



Institute
and Faculty
of Actuaries

EXAMINERS' REPORT

SP8 – General Insurance Pricing Specialist Principles

April 2023

Introduction

The Examiners’ Report is written by the Chief 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.

For some candidates, this may be their first attempt at answering an examination using open books and online. The Examiners expect all candidates to have a good level of knowledge and understanding of the topics and therefore candidates should not be overly dependent on open book materials. In our experience, candidates that spend too long researching answers in their materials will not be successful either because of time management issues or because they do not properly answer the questions.

Many candidates rely on past exam papers and examiner reports. Great caution must be exercised in doing so because each exam question is unique. As with all professional examinations, it is insufficient to repeat points of principle, formula or other text book works. The examinations are designed to test “higher order” thinking including candidates’ ability to apply their knowledge to the facts presented in detail, synthesise and analyse their findings, and present conclusions or advice. Successful candidates concentrate on answering the questions asked rather than repeating their knowledge without application.

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.

Sarah Hutchinson
Chair of the Board of Examiners
July 2023

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

The aim of this General Insurance: Pricing Principles 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.

Subject SP8 deals with applications of general insurance pricing techniques across many different types of products. Candidates should expect the examiners to draw these applications from all parts of the syllabus to test as wide as possible a range of skills and, in particular, to achieve a fair balance between personal and commercial lines.

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 SP8 examination.

As well as pricing techniques, SP8 also covers the workings and use of reinsurance products, so candidates should also expect the examiners to set questions on these aspects.

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 not be awarded 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.

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.

Candidates who give well-reasoned points, not in the marking schedule, are awarded marks for doing so.

B. Comments on *candidate performance in this diet of the examination.*

Most candidates attempted all questions on this paper and addressed basic points reasonably well. Although most candidates demonstrated a good knowledge of the relevant subject material, there was evidence that some candidates found difficulty in applying this to the situations given. On some questions, several candidates did not answer the precise question asked, or they failed to use the specific information in the question to tailor their answers appropriately. However, it was pleasing to see that many answers were given in a level of detail that reflected the command verb given (e.g., list, describe, explain). There was evidence of time trouble on a few scripts due to inadequate allocation of time, e.g., not leaving enough time to fully answer Question 9, or missing out parts of questions. A significant number of candidates couldn't prepare the equation correctly in Question 2 and couldn't generate enough points in Question 5(iii).

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 55.
351 presented themselves and 121 passed.

Solutions for Subject SP8 – APRIL 2023

Q1

(i)

The final rate (premium) paid will depend, at least in part, on the loss experienced [1]

It is a form of retrospective experience rating [½]

Often used in situations where there is a marked difference in opinion about the future loss experience between the reinsured and cedant [½]

[Marks available 2, maximum 1]

(ii)

Maximum 1 mark for each form of swing rate)

Minimum Plus - the final premium paid by the cedant consists of a minimum (paid upfront) [½]

plus, a factor times the actual losses to the layer [½]

subject to an overall maximum amount [½]

sometimes the premium paid upfront is the provisional amount between the minimum and maximum [½]

the cedant pays an upfront premium (deposit) [½]

the final premium is determined as a factor times the losses (subject to a minimum and maximum) [½]

usually, the deposit is between the minimum and maximum [½]

[Marks available 3½, maximum 2]

[Total 3]

Generally, very well answered, giving it was a knowledge based question. Only a few answers were not precise enough to score full marks.

For part (ii), a few candidates failed to identify the two forms of swing rate, e.g., giving two types of experience rating instead.

Q2

Partial credibility factor is

$$Z_A = \sqrt{\frac{n}{n_N}} \quad [½]$$

Full credibility is $Z = 1$ is reached when $n = 1600$

i.e., partial credibility $Z_A = \frac{\sqrt{n}}{40}$ [½]

where $n < 1600$ [½]

Bühlmann-Straub credibility factor is

$$Z_B = \frac{n}{n + \frac{\phi}{\lambda}} = \frac{n}{n + 391} \quad [½]$$

In order to have $Z_B > Z_A$

$$\frac{n}{n + 391} > \frac{\sqrt{n}}{40} \quad [½]$$

$$\frac{\sqrt{n}}{n + 391} > \frac{1}{40} \quad [½]$$

$$40\sqrt{n} > n + 391 \quad [½]$$

$$1600n > n^2 + (391 * 2n) + 391^2 \quad [1/2]$$

$$n^2 - 818n + 152,881 < 0 \quad [1/2]$$

To obtain the roots of this quadratic equation,

$$n = \frac{818 + \sqrt{818^2 - 4 \times 152881}}{2} \quad \text{and} \quad n = \frac{818 - \sqrt{818^2 - 4 \times 152881}}{2} \quad [1/2]$$

i.e., $n = 289$ and 529 [1/2]

