
 - There might be some losses that haven't been notified yet because of reporting delays or because the estimated amount isn't big enough yet.
 - We should analyse how open claims have moved historically,
 - ...and possibly adjust the open claims:
 - closed claims may also re-open and move
 - we should adjust for inflation
 - older claims data may be less relevant than newer ones
 - claims below excesses/deductibles may be missing
- (ii) (a)
- Remove the extra excess from each claim.
- (b)
- We can add \$15k to each of the claims.
 - However, there may be claims we do not know about below \$25k.
 - Ideally we would get all ground up claims from the insured.
 - Or make an adjustment to the claims we have based on benchmark data such as an exposure curve.
- (c)
- Remove the claims we have labelled flood.
 - Check whether the whole claim was due to flood.
- (d)
- We are introducing a new coverage so will have no historical data.
 - Need to use data from elsewhere.
 - Could also use an exposure method/catastrophe model.
- (e)
- Limit all claims to \$1m.
 - We have one such claim only. The \$5m claim becomes \$1m.
- (f)
- We need to add on additional claims between \$5.025m and \$10.025m.
 - We may not know this information for the limits claims i.e. the \$5m one.
 - Ideally we would get all GU claims from the insured.
 - or make an adjustment to the claims we have based on benchmark data, e.g. an exposure curve.

There were no systematic problems with this question. However, the better-scoring candidates used examples from the actual claims data to reinforce their points. In (ii)(b), some students seemed to want to add \$10k onto the claims rather than the correct \$15k.

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- (i)
 - (a) Own (accidental) damage
 - (b) Third-party bodily injury
 - (c) Third-party property damage
 - (d) Fire
 - (e) Theft of vehicle
 - (f) Theft from vehicle
 - (g) Windscreen
 - (h) Personal accident to the insured may be included
 - (i) Malicious damage
 - (ii)
 - (a) No
 - (b) Yes
 - (c) Yes
 - (d) Sometimes/usually
 - (e) Sometimes/usually
 - (f) Sometimes/usually
 - (g) No
 - (h) No
 - (i) No
 - (iii) Own damage
 - The insured peril is damage to the policyholder's vehicle due to an accident.
 - If the insured vehicle is damaged the insurer will pay for the car to be repaired.
 - If the car cannot be repaired then the insurer will pay the insured its market value before the damage.
 - ...and retain the vehicle.

Third party bodily injury

- The insured peril is injury to a third party caused by the insured driver.
- The insurer pays compensation to the injured victims.

Third party property damage

- The insured peril is damage to the property of a third party caused by the insured driver.
- The insurer pays compensation for the loss or damage.

Fire

- The insured peril is damage to the policyholder's vehicle caused by fire.
- The cover is the same as for Own Damage.

Theft of vehicle

- The insured peril is theft of the entire vehicle.
- or theft of the contents of the vehicle.
- and damage to the vehicle caused by attempted theft.
- If the vehicle is not recovered, the insurer will pay the current market value before the loss.
- If the contents are not recovered, the insurer will pay the cost of replacement, up to an upper limit.
- If the vehicle is damaged during theft, the insurer will pay for the cost of any repairs.

Windscreen

- The insured peril is damage to windows.
- The insurer will pay for replacement or repair.

Personal accident

- The insured peril is injury to the insured driver in an accident.
- The insurer will pay fixed benefits depending on the nature of the injuries.

(iv) Own damage

- Covers both parts and labour.
- Wage costs tend to increase more quickly than cost of parts.
- A suitable index is between a wage index and price of good index.

Third party bodily injury

- Amounts paid for compensation of injury tend to increase more quickly than price or wage indices.
- This appears to be because of a general trend towards more generous compensation for injury, especially serious injury.
- Occasional legislative changes tend to have one-off effects on the level of compensation.
- E.g., Ogden or Courts Act.
- A suitable index would be a wage index with a moderate addition.
- For structured settlements/periodic payments, an index based on cost of medical care would be needed.

Third party property damage

- Very similar to own damage.

Fire

- Here there will be a higher proportion of total losses than with own damage.
- So an appropriate index would be closer to the price of goods.

Theft of vehicle

- Very similar to fire.

Theft from vehicle

- This covers mainly replacement of stolen items.
- so an appropriate index will be close to a price of good index.

Windscreen

- Very similar to own damage.

Personal accident

- No inflation, as benefits are fixed.

Many candidates lost marks by failing to separate the covers in later parts of the question. Other particular problems noted in answers were:

- *Failure to distinguish between bodily injury and property damage liability covers*
- *Insufficient precision in descriptions of the benefits of cover*
- *Statements that for third party covers the insured gets money from the insurer to pay compensation to third parties*
- *Statements that if a car were written off or stolen the insured would receive "new for old".*

10 (i)

- The proposal would be expected to stimulate growth in sales volumes, possibly due to:
 - it being a unique offering that attracts business from competitors
 - customers placing a high value on it, so the company can charge more for it and still lift volumes.
 - the feature being exciting for sellers, encouraging them to promote it
- Volume growth will allow fixed expenses to be spread over a larger book.
- Extending it to renewals should improve retention rates now.
- Extending it to renewals will improve consistency with new sales.
 - This would help to avoid existing policyholders becoming disgruntled or “churning” to a new policy at renewal.
- It may reduce the incentive for claimants to inflate claims in an attempt to recoup the policy excess.

- It may attract more low risk policyholders who consider themselves unlikely to claim as a result of their own actions.
- It may result in higher policyholder satisfaction with the product.
 - which may lead to better retention rates in the future.
 - and cross-selling opportunities.

