

INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

April 2018

Subject ST8 – General Insurance: Pricing Specialist Technical

Introduction

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 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. The Examiners have access to the Core Reading, which is designed to interpret the syllabus, and will generally base questions around it but are not required to examine the content of Core Reading specifically or exclusively.

For numerical questions the Examiners' preferred approach to the solution is reproduced in this report; other valid approaches are given appropriate credit. For essay-style questions, particularly the open-ended questions in the later subjects, the report may contain more points than the Examiners will expect from a solution that scores full marks.

The report is written based on the legislative and regulatory context pertaining to the date that the examination was set. Candidates should take into account the possibility that circumstances may have changed if using these reports for revision.

Luke Hatter
Chair of the Board of Examiners
July 2018

A. General comments on the *aims of this subject and how it is marked*

1. The aim of this General Insurance: Pricing Specialist Technical subject is to instil in successful candidates the ability to apply, in simple pricing analysis situations, the mathematical and economic techniques and the principles of actuarial planning and control needed for the operation on sound financial lines of general insurers.
2. Subject ST8 deals with applications of general insurance pricing techniques across many different types of product. Candidates should expect the examiners to draw these applications from all parts of the syllabus in order to test as wide as possible a range of skills and, in particular, to achieve a fair balance between personal and commercial lines.
3. Examiners will sometimes require the use of standard general insurance actuarial and statistical techniques that are covered in earlier subjects. Candidates should ensure that they are familiar with these when preparing for the ST8 examination.
4. As well as pricing techniques, ST8 also covers the workings and use of reinsurance products, so candidates should also expect the examiners to set questions on these aspects.
5. In questions with an element of calculation, different numerical answers may be obtained from those shown in these solutions depending on whether figures obtained from tables or from calculators are used in the calculations. Candidates are not penalised for this. However, candidates may lose marks where excessive rounding has been used or where insufficient working is shown. Where questions require looking up values in tables, candidates are expected to interpolate between two values if reasonable to do so, even when this is not stated in the question.
6. Where examples are given in the solution to illustrate the points made, marks were awarded to candidates who gave these particular examples or an equally valid alternative.
7. Candidates who give well-reasoned points, not in the marking schedule, are awarded marks for doing so.

B. General comments on *student performance in this diet of the examination*

1. The paper was of a fairly standard level and the general performance of candidates was slightly up on previous sittings. Most candidates demonstrated a good knowledge of the subject areas examined and scored well in basic bookwork and numerical questions. However, questions which required application of this knowledge and tested higher order skills proved more challenging. There was no evidence of time pressure in this paper.

2. Bookwork questions were generally well answered, and better prepared candidates successfully tailored the answers to the questions, instead of making more general comments. Candidates did not score so well on application and higher order skills questions, in particular parts of 7, 8 and 9. A common fault was candidates not reading the question properly and making lots of points that were either not relevant or lacked detail.
3. The comments that follow the questions concentrate on areas where candidates could have improved their performance. Candidates approaching the subject for the first time are advised to concentrate their revision in these areas.

C. Pass Mark

The Pass Mark for this exam was 61.

Solutions

| | | |
|-----------|--|-----|
| Q1 | Data may not be available, i.e. may take time to physically extract data from systems | [½] |
| | Takes time for recent claims and policy data to be entered onto systems | [½] |
| | So will need to cut off data some time before new rates are implemented | [½] |
| | Data may need to be reviewed/cleaned before use, which takes time | [½] |
| | Will need to analyse claims experience | [½] |
| | E.g. to project forward recent claims, which would mean accessing or building a suitable development curve, i.e. recent claims may be underdeveloped | [½] |
| | May want to discuss anything unusual in data with claim handlers/underwriters | [½] |
| | Most recent experience may be so volatile/incomplete/immature that it needs to be excluded | [½] |
| | Calculation of rates will take some time | [½] |
| | May take some time to gather/analyse other relevant information for determining loadings such as expenses, commission, profit, reinsurance, etc. | [½] |
| | May want to research market rates/underwriting cycle | [½] |
| | May need to research/incorporate external trends | [½] |
| | Time will be needed for the actuary's work to be reviewed | [½] |

| | |
|--|----------------|
| Need time to agree the new premium rates and premium structure, e.g. internal governance | [1/2] |
| Need time to administer and implement the new rates | [1/2] |
| Which may involve testing of systems and/or training of staff | [1/2] |
| Need time for any approval from a regulatory body | [1/2] |
| | [Available 8½] |