For $n \leq 289$, Formula A leads to a higher or equal credibility factor, and similarly for $n \geq 529$. Hence, maximum number of years for which Formula B leads to a higher credibility factor is $528 - 289 - 1 = 239$. [1/2]

(Note to Markers: If the candidate gets this incorrect very early-on, they will need only a few steps to arrive at a (wrong) answer. Please award marks for each correct step.)

[Total 6]

Answers varied. Many candidates were not able to form the initial comparison equation. A common error was putting $n=1$ in Formula A (to give a partial credibility of $1/40$), but the question states that one claim is expected each year. Better prepared candidates set up a correct quadratic equation and solved it to get two roots. Some candidates used a numerical trial and error approach, which also gained full credit if the correct roots were found.

Q3

(i)

To understand how the true underlying average cost per claim and/or claim frequency has changed, it is important to remove the effect of changes in mix [1]

For example (*1/2 mark for each valid example, maximum 1*):

average cost per claim will increase if the size of risks being insured (e.g., sum insured) has increased [1/2]

with household insurance, mix of business by location will affect exposure to flood [1/2]

or any other sensible example [1/2]

Failure to do this is likely to lead to wrong conclusions being made [1/2]

premiums being set incorrectly [1/2]

which could lead to anti-selection [1/2]

or unintentional cross-subsidies between different (risk) segments of the book [1/2]

The amount of capital required will be dependent on mix of business [1/2]

lots of heterogenous risks gives diversification benefits [1/2]

and mix needs to be understood for allocation of capital [1/2]

It is also important to monitor mix of business from an accumulation risk perspective [1/2]

an insurer may have a limit on the proportion of its book that is say exposed to hurricane/flood/earthquake [1/2]

or review their risk management strategy [1/2]

Reinsurance strategy might need to be reconsidered if the riskiness of the policies change [1/2]

Understanding the source of business may inform the insurer's strategy [1/2]

by allowing profitability and persistency by source to be compared [1/2]

and is also needed to allocate expenses effectively	[½]
e.g., different brokers may be paid different rates of commission	[½]
Understanding mix will also help the insurer with business planning/ marketing	[½]
e.g., cross-sell of other insurance products, bundling or otherwise	[½]
and monitor how actual mix compares with the target mix	[½]
and understand how the mix is affected by changes in pricing/ distribution channels etc	[½]
Helpful for reserving – choosing appropriate trends / patterns / parameters	[½]
Comply with regulatory requirements	[½]
e.g., to show that customers are being charged fairly.	[½]
[Marks available 13½, maximum 5]	

(ii)	
Such a score would be very easy to calculate/understand/communicate	[½]
The mix score varies according to the likely cost of repair so makes sense	[½]
However, it assumes that a luxury car is 3 times as “bad” as a basic, and a standard is 2 times as “bad” as a basic which may not be appropriate	[1]
Need to understand how a brand is categorised as luxury, standard or basic	[½]
and some car brands may have multiple models in each category	[½]
The score also depends on the number of policies written which doesn’t tell you anything about mix	[½]
e.g., if you only insured basic cars the score would increase for each policy sold (but the mix hasn’t changed)	[½]
e.g., 2 standard cars have the same score as one luxury and one basic (but the mix is different)	[½]
It would be better if the underwriter’s score was divided by the number of policies	[½]
Size/quality of car is only one measure of risk and tells you nothing about mix in terms of other factors such as driver age, claim free years etc.	[½]
Younger policyholders, who tend to be riskier, may be more likely to own basic cars	[½]
Size/quality of car is more likely to be useful as a mix indicator of average cost per claim rather than claim frequency	[½]
and not very useful to understand the impact on third party liability claims	[½]
[Marks available 7, maximum 3]	
[Total 8]	

Part (i) was generally well attempted, and many answers covered a sufficiently wide range of different reasons to score well.

Part (ii) was also generally well answered. Many candidates demonstrated an understanding of the described measure and gave valid comments on both merits and shortfalls of this measure.