Some candidates wasted time here by giving disadvantages.

(ii) Data problems

- There may be a lack of information on claims below the excess point to use for rate reviews if the company has not offered a nil excess before on this product.
- The quality of any data for an incident below the excess point that has been recorded may be lower quality because it did not lead to a claim.
- Claims data may not be available in enough detail to analyse separately the experience for the “criminal act” types of claim.
- There may be systematic bias in historic claim amounts (eg artificially low case estimates) that would distort the analysis.
- The pricing analyst may make a mistake when adjusting historic data for use in rating.

Random error

- Depending on the definition of criminal act there might be only a small number of claims where the excess is waived, which could lead to over-fitting of claim frequency in rating models.
- There might be a catastrophic event (e.g., a riot), concentrated in a particular area that could distort claim frequencies and average claim amounts, leading to over-fitting of rating models.

Model error

- There may be insufficient data for a hold-out sample, particularly in the early days of the initiative, which will make it difficult to validate the model.
- Newer, more relevant data will be incomplete, whereas older, more complete data will be less relevant, which makes it difficult to decide which data to pick for the model.

Adjustment of experience

- When rates are next reviewed, claims experience will need to be adjusted for differences that are very difficult to predict, such as:
 - More claims below the old excess point
 - More claims just above excess point where previously the policyholder would not have bothered claiming
 - Lack of excess could encourage a lack of care

- Lack of excess could encourage fraud (e.g. giving crime as the cause for non-criminal claims)
- Rating factor relativities could be invalidated by the change, particularly since level of excess is probably used as a rating factor.
- Development factors may alter due to change. This may affect the IBNR loading.

Market conditions

- Any assumed uplift in sales volumes could be over-optimistic, depending on the point in the market cycle.
- The initiative could be copied by competitors, so benefits are curtailed.
- The need to charge more for the product could make it less attractive than assumed.
- Legal or regulatory challenges or market pressure could cause the company to allow more zero excess claims than planned (ie, not force as many policyholders to prove that claims are crime-related).
- Sellers and claims advisers may not understand the policy conditions consistently, resulting in unpredictable experience.
- The coverage or price of outwards reinsurance is uncertain.

Portfolio movements

- If the company fails to allow an appropriate cost of risk in the premium then it could be subject to antiselection.
- The larger number of claims could cause a increase in claims expenses.
- The change in mix of business may mean the expense loadings become inappropriate and need to be reviewed.
- The effect on new business and renewal volumes is uncertain so the cross-subsidy between new business and renewal may be invalid.
- The additional costs associated with marketing and administration of the changes are uncertain.
- It will take a long time for the full effect on all renewals to be identified and there will initially be a mixture of cohorts renewing at any one time, some with the lower excess and some without.

(iii) Data problems

- If there are any other products with a nil excess the company could use this data with suitable adjustments to help estimate the effect of removing the excess.
- There may be some external data available to help validate the distinction between “criminal act” and other claims experience (eg overall frequencies or amounts).
- If “criminal act” claim types cannot be distinguished then at a minimum the company should change systems and procedures so that this is fixed for the future.

- Carry out peer review and checking of data to spot any errors in data manipulation or adjustment.

Random error

- Take care in modelling to avoid over-reliance on small exposures by grouping and smoothing experience.
- Conduct peril level analysis to identify unusual events and employ appropriate smoothing to claim frequencies and amounts.

Model error

- Build a model of expected claims distribution by size and type and monitor regularly the observed experience against expected to help assess whether rating adjustments are needed.
- Avoid over-reliance on immature data with small exposure by using judgmental smoothing adjustments.

Adjustment of experience

- Separate claims under the two sets of policy conditions, adjust the claims under the old conditions for the estimated effect of the nil excess and recombine the data to get a more reliable run-off pattern.
- Pay particular attention to the factors that are likely to change the most, such as policy types with high crime risk or high compulsory excesses.
- Consider restricting availability of the nil excess “subject to status”, i.e. depending on characteristics of the policyholder, the property/vehicle or claims history.
- Insist on proper precautions such as robust locks for household, alarm system for motor.
- Voice recognition to pick up on fraudulent attempts to suggest damage results from a criminal act.

Market conditions

- Run seller and customer focus groups beforehand to gauge their reaction to the product features.
- Run a smaller scale pilot for a limited period, perhaps restricted by geography or channel and capture the learning before deciding whether to roll out fully.
- Ensure there is a robust plan for achieving sales targets with adequate contingency for possible market effects.
- Put monitoring in place to pick up whether competitors are copying the idea and what their rating movements are.
- Put measures in place to increase certainty of claims treatment, such as:
 - Require claimants to report crimes to the police (to reduce the chance of non-criminal claims being described as criminal).

- Ensure that the criteria for proving that a claim is crime-related are properly defined and clearly communicated to claims staff, brokers and policyholders.
- Put restrictions in underwriting and claims systems to enforce rules and reduce the chance of claims leakage.
- Ensure there is a precise definition of crime-related claims in the policy wording reviewed by underwriting, claims and legal experts.
- Create a robust training plan and test it before roll-out.
- Brief reinsurers on the proposition and give details of expected changes in claims and mix of business.

Portfolio movements

- Be vigilant against increased fraud or an unexpected rise in certain types of claim by ensuring adequate claims controls are in place.
- Run a portfolio model to predict changes in mix of business and put monitoring of mix of business in place to pick up possible antiselection.
- Plan to review expense allocation after a suitable period to assess whether loadings are suitable.
- Ensure that renewal experience can be split by cohort to identify the policies on old and new excesses.

END OF EXAMINERS' REPORT