This question was generally answered well, although a significant number of candidates focused on future changes to the data or reasons why the data would be out of date, but this is not a reason not to use the data – it would just need to be adjusted before use. Those candidates that generated a wide variety of points by thinking about the different steps involved in the rate calculation process scored well.

| | |
|---|-------|
| Q2 On the face of it, the suggestion has merit | [1/2] |
| If the insurer doesn't lower rates, may end up being uncompetitive | [1/2] |
| Leading to low business volumes/expense strain | [1/2] |
| However, there may have been changes to mix of business (historical and/or future) | [1/2] |
| And likewise, changes to policy terms and conditions | [1/2] |
| Also should consider stage of underwriting cycle – if it has reached the bottom then it would not want to reduce premiums further | [1/2] |
| Consideration needs to be given to known or expected trends, or changes in the external environment that might affect future claims | [1/2] |
| There is no allowance for inflation - high claims inflation may mean we need to charge more than last year | [1/2] |
| The insurer may have had exceptionally good experience, but should not expect that to be repeated again next year | [1/2] |
| Would need to investigate how current rates and proposed reductions compare to market | [1/2] |
| May be some profit-sharing arrangement in place, so that policyholders are relaxed about paying higher rates as they can get a partial refund if experience is favourable | [1/2] |

- (Or may want to introduce/extend existing profit share arrangements as a more sustainable alternative to rate reductions) [½]
- May be regulatory restrictions on price [½]
- May co-insure/lead/follow some risks, so may be difficult to lower rates unilaterally [½]
- May not be advisable to react to one year's AvE analysis [½]
- Especially as commercial property business can be especially volatile as is exposed to natural catastrophes [½]
- May want to split AvE analysis into large, attritional and cat [½]
- If experience on large or cat has been better than expected, may be unadvisable to reduce rates straight away, as these assumptions are likely to be based on longer-term trends [½]
- May want to check how reliable the AvE analysis is, i.e. it may contain errors [½]
- Need to check how significant the expected difference is [½]
- E.g. if there's a distribution around expected experience, where does the annual experience sit on this distribution [½]
- May want to be more specific about what's caused the favourable experience, i.e. which pricing assumption(s) were incorrect [½]
- E.g. is it driven by frequency or severity (or other valid example) [½]
- better than expected experience may be driven by policies sold more than 12 months ago, so does not fully take into account rate reductions already given in the past 12 months [½]
- Need to consider views of the reinsurers as cutting rates could directly impact the reinsurer's experience [½]
- The product may have been loss making, so improved performance needed just to make a profit [½]
- And/or better claims experience may just be offsetting other increasing costs, e.g. increased reinsurance costs or other expenses and loadings [½]
- Expected claims may have been based on prudent assumptions (so we'd expect actual to be better) [½]

[Available 14]

Generally answered reasonably well and most candidates generated a good number of points considering both the merits and drawbacks of the proposal.

Q3

- | | | |
|-----|--|-------|
| (i) | Risk appetite/attitude to risk | [1/2] |
| | Size of free reserves/capital, i.e. ability to absorb large losses | [1/2] |
| | Level of diversification | [1/2] |
| | Regulatory requirements ... | [1/2] |
| | ... in countries it writes in | [1/2] |
| | Availability of reinsurance ... | [1/2] |
| | ... including which territories available for and/or what type of reinsurance treaties available | [1/2] |
| | price of reinsurance | [1/2] |
| | market practice | [1/2] |
| | relationship with brokers | [1/2] |
| | exposure to catastrophes/large events in the geographical locations where written | [1/2] |
| | concentrations risk/exposure to accumulations | [1/2] |
| | may need more reinsurance if book has grown rapidly | [1/2] |
| | ... or changed substantially in recent years | [1/2] |
| | ... or if insurer plans to expand substantially in future / write larger risks | [1/2] |
| | Presence of a parent company/captive reinsurer to help absorb losses | [1/2] |
| | May want to use several reinsurers to avoid concentration of risk with a single reinsurer | [1/2] |
| | Volatility of past results | [1/2] |
| | Recent external changes have introduced a new, material source of uncertainty | [1/2] |
| | Business objectives, e.g. smooth profits/shareholder dividends | [1/2] |