Q4

(i)	
A customer with NCD may be unwilling to buy from an insurer that does not offer NCD	[½]
This may limit shopping around options for better risk customers	[½]
especially if their current insurer offers an NCD	[½]

and those that don't offer NCD may be more attractive for poorer risk customers, i.e., they will be selected against [½]

Likewise, a customer with an insurer that does not have an NCD system in place may find it difficult to switch to an insurer that does as they may have to start with no NCD entitlement [½]

or it may make the switch more complicated [½]

With an NCD in place, the policyholders are also likely to have a lower propensity to claim (to protect their NCD discount) [½]

Even where two insurers offer NCD they may have different structures [½]

so, a customer may not retain the same discount upon switching to another insurer [½]

The fact that there is no consistency in the market makes it difficult for customers to make informed choices [½]

especially as the rules used by each insurer may not be known to customers [½]

This can be confusing to customers [½]

and not in line with treating customers fairly [½]

The flexibility in setting an NCD policy allows insurance companies to differentiate their product [½]

allowing them to attract customers with unique NCD structures [½]

and attract a profitable mix of risks [½]

Some insurers may be moving far away from the 'pooling of risk' principle of insurance, e.g., by using complex NCD structures with many levels [½]

The inconsistency makes it harder for the regulator to review and compare premiums. [½]

Similarly, market comparisons are harder for benchmarking purposes [½]

[Marks available 9½, maximum 4]

(ii)

By linking motoring convictions to NCD, the regulator may be wishing to reward good drivers by charging more for those with convictions [½]

but there may not be a clear link between claims and motoring convictions [½]

Customers are able to make better choices around the products they buy / the insurance company they buy from [½]

while making it easier to switch between different insurance providers without losing discount entitlements [½]

The change may have been motivated by complaints from customers about the difficulty of understanding how insurers' NCD systems work [½]

Reduce barriers to entry for insurers through the consistent use of NCD [½]

It highlights to the public that good driving is rewarded with cheaper premiums [½]

and therefore, acts as an incentive to improve driving standards [½]

It also makes quote processes simpler as customers won't have to declare claims / motoring convictions [½]

also avoids the risk that they don't declare them when they should / avoids fraud [½]

Enhanced regulation and oversight of pricing and claims [½]

To avoid the risk of insurers running into financial difficulties by offering NCDs that are too generous [½]

while also ensuring that some NCD systems are not so granular/ personalised as to eliminate pooling of risk [½]

The regulator may have believed some existing NCD systems were unfairly structured, e.g., those with 'full NCD' being excessively subsidised by other customers. [½]

Encourage insurers that currently don't offer NCD to offer these for more consistent treatment of policyholders [½]

[Marks available 7½, maximum 2]

(iii)	
Identify what their customers' NCD would be under the new system	[½]
if possible, get data from the government/ external sources around motoring convictions	[½]
Preferably going back a number of years	[½]
Communicate with regulator for full understanding of NCD scheme	[½]
The renewal premium for policyholders with NCD likely to be lower	[½]
This means that a higher base premium is probably needed to meet the company's overall profitability target	[½]
The pricing actuary should add NCD as a factor to its risk premium models (e.g., GLMs)	[½]
This should be done as an offset	[1]
with the relativities reflecting the discounts for each NCD level	[½]
This will allow other factors in the model to adjust, particularly if they are correlated with NCD	[½]
The loadings / allocation of expenses needs to be updated to ensure that premiums are sufficient after NCD is applied	[½]
Additional costs for system alterations required to implement this change	[½]
Review the impact on the renewal book	[½]
Are customers more likely to renew?	[½]
What will be the impact on profitability when NCD is introduced to existing customers?	[½]
Pricing actuary should speak to other departments (e.g., Marketing / IT / call centre) within the company to understand / explain the implications of this change	[½]
	[Marks available 8½, maximum 4]
	[Total 10]

For Part (i), most candidates got a few valid points, but only well prepared candidates considered a wide range of different aspects of the circumstances. Some answers described use of NCD schemes generally, rather than considering the specific situation.

Part (ii) was generally well answered, with some answers giving a good range of different possible motivations.

Part (iii) had a varied set of responses. Many candidates recognised that NCD should be added to a pricing model as an offset factor. Some failed to recognise that the insurer currently does not use NCD or didn't answer this from the Pricing Actuary's viewpoint.

