INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

September 2021

CP2 – Modelling Practice
Core Practices
Paper Two

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.

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
December 2021

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

The aim of this subject is to ensure that the successful candidate can analyse data, develop a model, and document the work (including maintaining an audit trail for a fellow candidate and senior actuary). They should be able to analyse the methods used and outputs generated and communicate to a senior actuary the approach, results and conclusions.

The subject is split into two papers. The second, dealt with in this report, covers the objectives:

- Ability to analyse the methods used and the model's outputs.
- Ability to apply and interpret the results.
- Communication of the approach, results and conclusions to a senior actuary.

As the focus of the subject is on communication, the majority of the marks are for the documentation and outputs generated rather than for technical modelling skills. For example, a technical mistake is only penalised once and candidates can still earn marks for accurate and clear communication of what was done.

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.*

Modelling
The required modelling was reasonably straightforward for this exam, and most candidates scored well, completing all the required work correctly. There were some candidates that made errors on the Macauley duration, usually as a result of not implementing the formula provided in the model.

The charts section was also well handled. Most candidates scored highly, with some losing only a few marks for poor labelling of charts and axes.

Summary
The methodology was well set out by better prepared candidates, with generally clear explanations covering most of the main steps. There is a tendency to use less detail than is expected by the CP2 examiners, but this is still an area that is well handled.

It is heartening to see that the number of candidates that either copy the provided audit trail into the summary paper, or write the summary in the style of an audit trail (with numerous references to the spreadsheet) is once again reduced from previous sessions. We have repeatedly stressed that taking this approach is penalised, and candidates that take this approach tend to score poorly, and it appears that this message is having the desired effect. The summary paper should be a standalone document that doesn't make any reference to the spreadsheet. Similarly, inserting 'reasonableness checks' (which belong in the audit trail) should be replaced by explaining and commenting on results.

Most candidates managed to pick out the most obvious conclusions from the results. However, they were still often rather brief and basic, focussing on the 'what' but not the

'why'. This area remains the clearest distinction between good candidates and the rest, as it shows an understanding of the assignment and an ability to communicate this. Candidates should aim to explain what they see, and find a reason for it. As an example, many candidates noted that there appeared to be a reduction in claims in the last few years of the data provided (or that there is notable volatility in the claims from year to year). Only the better candidates went on to explain the potential impacts of this on the analysis.

Most candidates produced plenty of next steps, but only the better candidates linked these clearly to the scenario in the question and explained how each step would help. Those who produced a 'scattergun' list of short one-liners earned very limited credit. In particular, the use of a template list of next steps can often be noticed, either by not making these relevant to the assignment, or including steps which are patently out of place. Submissions of steps that are irrelevant or inappropriate for the assignment will therefore tend to score poorly.

Often, suggested next steps will be areas that are already covered by the assignment, such as sensitivity testing a parameter which was changed in one of the scenarios. Mentions of an epidemic being a shock scenario were numerous, but many lacked a clear link with what impact this would have on the task at hand. Candidates should ensure that their suggestions are relevant to the situation, and make sense as an additional area of investigation. They should also try think a bit deeper and explain the benefit one would achieve from doing this – which will ensure that they get maximum credit for each idea.

It is strongly recommended that prospective candidates do a number of past papers, and look closely at both the model solutions and the marking schedule to get a better idea of the range of conclusions and next steps which could be submitted.

C. Pass Mark

The Pass Mark for this exam was 60
1148 presented themselves and 776 passed.

Solutions for Subject CP2-2 – September 2021

Q1

Spreadsheet Additional Scenario

(i)

Calculate the Macauley duration of the projected cashflows [3]

(ii)

Repeat the calculations completed by your colleague but under the new proposed structure

Calculation of new frequency, severity and expected claims	[1½]
Calculation of new present value of claims	[1½]
Calculation of premium required to meet minimum margin	[1]
Calculation of the Macauley duration of the new policy	[1]
Sensible auto check	[1]
	[Total 9]

The majority of candidates managed to complete the modelling required. There were a few errors in the calculation of the Macauley duration, but in general candidates scored well in this section.

Q2

Chart Production

(i)

Construction of chart showing the number of claims occurring in each year under the original proposal [3]

(ii)

Construction of chart showing the average claims amount for each year under the original proposal [3]

(iii)

Construction of chart comparing the projected (undiscounted) claim cashflows under each proposed policy [3]

[Total 9]

Charts were generally well constructed, and most candidates scored well in this section.

Q3

Summary

(i)

Methodology (including purpose, data, approach and assumptions)

Statement of purpose [1]

Data used, including source [1]

Data validation/review [1]

Assumptions: up to 5 marks for a good list of "added value" assumptions [5]

Award a total of 1 mark for restating assumptions from the audit trail. Award 1 mark for any valid assumption not included in the audit.