Whether the insurer needs financial assistance [½]

To benefit from expertise of reinsurer, especially if new line of business [½]

As a large company it may want fairly high layers of XL cover, as it can probably absorb smaller losses [½]

Large properties may well be unique. This may mean that some properties have to be reinsured facultatively, rather than by treaty. [½]

Diversification across countries tends to reduce the amount of reinsurance required. [½]
[Available 12½]

(ii) Insurer will receive $(32 * 1.25 - 20) = \$20\text{m}$ of recoveries [1]

(iii) If the reinsurance contract used prevailing market rates, insurer would have received $(32 * 1.35 - 20) = \$23.2\text{m}$ [1]

i.e. \$3.2m more than they actually got [½]

This demonstrates that it is not effective [½]

... and exposes Company A to currency risk. [½]

Alternatively in £s, pay claim of $(32 - 20/1.35) = £17.19\text{m}$, which is more than 50% of £32m, hence not effective.

[Available 2½]
[Total available 16]

Part (i) - a few candidates did not answer the precise question, and instead gave reasons for reinsurance, or suggested types of reinsurance, and so did not gain many marks. The better answers were those that considered a wide range of different factors.

Part (ii) - a straightforward calculation that was answered correctly by the vast majority of candidates.

Part (iii) - credit was given for a number of alternative calculations used to demonstrate effectiveness. Some answers did not make clear whether the programme was effective or not.

Q4

$$(i) \quad X = \begin{pmatrix} 1 & 0 & 2 & 8 & 64 \\ 1 & 0 & 0 & 2 & 4 \\ 1 & 0 & 0 & 11 & 121 \\ 1 & 1 & 1 & 5 & 25 \end{pmatrix} \quad X = \begin{pmatrix} 1 & 0 & 0 & 1 & 8 & 64 \\ 1 & 0 & 1 & 0 & 2 & 4 \\ 1 & 0 & 1 & 0 & 11 & 121 \\ 1 & 1 & 0 & 0 & 5 & 25 \end{pmatrix}$$

[2½]

(Columns need not be in the same order as above, and for the categorical factors different numbers to 0,1 or 0,1,2 could be used.

If size of dog is split into two binary factors then a matrix with 6 columns will be needed as in the matrix on the right above.)

where (for **X** on the left)

column 1 = the base level parameter/covariate (intercept was also accepted) [½]

column 2 = pre-existing condition (0 = No, 1 = Yes) [½]

column 3 = size of dog (0 = small, 1 = medium, 2 = large) [½]

column 4 = age of dog [½]

column 5 = (age of dog)² [½]

[Available 5]

(ii) Under the null hypothesis that the two models are not statistically different

$$\frac{D_1 - D_2}{\phi} \sim \chi^2_{df_1 - df_2} \quad [1]$$

In the example

$$D_1 = 45.5766$$

$$D_2 = 41.3718$$

$$df_1 - df_2 = 2 \quad [1]$$

Therefore the test statistic is

$$\frac{45.5766 - 41.3718}{0.36} = 11.68 \quad [1]$$

Compare with $\chi^2_2(5\%) = 5.991$. [1]

As $11.68 > 5.991$, we reject the null hypothesis and conclude that the factor size of dog is statistically significant. [1]

[Available 5]

[Total available 10]

The question states that the linear predictor may be written as $\eta = X\beta + \epsilon$, although this would normally be expressed as $\eta = X\beta + \xi$, or simply $\eta = X\beta$ if there is no offset term. This did not change the answer or make it difficult to answer the question.

Part (i) – there are many possible ways of expressing X and two examples are given above. Many candidates did not include a column for (age of dog)².

Part (ii) - generally well answered. The most common error was in the number of degrees of freedom. A few answers stated to reject the “null” or H_0 , without stating what the “null” was.