Q5

(i)

Marine cargo insurance:

Indemnifies traders against the loss or damage of cargo [½]

during transport [½]
 and possibly also while unloading/loading [½]
 and when temporarily stored at docks [½]
 can also cover connected air and land transport [½]
Perils include theft, piracy, perils of the sea, fire, explosion, sinking, jettison [½ mark for each peril, maximum 1]

[Marks available 3½, maximum 2]

(ii)

Experience rating:
 Obtain historical claims information [½]
 ideally minimum of 5 years of individual claims information [½]
 Segment by key claims characteristics [½]

For example (maximum 1):

Claim type e.g. total / partial / salvage / increased value [½]
 Risk factors e.g. cargo type [½]
 Vessel type, vessel flag (country) [½]
 Project historical claims / develop to ultimate / allow for IBNER [½]
 using standard actuarial reserving techniques [½]

Adjust the data for:

Change in exposure / calculate per unit exposure [½]
 Inflation (e.g., losses becoming more expensive) [½]
 Trends in claims (e.g., reducing frequency) [½]
 On-level premium using appropriate rate change indices (if pricing cargo re-insurance) [½]
 Adjust to the mid-point of exposure period [½]
 Adjust for changes in underlying risk profiles [½]
 e.g. changes in coverage, type of contract and types of cargo shipped [½]
 Risk premium can be calculated using burning cost method [½]
 Large / catastrophes or unusual claims should be investigated [½]
 and separate load applied for large losses/ENIDs if appropriate [½]
 using a frequency/severity model [½]
 and/or a catastrophe model built for this purpose [½]
 although traditional catastrophe models may only model stationary risk – e.g., cargo stored at ports. [½]

Other relevant steps from frequency / severity models – e.g., identify outliers, fitting curves, selecting a large loss threshold. [½ mark each, maximum 1]

Sometimes, the premium is experience rated (premium is dependent on the loss experience of the policy) [½]
 must calculate the expected claims distribution to accurately account for this [½]
 and calculate the corresponding range of expected premium [½]
 Could credibility-weight the policy's past experience against that of the wider marine book (exposure) in determining the expected cost of claims for the policy [½]

[Marks available 13½, maximum 6]

(iii)

Exposure rating:
 Consider the desired level of coverage to be priced [½]
 Define value of cargo being transported [½]

Assign a rate to apply to the value of the shipment [½]

Examples below (maximum 2)

It may be set by the insurer based on historical experience of all its cargo business [½]

May vary by factors e.g. type of cargo shipped [½]

Could use company's internal data / benchmarks [½]

Use exposure curves to adjust for limits & deductibles [½]

Adjusted for inflation [½]

Apply discount/loadings specific to the policy being insured for (*½ mark each point, maximum 2*)

Applicable rating factors [½]

Size of deductible that applies (usually percentage of value insured) [½]

Exclusions [½]

Applicable endorsements and warranties [½]

Loading for large and catastrophe losses [½]

[Marks available 6, maximum 3]

[Total 12]

Part (i) was knowledge based question and generally well answered.

Part (ii) was generally well answered, with many candidates outlining a sufficient number of steps to answer well. Answers that considered both burning cost and frequency-severity approaches tended to score more highly. However, some answers only described experience rating, and not “how” it “may be used to calculate the risk premium”, which limited their potential to score.

Part (iii) was not well answered. Most candidates were scored two or three valid points, but very few answers gave sufficient detail to do well. The key was to explain the process – identify and adjust the base data and then use the exposure curves to apply to the specific policy. Some points made were not relevant to marine cargo insurance, e.g., use of ILFs.

Q6

(i)

To ensure customers are assigned to the correct rating cell [½]

To ensure that the premiums charged are appropriate for the level of risk / avoid anti-selection [½]

To make correct underwriting decisions [½]

Analysing:

exposure / volume of business in force [½]

claims experience [½]

mix /change in mix [½]

allocation of expenses [½]

Data protection regulation may require accurate records to be held [½]

For reporting requirements / financial returns [½]

Help protect against fraud / criminal activity [½]

To validate a claim	[½]
To validate customers when communicating with them	[½]
Ensure the company holds the right level of capital / level of reserves	[½]
So that you get the appropriate reinsurance program for the best price	[½]
HR purposes	[½]
To manage relationship with third parties	[½]
Correct investment decisions are made	[½]
Correct management/strategy/marketing decisions made	[½]
Reduce expense associated with data cleansing and holding of data	[½]
	[Marks available 9½, maximum 5]