Calculation of the inflation adjusted claims [2]

Calculation of the payout for each claim under the proposed policy [1]

Calculation of the average frequency and severity of claims per year [1]

Calculation of the total expected claims [1]

Calculation of the present value of expected claims (payout pattern 1 mark and discounting calculation 2 mark) [3]

Calculation of the net premium & check whether the proposed policy can be written [1]

Calculation of the Macauley duration [2]

Update for new treaty terms [2]

Calculation of the minimum premium under the new proposed policy [1]

The level of detail included is appropriate for a senior actuary [2]

All methodology steps are set out clearly [2]

The senior actuary would be able to understand the approach taken without having to refer to other documentation [1]

(ii)
Results, including charts
Inclusion of charts showing the number and average size of claims [1]
Result is that the policy should be written [1]
Inclusion of chart showing undiscounted cashflows [1]
Inclusion of the two Macauley durations [2]
Statement of the minimum premium required for the new proposed policy [1]

(iii)
Conclusions
Where results are observed but not explained only ½ mark should be awarded unless the mark is specifically stated to be for an observation
Observation that there has been at least one claim per year [1]
As a result there is an average size of claim each year [1]
Observation on the reduced number of claims in recent years [1]
Explanation that the time to too short to conclude there is a genuine reduction [1]
Maximum average claims is $5m, consistent with the policy terms [1]
Comment on the high level of variation annually [1]
So the outcome in any one year will be very uncertain [1]
Value of discounting (undiscounted value less discounted value) is consistent with the Macauley duration (interest earn on net premium) [2]
Observation that the policy could not be written without the assumed investment income [1]
Explanation of why the investment income on the net premium only should be included (that the margin will be partly spent on costs) [2]
Explanation of the increase in claims frequency under the new proposed policy award 1 mark if only observed and not explained [2]
Explanation of the increase in the average severity of claims under the new proposed policy [1]
Difference is consistent with the increase in claims frequency [1]
(One extra claim in the $3m-$5m range) [1]
Explanation of the differences in the cashflows between the two policies (peak 1 mark and volume 1 mark) - award 1 mark if only observed and not explained [2]
Explanation why the Macauley duration is longer than the mean of the payout pattern award 1 mark if only observed and not explained [2]
Explanation of the change in the Macauley duration under the new proposed policy award 1 mark if only observed and not explained [2]
Conclusion that the actual outcome is very uncertain as the experience in any particular year is volatile [1]
Any other valid conclusion with the reason why [3]
[Marks available 27, maximum 22]

(iv)
Next steps
Check the claims data is up to date [1]
Try to obtain claims data for more years for better credibility or from other commercial property insurance policies ABC Re. already reinsures [1]
Allow for additional premium to be charged over the 6 years if the claims experience worsens beyond a point [1]
This would also increase profitability [1]

Check if more recent reported claims are final or are they estimates that are subject to change [2]
Confirm with DEF that all claims for the more recent years have been reported so that there are not unreported claims. Or include estimates of any unreported claims [2]
Consider a shorter time period over which to calculate the frequency of claims [1]
Check the claims inflation table against other industry sources in particular check the assumed rates for 2021 and 2022 [2]
Produce a summary of outcomes under a range of frequency and severity scenarios [1]
Model the expected future claims stochastically based on a range of outcomes around the frequency and severity assumptions [2]
Consider whether ABC Re should include investment income on the margin received [1]
Consider the investment products available to ABC Re to earn a higher investment income than the current proposal [1]
Consider the investment products available to ABC Re to earn a guaranteed investment return [1]
To reduce the investment risk [1]
However these may lead to liquidity risk if the investment is not available on request and claims are due to be paid [1]
Sensitivity test the result to the assumption of 3% claims inflation for 2020 and 2021, a small change in the assumption may lead to a different decision as to proceed [1]
Sensitivity test the assumptions of the payout patterns, in particular that claims are paid quicker than currently assumed [1]
Sensitivity test the discount rate as the profitability of the contract is reliant on the investment returns [1]
Consider any regulatory changes, which could affect the claims on commercial property insurance [1]
Consider any changes in the legal environment, which could affect the claims on commercial property insurance [1]
Confirm that the 10% margin is sufficient for ABC Re to cover its costs [1]
And in particular the additional capital required to write the policy and hence its costs of capital [1]
Consider other policy structures that may also be of interest to DEF Insurance, depending on their risk appetite [1]
Back test using other similar policy data [1]
Allow for tax on profits [1]
Obtain a peer review of the work performed [1]
Any other valid next steps [2]

[Marks available 32, maximum 18]

The above list is not a definitive list of next steps but represents a good range of example next steps. Each next step should be specific to the project being considered and in most cases should explain the rationale for completing the next step. More simple next steps are awarded up to 1 mark (for suggesting the next step specific to the project) whereas more complicated next steps are awarded up to 2 marks (1 mark for stating the next step specific to the project and 1 mark for stating the rationale for completing the next step).

(v)
Drafting
Clear / concise drafting of the objective, and data summary/description [1]
Clear / concise drafting of the assumptions and methodology [2]

Clear / concise drafting of the results and conclusions	[2]
The summary report is written in clear, crisp and flowing English	[2]
Accurate spelling	[1]
The summary is well laid out, in a reasonable order, with good formatting to aid clarity	[2]

[Total 26]

The description of methodology was usually handled reasonably well. Better candidates are able to describe what was done, and how it was done. Most candidates also managed to include the majority of the requested results in the summary.

However, as has been stated for previous exams, candidates struggle to comment on the results, and draw useful conclusions. Only the better candidates score well on this section, with most earning well under half of the marks on offer.

Next steps are usually better, with most candidates coming up with a number of reasonable suggestions. However, only the better candidates are able to elaborate on those next steps, providing justification for why they make sense for the given assignment.

[Paper Total 100]

END OF EXAMINERS' REPORT