Q5

- | | | |
|-----|--|-----|
| (i) | Hurricane / windstorms / typhoon/ cyclone / tornado | [½] |
| | Earthquake | [½] |
| | Tsunami | [½] |
| | Winter storm / freeze | [½] |
| | Flood [½] | |
| | Infectious diseases | [½] |
| | Terrorism | [½] |
| | Warfare | [½] |
| | Nuclear disasters | [½] |
| | Uncontrolled wilderness fires / conflagration | [½] |
| | Explosion e.g. at power plant | [½] |
| | Pollution, e.g. oil tanker crashing and breaking up at sea | [½] |

[Available 6]

- (ii) There isn't enough data about historical severe hailstorms [½]
- ...so cannot rely solely on the historical claims data [½]
- But can develop probabilistic models [½]
- ...and use them together with meteorological data to estimate the long term risk [½]
- Specific meteorological parameters can be extracted from the data set [½]
- ...and used in a regression analysis [½]
- ... to estimate the probability of severe hailstorm activity on any day in the historical period covered by the meteorological data [1]
- The probability of hail activity is dependent on the type and severity of weather[1]
- ... and depends on the season too – hail is primarily seen in the warmer months [½]
- The resulting probability can be used to determine a distribution of simulated events [½]
- ...ultimately producing a stochastic catalogue that can be used to estimate hail risk [½]
- [Available 6½]
- (iii) Other modules:
- Hazard, inventory (or exposure), vulnerability, financial analysis [1]
- Data sources:
- The hazard module is based on meteorological assessment e.g. to determine likely size and speed of hailstones at each location [1]
- The inventory and financial analysis modules both rely primarily on data input by the user (an insurer or reinsurer) of the modules [1]
- The vulnerability module relies on engineering assessment, such as extent to which different car makes / models can withstand hail events – information from industry bodies such as the ABI vehicle classification may be useful in determining this [1]
- [Available 4]
- [Total available 16½]

Part (i) - most candidates did well giving a wide range of perils.

Part (ii) - many answers described an event module in general, rather than adapting this to the specifics of hail risk.

Part (iii) - candidates that structured their answers around the four other modules in a cat model generally did well. Again, the higher-scoring answers were those that were adapted to the specifics of “hail” and “motor insurance”.

Q6

- | | | |
|-----|---|-----|
| (i) | Background information about the insured and the cover sought | [½] |
| | The professions covered by the insured | [½] |
| | Historical mix of exposure of the insured... | [½] |
| | ... e.g. information on the countries or territories in which the insured operates | [½] |
| | Information on corporate acquisitions or disposals | [½] |
| | Projected or pipeline exposure mix of the insured for the prospective policy period | [½] |
| | Changes in internal risk management at the insured that reduce the risk of negligence | [½] |
| | Whether the claims amounts are gross or net of excesses/deductibles ... | [½] |
| | ... and what the excesses/deductibles are... | [½] |
| | ... and information on individual or aggregate limits | [½] |
| | Inflation trends for the last 10 years | [½] |
| | in particular court award inflation | [½] |
| | Regulatory or legislative changes over the last 10 years, | [½] |
| | and any likely to impact the prospective policy period | [½] |
| | Changes in economic conditions | [½] |
| | Development factors to project claims to ultimate | [½] |
| | Information about changes in claims handling processes or planned initiatives | [½] |
| | Changes over the base period or planned changes in cover/exclusions/Ts&Cs/underwriting strictness/reserving philosophy. | [½] |
| | Which, if any, of the losses are large/catastrophic/ or exceptional | [½] |

Industry or other benchmark data such as experience of similar books of business [1/2]

Whether claim amounts are gross or net of reinsurance [1/2]

what, if any, changes there have been in RI cover [1/2]
[Available 11]

- (ii) Let X be the random variable for the claim severity.

Then $X \sim \text{lognormal}(\mu, \sigma^2)$.

Using the method of moments

$$E(X) = e^{\mu + \frac{1}{2}\sigma^2} = 5,960,000 \quad [1/2]$$

and

$$\text{var}(X) = e^{2\mu + \sigma^2}(e^{\sigma^2} - 1) = 1,040,000^2 \quad [1/2]$$

Therefore

$$5,960,000^2(e^{\sigma^2} - 1) = 1,040,000^2 \quad [1/2]$$

So

$$e^{\sigma^2} = \left(\frac{1.04}{5.96}\right)^2 + 1 \quad [1/2]$$

Hence

$$\sigma^2 = \ln\left(\left(\frac{1.04}{5.96}\right)^2 + 1\right) = 0.03 \quad [1/2]$$

and

$$\mu = \ln 5,960,000 - \frac{1}{2}\sigma^2 \quad [1/2]$$

$$= \ln 5,960,000 - \frac{1}{2} \ln \left(\left(\frac{1.04}{5.96}\right)^2 + 1\right) \quad [1/2]$$

$$= 15.59 \quad [1/2]$$

[Available 4]