(ii)

Information collected from customers should be played back to them and they should be asked to confirm the accuracy	[½]
This could be at the point of sale but also before making a claim	[½]
Addresses should be cross-checked against independent databases	[½]
Vehicle details can be checked against external data sources using registration number	[½]
Information should be selected from drop-down lists rather than free text	[½]
Logic should be built in that prevents erroneous data e.g., years held licence < driver age – 17	[½]
Data validation only permitting certain types of data in certain fields e.g., numeric or text	[½]
Check digits (e.g., last character of a policy number is a check digit)/ data field integrity checks / mandatory fields	[½]
Preferably there should be a single source of truth – a single MI database	[½]
It should be possible to reconcile information held on the MI database with the source systems, e.g., sales system, claims system, billing system	[½]
Different departments should reconcile common meta-data features, e.g., GWP, number of policies, claim payments	[½]
When a piece of work is completed, it should be checked thoroughly by a reviewer	[½]
Invoices should be approved by two or more people to ensure it is accurate	[½]
Staff training – ensuring only authorised / fully-trained employees are allowed to enter and modify data	[½]
Monitoring of staff, regular audits and/or random checks on data	[½]
<i>(Marks to be awarded for other valid, adequately described suggestions)</i>	

[Marks available 7½, maximum 4]

(iii)

Group and summarise the data prior to modelling	[½]
Requires knowledge of the expected pattern	[½]
Mainly adopted as a method of eliminating levels with little exposure	[½]
Grouping in the modelling package	[½]
Assigns a single parameter to represent the relativity for multiple levels (of the factor)	[½]
Curve fitting, or use of a variate	[½]
Factor levels are each assigned an x-value and a polynomial is fitted	[½]
The parameters in the model are the parameters from the polynomial itself	[½]
Piecewise curve fitting	[½]
Factor levels are broken into sections and grouped, or a curve fitted as above	[½]

The join at each boundary can be disjoint or piecewise continuous as required [½]
 [Marks available 5½, maximum 3]
[Total 12]

All three parts were generally well attempted.

For part (i), most candidates gave several valid ideas. However, despite the command verb being “state”, some answers gave a lot of detail on one or two aspects (e.g., pricing) and so failed to give the wide range of different ideas needed to score highly.

For part (ii), the better prepared candidates gave lots of different ideas and scored highly. Some ideas given were considered quite similar, and so could only score once.

For part (iii), candidates who correctly identified this as knowledge based question on parameter smoothing (in the context of generalised linear modelling) scored well. Several answers described spatial smoothing methods, which was not correct.

Q7

(i)

Reinsurance hardening is often in response to large or cat losses to the industry. [½]
 This might be reflected by a higher estimate for future losses, hence a higher risk premium. [½]
 or a higher profit loading to take advantage of market conditions [½]
 Higher loading for expenses / lower investment income assumptions may be incorporated in the technical pricing model [½]
 The underwriter might adjust the rates upwards to maximise the profit in the market either by offering less discounts or charging higher than the technical price stated by internal models [½]
 The contract structure / wordings might also be tightened [½]
 which reduces the coverage of the contract and expected losses [½]
 e.g., adding an exclusion for perils that recently caused market losses [½]
 e.g., introduction of an aggregate deductible / sub-limit / harsher reinstatement terms [½]
 This may reduce the overall expenses as the claims handling costs of such perils or smaller losses may be disproportionately high [½]
 Unlikely to be the same for all lines of business and territory as they may all be in different phases of the reinsurance (underwriting) cycle [½]
 it may also differently impact adjacent layers of reinsurance contracts [½]
 Some reinsurers might also look to increase market share with unchanged premium assumptions or even discounts. [½]
 [Marks available 7, maximum 4]

(ii)

(accept simpler forms of interpolation for the exposure curve attachment, (marks

Sum Insured (\$m)			½ mark	½ mark	1 mark	1 mark	1 + 1 mark for interpolation		1 mark
Lower Limit	Upper Limit	Original Premium (\$m)	Average Sum Insured (\$m)	Original Loss Cost (\$m)	Treaty Attachment Point %	Treaty Exit Point %	Exposure Curve Attachment	Exposure Curve Exit	Loss Cost to Layer (\$m)
0	10	450	5	292.5	100.0%	100.0%	100.0%	100.0%	0.0
10	20	300	15	195	100.0%	100.0%	100.0%	100.0%	0.0
20	30	250	25	162.5	100.0%	100.0%	100.0%	100.0%	0.0
30	40	50	35	97.5	71.4%	100.0%	94.4%	100.0%	5.4
40	60	90	50	58.5	50.0%	80.0%	85.0%	97.0%	7.0
60	100	70	80	45.5	31.3%	50.0%	62.0%	85.0%	10.5
									22.9

not lost if first three rows of table omitted)