- (iii) Plot the density function of the observations [½]
- together with the density function of the fitted distribution [½]
- and they will be close if the fit is good [½]
- however there are several statistical goodness of fit tests that are more objective [½]
- Three commonly used tests are:
- Chi-squared statistic [½]
- The range of claim sizes can be split into “bins” and the number of actual and expected claims falling into each bin counted. The sum of $(O - E)^2/E$ over all the bins has a chi-squared distribution. [1]
- Kolmogorov-Smirnov statistic [½]
- quantifies a distance between the empirical distribution function for the sample of claims and the cumulative distribution function of the fitted distribution [1]
- Anderson-Darling statistic [½]
- this uses a similar metric to the K-S statistic [½]
- but gives more weight to differences in the tails of the distribution [½]
- [Available 6½]
- [Total available 21½]

Part (i) - generally answered well. However, some candidates described the claims data, in spite of the word “other” in the question. A few answers failed to spot this was for the severity distribution and gave points that were only relevant to frequency (e.g. changes in the propensity to claim)

Part (ii) - a wide variety of different, but correct, methods were used. The most common mistake here was using 5.96 and 1.04 rather than 5,960,000 and 1,040,000.

Part (iii) - many candidates could list the statistical GOF tests, but only the better prepared candidates went on to give a correct description of each.

Q7

- (i) Ceding commission is an expense reimbursement [½]
- paid by the reinsurer to the ceding company [½]
- [Available 1]

- (ii) The profitability of the business ceded i.e. the loss ratio [½]
- The volatility of claims experience for the ceded business (higher uncertainty would tend to imply that a lower commission would be paid) [½]
- Competitive pressures [½]
- Position in the reinsurance cycle, e.g. may give more generous commission in a softer reinsurance market [½]
- The level of other cashflows:...
- ... Reinsurer's required profitability [½]
 - ... Reinsurer's expenses (including brokerage and retrocession costs) [½]
 - ... other loadings (for contingencies, investment income etc.) [½]
 - Level of the cedant's acquisition expenses or effort by cedant to win business [½]
 - And level of claims handling expenses [½]
 - And/or preferred terms specified by the cedant (or broker) [½]
 - Reinsurer's strategy / business objectives / desire for the business [½]
 - Relationship with broker / ceding insurer / negotiating strength [½]
 - Market practice for the line of business [½]
 - Market practice for the territory [½]
- [Available 7]
- (iii) Data considerations:
- As many years as possible (ideally at least 10)... [½]
 - ... of premium and claims data ... [½]
 - ...triangulated (preferably on an underwriting year basis) [½]
 - Information on rate changes over the period covered by the triangles [½]
 - Estimates of premium income to be written [½]
 - ... and rate changes for the period of cover being priced [½]
 - Information on changes in mix of business ... [½]

| | |
|--|----------------|
| • ... and policy terms and conditions of the cedant over the period | [½] |
| • ... and of the treaty itself | [½] |
| • Changes in underwriting strictness/claims handling/legislation | [½] |
| • Information on catastrophe exposure and large/cat losses | [½] |
| • Lines of business | [½] |
| • Past and future inflation | [½] |
| Use an appropriate set of actuarial methods | [½] |
| ...to project the triangulated data to the ultimate settled position for each historical year | [1] |
| May need to use benchmark development factors if our own data is insufficient | [½] |
| Then the resulting loss ratio for each year can be calculated | [½] |
| Trends should be applied to these loss ratios (for the effect of claims inflation) to put them “on level” to reflect the level of premium rates for the period of cover being priced | [1] |
| The set of resulting adjusted loss ratios could be averaged to give an estimate of the expected loss ratio for the period of cover | [1] |
| However, if a clear trend is apparent in the resulting adjusted loss ratios, we may want to allow for this. | [½] |
| If they are considered as a set of observations from a statistical distribution, their mean and standard deviation could be used to parameterise a distribution | [1] |
| ...the log normal distribution is commonly used for this purpose | [½] |
| Load the non-cat expected loss ratio to allow for catastrophes/large losses | [½] |
| Seek the views of the lead reinsurer (if applicable) | [½] |
| Seek the views of the reserving team | [½] |
| Need to allow for any inuring reinsurance | [½] |
| Allow for retrocession | [½] |
| Allow for the reinsurance cycle, if possible | [½] |
| | [Available 16] |

- (iv) Check that $100 - \text{loss ratio \%} - \text{ceding commission \%}$ leaves enough to cover the reinsurer's expenses and profit [1]

It may also be instructive to use the loss ratio distribution to identify the probability of the reinsurer making a loss [1]

If this is too high, then the reinsurer should reduce the ceding commission even though the mean outcome is satisfactory [1]

[Available 3]

[Total available 26½]

Part (i) - most answers scored full marks, but some omitted to mention that it reimburses expenses

Part (ii) - generally done quite well – a wide variety of answers were seen.