[Total 6]

(iii)

- No information about the sum insured of policies within each band [½]
- the simple average / mid-point may not be suitable [½]
- The policies may even be clustered around the upper limit of each band [½]
- in which case, the reinsurer's pricing will be insufficient. [½]
- In particular, the average for the 20-30 sum insured band falls exactly at the treaty attachment point [½]
- and it is not appropriate for the loss cost to be 0 for this band [½]
- Ideally, the complete list of policy sum insureds should be requested [½]
- How is the risk profile expected to change in the following year? [½]
- no information regarding underlying deductibles & limits [½]
- Has it been adjusted for expected inflation? [½]
- The cedant's data does not explain how the expected loss ratio is calculated [½]
- Does it include loadings for large and cat losses? [½]
- and does it account for trends in the loss ratio (as the contract will apply to next year's policies)? [½]
- Other reasonable adjustments [½]
- The expected loss ratio may not be the same for each banding [½]
- Larger risks tend to have lower loss ratios to compensate for the higher expected volatility [½]
- Information from cedant may be insufficient to assess the appropriateness of using the exposure curve, and the appropriateness of using it for all bands [½]
- No features of the reinsurance treaty, such as inuring reinsurance or a limited number of reinstatements, that would complicate the calculation [½]

[Marks available 9, maximum 5]

[Total 15]

Some candidates did very well on Part (i), covering many different elements of the pricing basis and how (re)insurers could react to market conditions. However, other candidates did not appear to understand the situation described.

Part (ii) was generally answered well, with many fully correct answers. The most common reason for not scoring full marks was to round the 71.4% and 31.3% loss severities (to 70% and 30%), and hence not get awarded marks for interpolation.

Most candidates made a few observations in Part (iii) that earned marks. The better answers considered many of the different assumptions made in detail. Concerns that are specific to the calculation performed and its assumptions were more likely to score.

Q8

(i)

		<i>1 mark</i>		<i>½ mark for first row + ½ mark for copying formula + 1 mark for average</i>
Probability	Loss Ratio (A)	Commission (B)	Expense Loading (C)	Profit Margin (1-(A+B+C))
5%	50%	35%	7%	8%
10%	52%	35%	7%	6%
20%	54%	35%	7%	4%
30%	56%	34%	7%	3%
20%	60%	30%	7%	3%
10%	65%	25%	7%	3%
3%	70%	25%	7%	-2%
2%	75%	25%	7%	-7%
Expected Value	57.4%	32.2%	7%	3.4%

(Note to markers: Average profit margin can also be calculated by calculating the averages of loss ratio and commissions without calculating profit margin for each probability. This approach should also be given full marks.)

[Total 3]

(ii)

The average profit margin is 3.4% (from previous part, no marks)
 though the most likely result is 3%
 with a likelihood of 60%.
 or a 90% chance of the profit margin being between 3% and 6%)

[½]

[½]

The sliding commission structure removes the risk of loss ratio fluctuations between

the loss ratios of 55% and 65%.	[½]
The profit distribution looks skewed in favour of the reinsurer with more upside than downside.	[½]
only 5% chance of reinsurer making a loss	[½]
The highest profit margin is 8%	[½]
while there is a possibility of making a loss of 7%	[½]
losses are made in the banding over 70% loss ratios	[½]
Even at the highest loss ratio of 75%, the contract can still cover the losses and commission	[½]
The simplified distribution doesn't allow us to calculate the profit margin for loss ratios less than 50% or greater than 75%	[½]
hence the range of possible outcomes appears narrow	[½]
	[Marks available 6, maximum 3]

(iii)