Part (iii) - some candidates did very well, giving the detail described in the core reading. Most candidates were able to give the right ideas and so faired reasonably. A number of candidates failed to appreciate that this was a quota share treaty and so spent time describing how to adjust the cedant's loss ratio to allow for recoveries, etc.

Part (iv) – generally poorly done, most answers failed to give the relevant bookwork.

Q8

$$(i) \quad n_X = \left(\frac{y}{k}\right)^2 \left(\frac{\sigma_X}{\mu_X}\right)^2 \quad [1/2]$$

$$\sigma_Y = 2\sigma_X \quad [1/2]$$

$$\mu_Y = 5\mu_X \quad [1/2]$$

where

$$\Phi(y) = \frac{1+P}{2}$$

Since P (and therefore y) and k are the same for X and Y , then

$$n_Y = \left(\frac{y}{k}\right)^2 \left(\frac{\sigma_Y}{\mu_Y}\right)^2 \quad [1/2]$$

$$= \left(\frac{y}{k} \right)^2 \left(\frac{2\sigma_X}{5\mu_X} \right)^2 \quad [1/2]$$

$$= \left(\frac{y}{k} \right)^2 \frac{4}{25} \left(\frac{\sigma_X}{\mu_X} \right)^2 \quad [1/2]$$

$$= \frac{4}{25} n_X \quad [1/2]$$

$$= \frac{4}{25} \times 1000 = 160. \quad [1/2]$$

[Available 4]

- (ii) Covering the cost of fixing the in-car software if it stops working (even if no accident is caused) [1/2]

Loss or damage to the vehicle caused by hacking or attempted hacking of its operation system or other software [1/2]

Covering accidents that result from failures of the driverless technology (both third party liability and own damage) [1/2]

Possible compensation to the policyholder for not being able to use the driverless car (e.g. if satellite system is not working) [1/2]

Cover for 3rd party liability in the event of an accident caused by failure of policyholder to update vehicle's operating system, firewall, and mapping and navigation systems within a reasonable time of being informed by the manufacturer [1]

Loss or damage to 3rd parties caused by policyholder failing to use manual override to avoid an accident in the event of a software or mechanical failure [1]

Cover the cost of damage to software as the result of a virus [1/2]

Cover the cost of damage or 3rd party liability resulting from incorrect mapping of the area being driven in [1/2]

Damage to a third party's driverless car resulting from incorrect data from the insured's car being communicated (if the technology relies on shared data) [1/2]
[Available 5 1/2]

- (iii) Fewer accidents/claims (due to the removal of the human error element of risk) [1/2]

Average claim size could also reduce, especially because there may be fewer large losses (e.g. large losses resulting from driving over the speed limit or driving while under the influence of drink or drugs) [1/2]

The technology may also reduce the average claim size for accidents by reducing the severity of damage, e.g. by swerving or braking to some extent when a human driver may have been unable to react in time at all [½]

This could cause premiums to be reduced and/or the insurer's profitability increasing [½]

On the other hand, claim frequency may increase, especially if failings in the technology are not spotted during testing – this might be worst in the early years of implementation of the new law [½]

And severity could also increase, e.g. head-on collisions may occur in circumstances where they would previously not have [½]

The cost to replace and repair parts after a crash could be higher [½]

...e.g. if there was a crash due to the automated systems, extensive software and hardware analysis would be necessary to determine the reasons for the crash (*or any other valid example*) [½]

...these could inflate premiums, or reduce profitability [½]

...and may increase the demand for comprehensive policies [½]

Increased quantity and availability of data could be beneficial in accurately assessing the risk [1]

...and reduce fraudulent claims [½]

insurers may have to build capability to store and analyse larger volumes of data [½]

Risk may be transferred from the individual driver to the manufacturer [½]

Accidents will be principally caused by the malfunctioning of systems, which could force manufacturers to insure whole fleets of cars instead of the driver insuring themselves [1]

...resulting in a shift from personal lines motor insurance to product liability insurance [½]

Demand for insurance may change e.g. driverless cars could be too expensive or driverless cars might encourage more onto the roads [½]

There could be expensive disputes over whether liability lies with the manufacturer or the driver in cases where it is not clear whether the driver was able to override the technology if a serious accident has occurred. [½]

It could introduce aggregation risk caused by a system failure affecting multiple vehicles at once [½]

It is also possible that damage and theft risk may become part of household contents policies [1/2]

... and motor insurance companies may need to find other revenue streams to widen the tight profit margins [1/2]

Alternatively, risk in relation to accidents could move to the manufacturer, but other perils such as fire, theft, etc could continue to be covered under a personal motor policy. [1/2]

Cyber risk could be prevalent [1/2]

E.g. nuisance attacks like “spam jams” and hacker created congestion, causing changed destinations or clogged up roads [1/2]

Driverless cars could potentially be a threat as terrorists could gain control of vehicles for attacks ... [1/2]

...while standard policy wordings do not cover illegal use of the vehicle, this remains a potential risk that may have to be insured elsewhere [1/2]

Staff will need to be retrained, especially when handling claims [1/2]

How will the policies be rated given no historical experience of such cars [1/2]

Rating is likely to be based less on the policyholder (age/occupation etc) and more on the vehicle (make/model) [1/2]

New policy terms and conditions will have to be written [1/2]

There are likely to be problems in the transition period where a mix of car types are on the roads – this could lead to more claims [1/2]

Equally a problem if only cars are driverless - what about buses, lorries [1/2]

Problems with insuring cars for travel abroad – different laws, incompatible software [1/2]

Time will be needed to build, test and implement a new approach to rating [1/2]

The software may mean claims can be investigated more quickly and hence reduce settlement time [1/2]

Higher margins may be required to allow for increased uncertainty. [1/2]

NCD may no longer be appropriate/ acceptable [1/2]

Changes are likely to result in increased expenses for insurers. [1/2]

[Available 20]
[Total available 29½]

Part (i) - generally well done with nearly all candidates having a good attempt at this, and most candidates scoring full marks.

Part (ii) – generally well attempted, but many candidates failed to think beyond property damage and liability resulting from failure of the technology.

*Part (iii) - reasonably well attempted. The better answers focused on the issues that **insurers** would be concerned about, and tried to give a wide range of these, without going into excessive detail.*

Q9

(i) (a)

Can allow ready-made access to market through a third party more quickly than it would be able to by itself... [½]

...reducing initial set-up costs [½]

...and allowing it to exit market relatively quickly if necessary [½]

...may also give access to market it wouldn't be able to access by itself, thereby achieving diversification [½]

(e.g. if coverholder is a specialist/has a strong brand) [½]

less admin/resource required to administer policies and handle claim [½]

Commission paid to coverholder may be less than cost of writing the business directly [½]

The coverholder may be in a location that is closer to the target market [½]

The coverholder may have superior business acquisition facilities [½]

(b)

Allows insurer to tailor its payments to broker/insured, so that the cost of poor experience can be shared with a third party [½]

Incentivises the third party to keep losses low/source good business [½]

... making the insurer's profits more stable [½]

The insured may elect to meet the cost of small claims itself to avoid losing profit commission ... [1/2]

... and fewer small claims may mean lower claims handling expenses [1/2]
[Available 7]

(ii) Lack of control over underwriting may lead to:

Poor risks being accepted that would have been rejected by the syndicate [1/2]

Aggregations of risk, e.g. in a particular industry or geographical region, that would have been avoided by the syndicate [1/2]

A mix of business that differs from the syndicate's target market [1/2]

Lack of control over which claims are paid/declined [1/2]

May end up paying claims that would be declined if handled directly by the syndicate [1/2]

Increased risk of fraudulent claims [1/2]

Which may invalidate pricing assumptions, causing higher losses than expected [1/2]

Or may decline claims which the syndicate would pay [1/2]

Which may lead to potential adverse publicity/poor relationship with brokers/insureds [1/2]

Increased risk of errors in the data [1/2]

And it may be more difficult to spot data errors in block bookings [1/2]

Increased burden of having to audit the coverholder regularly [1/2]