The frequency severity distribution is calculated using granular data e.g. large or cat losses modelled separately; or split by perils	[½]
This approach mirrors the underlying process hence is readily understood by underwriters	[½]
also provides additional insight into aggregate loss amounts and the identification of outliers / large losses	[½]
This allows each type of loss to be developed separately and apply accurate trends	[½]
Adjustments can also be made for changes in contract condition e.g. a type of loss being excluded from contract wordings or a change in policy limits	[½]
The burning cost method would work with loss aggregates harder to spot trends	[½]
adjusting past data is difficult	[½]
The burning cost method would not yield enough data points for a loss distribution hence would not be possible to accurately calculate the commission	[½]
	[Marks available 8, maximum 5]

(iv)

The reinsurer would consider which model is considered more robust for the perils and geographical location this contract is exposed to	[½]
Multiple models might be considered based on their capabilities if the contract covers multiple perils or countries	[½]
They could assess the assumptions behind each of the models e.g., do they account for secondary uncertainty? and how often they are updated or when it was last updated?	[½]
Does it account for climate change?	[½]
Seek the views of catastrophe modellers/experts	[½]
How the input data requirement differs, and which model is more in line with the cedant's data provided	[½]
How the output of the models differ?	[½]
Quota share contracts don't require very detailed data but some basic simulation information to assess the volatility of losses	[½]
What is the cost of the available models?	[½]

How quick/easy is it to run?	[½]
Any training required/provided by the model provider.	[½]
Consider what the other reinsurers in the market are using	[½]
Sometimes the results from different models are combined	[½]
The decision might also be driven by what is available	[½]
because not all models might be licensed by the reinsurer	[½]
and brokers may provide model results for some models	[½]
	[Marks available 9, maximum 5]
	[Total 16]

Part (i) had a good number of fully correct answers. Candidates that took the approach of considering averages generally calculated the weighted average loss ratio correctly but did not correctly calculate the corresponding average commission. The other common errors were not calculating expenses as 7% of ceded premium as instructed, and not defining the profit margin correctly.

Candidates that did not work out a profit margin for each probability (in part (i)), tended to struggle on part (ii). Many candidates found it difficult to generate many points here. Some failed to focus on the “profit margin distribution” as asked.

Part (iii) is a common SP8 question, and many candidates scored well. Some gave disadvantages of frequency-severity over burning cost, which did not score any marks. The better prepared candidates recognised that this was a quota share reinsurance contract and modified their response accordingly.

Part (iv) was also well attempted generally, with a pleasing number of highly scoring answers. A few answers described catastrophe models rather than answering the specific question.

Q9

(i)

Advantages – insurer:

Reduce admin costs for insurer	[½]
and increased retention of customers	[½]
and potentially higher volume of business in the longer term	[½]
Higher investment returns due to the longer time-period if premiums are collected in advance	[½]
Expected loss ratio will be less volatile because of diversification benefits between the years	[½]
Able to attract more customers, especially if competitors are only issuing annual policies	[½]

Advantages – policyholder:

Provide financial certainty for the policyholder	[½]
and a guarantee of insurance coverage for more than a year	[½]
Possibly lower price because the insurer passes on the benefits of lower cost and volatility over 3-years	[½]

In a hardening market, the policyholder is able to lock-in lower premiums over the long term	[½]
Similarly, if loss performance worsens over the period, the constant premium helps to avoid annual price increases	[½]
Decrease the transaction or search costs to policyholders in a case where annual policies are not renewed by their insurer	[½]
Incentive for the insurer to provide help to the insured with risk management	[½]
Disadvantages – insurer:	
lower flexibility for the insurer	[½]
as unable to change price in response to changing conditions or new information	[½]
Potential increase in moral hazard	[½]
Large scale mispricing could lead to insurer insolvency / or at least requirement to hold higher reserves	[½]
Pricing actuary may not have the skillset to price the 3-year contracts	[½]
Mismatch between asset and liability durations as the insurer transitions from annual to 3-year policies	[½]
More susceptible to:	
investment market and volatility	[½]
inflation / interest rate environment / recession	[½]
climate change	[½]
business mix / increase in exposure	[½]
<i>(Other valid points - maximum 1 mark)</i>	
Regulatory compliance:	
and possibly the requirement to hold a higher capital	[½]
Accounting treatment for such contracts might be more difficult	[½]
Difficult to find a matching long-term reinsurance cover	[½]
or might have to accept the mismatch between underlying contract and the reinsurance cover with the risk of cost increases	[½]
Disadvantages – policyholder:	
Lower flexibility for policyholders	[½]
If payments for 3-years are made upfront, might introduce cashflow problems	[½]
If bought in a hard market no room to take advantage of improved rates when market softens	[½]
Premiums might be higher to allow for guarantee / higher uncertainty	[½]
Inability to change policy if better policy options available in market after a year	[½]
<i>(Note to Markers: If candidates assume that 3-years is a shorter term than normal, they must explain this. In this scenario, marks for the reverse of the points must be awarded)</i>	
[Marks available 16½, maximum 8]	
(ii)	
Climate change risk is difficult to quantify	[½]
It may not be clear what events are caused by climate change and the impact might be gradual, taking decades or even centuries to show up clearly	[½]
If the intensity of events increases significantly, the maximum probable loss may be unacceptable compared to the insurer's solvency requirements	[1]