May need to prove to regulator/auditors that syndicate has proper oversight of the coverholder [1/2]

Unable to undertake detailed data analysis, e.g. [1/2]

- how to identify/expand profitable parts of book [1/2]

- reasons for high loss ratios/identifying loss making policies [1/2]

- compare actual experience to pricing assumptions, e.g. mix of business [1/2]

- monitor how make-up of book is changing over time [1/2]

- check exposure to emerging losses/latent claims, e.g. deafness [½]

cannot analyse frequency and severity separately (so a burning cost approach will probably be required) [½]

accurate pricing will be difficult [½]

if business written in different countries, information about original currencies may be lost [½]

With less detailed information, may push up reinsurance costs ... [½]

... or make it more difficult to assess reinsurance requirements [½]

Ability to estimate cat and large loss loadings will be compromised [½]

Delays in receiving bordereaux may mean cannot respond quickly to changing experience [½]

More difficult to set reserves/capital requirements, or will at least have more uncertainty [½]

There may be data protection issues around transfer of data, or which increases level of aggregation [½]
[Available 14]

(iii)

| <i>UWY</i> | <i>GWP</i> | <i>Inc. Claims</i> | <i>Dev. %</i> | <i>Ult. Claims</i> | <i>Loss Ratio</i> | <i>Profit Share Payment</i> |
|------------|------------|------------------------|---------------|------------------------|-----------------------|---------------------------------|
| 2014 | 20.2 | 10.6 | 65% | 16.3 | 81% | 0.0 |
| 2015 | 25.3 | 9.2 | 48% | 19.2 | 76% | 0.0 |
| 2016 | 30.3 | 2.7 | 12% | 22.5 | 74% | 2.4 |
| 2017 | 35.4 | 0.7 | 3% | 23.3 | 66% | 2.8 |

Total profit share = £5.2m

[£5.3m also accepted, due to rounding]

Ult Claims = 1.5 marks

Loss Ratio = 1.5 marks

Profit Share Payment per year = 1.5 marks

Clear statement of total profit share = 0.5 marks

[Full marks awarded if candidate gives alternative answer by applying a sensible IELR for a BF method] [Available 5]

- (iv) Should clarify how reported claims will be determined by the coverholder [½]
- and how exactly “ultimate claims” are to be calculated [½]
- e.g. which curve is to be used [½]
- And/or who exactly calculates ultimate claims [½]
- As the written premium figure may also be estimated (esp. UY2017), the method of estimation needs to be understood [½]
- The calculation incentivises the coverholder to overstate the written premium [½]
- Under current arrangement, coverholder could dispute calculations [½]
- A loss ratio of 74% or lower may mean syndicate makes losses-may want to set the target loss ratio lower [½]
- And/or take into account expenses, reinsurance costs, costs of capital etc. when calculating profit commission [½]
- Current arrangement is an “all-or-nothing” arrangement; should probably apply a more graduated approach [1]
- And/or apply a profit commission less than 8% [½]
- Might want to offset profit from some years with losses from other years [½]
- or alternatively, calculate profits for a period longer than 1 year, e.g. for all 4 years [½]
- Calculating ultimate claims for EL at the end of 1 year can be difficult [½]
- might want to apply a lag before payment is made (i.e. payment for an underwriting year after 3 years) to reduce uncertainty [½]
- This seems especially true in this case, as book is growing rapidly, ... [½]
- ... and the calculation relies on a benchmark [½]
- Also, GWP may not be known exactly at end of year (e.g. due to adjustments, delays etc.) [½]
- Might want to set maximum monetary cap on profit commission payment (especially as book is growing so quickly) [½]
- May introduce moral hazard in a poor year [½]
- The calculation appears to make no allowance for latent claims [½]

The syndicate should consider other common or standard profit commission agreements that are used in the market.

[½]

[Available 11½]

[Total available 37½]

Part (i) - some answers described the two features, rather than stating their advantages.

*Part (ii) - most answers got some of the key points. However, the better answers were those that were structured well, i.e. considered **BOTH** the issues with claims/policies being handled by the coverholder **AND** issues with aggregate data – sufficient detail was required for 5 marks.*

Part (iii) - generally, very well answered, with many fully correct answers.

Part (iv) - most candidates were able to describe one or two valid issues, but only a few were able to give the number required to score well.

END OF EXAMINERS' REPORT