A great deal of data is available to understand weather patterns	[½]
but it is difficult to translate that into insurance losses	[½]
The assumption that past losses are a reliable way to estimate future losses may no longer be true / insufficient data to estimate frequency-severity due to rapidly changing situation	[1]
Climate change could increase the randomness, so becomes more difficult to predict	[½]
Potential for significant accumulations – climate risk events are not independent / insurer may not be able to diversify globally	[½]
The probability of certain climate-related events occurring may be (or may become) too high to be conducive to insurance, e.g., droughts may become commonplace in certain regions	[½]
Premiums may increase to reflect the increasing risk, and consumers may not be willing to pay this	[1]
	[Marks available 7, maximum 3]

(iii)

Statement seems reasonable because:

Climate change would be implicitly reflected by including recent events in the analyses based on historical data	[½]
Longer term trends like climate change would be reflected gradually over time by adjusting the T&Cs annually	[½]
Constant monitoring of loss impacts may be enough to allow for the developing impact of climate change	[½]

Statement is flawed because:

To reflect the increasing climate related risk, the premium is likely to increase over the medium-long term	[½]
Customers may not accept this / this may reduce customer retention / lower customer lifetime value	[½]
The student's suggested approach is likely to be inappropriate to deal with an increasing frequency of cats	[½]
Need to build in an allowance for this in advance rather than reacting after the event	[½]
Regulators may require an explicit allowance	[½]
There are long term effects even on short term policies e.g., inflation effects over the settlement period	[½]
	[Marks available 4½, maximum 2]

(iv)

Frequency of events likely to increase, therefore adjustments may be needed to the historical observed frequency	[½]
Severity of events also likely to increase	[½]
Exposure may need to be reduced to avoid accumulations of risk which leads to higher fixed cost allocation	[½]
Policyholders may invest in climate risk mitigation measures, which could result in discounts being applied to their premium	[½]
And/or the government may be implementing measures to limit or reduce the impacts of climate change	[½]
This could impact insurance premium tax or on taxable profits from business to meet demands	[½]

Pricing may need to allow for:	
Changing pattern of events which could result in changes in the number/location of exposed risks	[½]
and/or tightening of T&Cs, introduction of higher deductibles or lower limits	[½]
How relevant is past data for pricing these future events?	[½]
and should more weight be put on more recent experience and trends?	[½]
There may also be second order effects e.g., demand surge	[½]
There may be newer risks that haven’t been modelled in the past e.g., damage due to high tides & sea level rise	[½]
Availability of reinsurance may be an issue	[½]
The requirement for, or cost of, reinsurance might increase	[½]
Costs for claim resolution may increase	[½]
Competitive environment needs to be assessed	[½]
as the market may not be pricing for these risks and charge lower premiums	[½]
Pricing will have to factor in changes to the mix of business e.g., due to traditional energy industry shutting down.	[½]
May be an impact on investment returns due to investing in ESG companies e.g., switch to green infrastructure funding in lower return bonds, or demand from stakeholders for a greener asset portfolio	[½]
Changes in regulatory requirements	[½]
Factoring in newer technologies and fuels where there is limited data	[½]
May need additional margins to allow for the increased uncertainty	[½]
	[Marks available 12, maximum 5]
	[Total 18]

The question was generally well attempted, but time pressures could be observed for some candidates.

For Part (i), answers that were split into four sections (advantages and disadvantages of each party) tended to do better.

Many of the good answers in Part (ii) were based on the knowledge based criteria of an insurable risk, tailored to climate change.

For Part (iii), better answers gave points both for and against the student’s suggestion. The stronger candidates gave points that were focussed on the pricing process and tailored to climate change in Part (iv).

[Paper Total 100]

END OF EXAMINERS’ REPORT



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