INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

April 2020

Subject SP7 - General Insurance Reserving and Capital Modelling Specialist Principles

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.

Mike Hammer

Chair of the Board of Examiners
July 2020

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

1. The aim of this General Insurance Reserving and Capital Modelling Specialist Principles subject is to instil in successful candidates the ability to apply, in simple reserving and capital modelling 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. Candidates who are well prepared generally appear to perform reasonably on SP7, although a number of candidates do not appear to be adequately prepared, or show poor exam technique. The following points are always worth considering to improve performance:
(i) Lists are hugely valuable for breadth of point generation but candidates should always exercise judgement when applying them. In many instances questions will be specifically designed to render a number of the standard points inappropriate and marks (often generous multiple marks) will be available for identifying and articulating these nuances well.
(ii) Calculation questions will come up on a regular basis within SP7 papers. Candidates should always be prepared for such staples as balance sheet preparation, triangle manipulations & projections and reinsurance layer calculations (along with being able to carry out any necessary adjustments including inflation, exposure, earning distortion and time period issues). Further, if the examiners cannot follow a candidate's logic they cannot give partial credit for incorrect calculations. Therefore a clear audit trail should be left to help secure appropriate method marks where the calculations are incorrect.
(iii) Capital questions should be expected on every paper and represent a sufficient proportion of the course content that candidates should not expect to be able to pass on their reserving knowledge alone. Those who do not encounter capital work in their professional lives should be particularly careful to ensure that they take time to familiarise themselves with this element of the course.
(iv) Candidates should aim to be able to give near exact glossary definitions as incoherent or vague descriptions will not score marks. If candidates struggle to remember definitions verbatim, they should take the time to properly analyse the glossary definition to ensure they have fully absorbed all the nuances of the definition.
(v) It is important to always read the question properly and to answer only what you are asked.

(vi) Always assume that question content is there for a reason. If something is pure bookwork, it should be obvious as such as it will generally go straight to a question with little or no specific context. These are the only sorts of questions where you should expect to provide generic answers. Otherwise you will need to make reference to the situation posed in the question to score well. For example if lines of business, types of insurance entity, a specific set of regulatory requirement or anything else is mentioned they have been chosen as they have an impact on the answer. If numbers are mentioned, they are there because we expect you to look at them, think about them and offer some comment or display some ability to notice unusual features of a table of numbers (a key skill for an actuary). In every exam there will be a significant number of candidates who are clearly extremely well prepared, who write very long answers that clearly display all the basic knowledge one might require to be able to think intelligently about a question, but they score poorly because the answer is purely generic with no obvious attempt to actually address the question scenarios.

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

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

With this sitting being the first online and open book sitting, candidates did well to adapt to the situation and change in style this required.

This session students did particularly well on bookwork questions. In particular Question 7 on regulations and regulatory framework was generally well answered in contrast to the previous sitting where the regulatory question was the worse answered on the paper.

As is often the case, calculation questions were generally less well answered than other questions on the paper. Calculation questions regularly come up in SP7 and candidates should practise these as part of exam preparation. For calculation questions students should copy their workings across from spreadsheets and state the formulas they have used in their calculations, otherwise they may miss out on follow-on marks if they have made an error.

C. Pass Mark

The pass mark for this exam was 58.
254 candidates presented themselves and 53 passed.

Solutions

Q1

- Capital model is likely to have a small number of time intervals that may not be appropriate for longer tail lines [½]
- Increasing the number of time intervals will increase model run time [½]
- This may lead to the run time being impractical [½]

Insurance risk

- Longer tail classes may be driven by different types of losses for Premium risk [½]
- For example, short tail property classes may be catastrophe loss driven [½]
- whereas Premium risk for longer tails are more likely to be driven by clash, attritional or large losses [½]
- Longer tailed lines are likely to be more reserve risk driven, unlike short tailed lines that may be more Premium risk driven [½]
- Example of how reinsurance bases may be different between long and short tail lines, such as claims made vs. risk attaching, which may change the types of assumptions needing to be made [½]

Market risk

- Market risk is likely to become more important [½]
- ...as payment patterns are likely to be longer for claims [½]
- May need to hold new types of assets [½]

Other risks

- When looking at longer tail classes, likely to be exposed to Credit risk for a longer period of time [½]
- Operational risk exposure associated with business will change, for example if the business takes longer to fully run off then it will be exposed to some operational risks for longer [½]
- Suitable argument on liquidity risk, for example assets held to match long tail liabilities may be less liquid so liquidity risk may become more important [½]

Correlations and dependencies

- Correlations and dependencies between risk groups may need to change [½]

General points

- Simplifications that were previously appropriate may no longer hold [½]
- Will depend on the purpose of the model as there may be specific requirements or implications [½]
- Company may not have product knowledge and data to know how to model and parameterise [½]
- …This lack of knowledge could also increase other risks, such as mispricing or poor estimation of reserving patterns [½]
- Any other suitable arguments [½, Max 1]

[10½, Max 4]

This question was generally well answered with candidates being able to generate ideas of ways in which a model may need to be changed.

Q2

(i)

Stress testing [½]

A firm using a simple stress test approach might undertake the following types of tests:

- A rise in interest rates of W% leading to reduced assets values and changed value of discounted liabilities (if the model discounts the liabilities) [½]
- An X % fall in equity prices [½]
- Currencies depreciating against sterling by Y% [½]
- A fall in property values by Z% [½]
- A change in the spread of corporate bonds/yields [½]
- In each case the degree of severity of the test will reflect the chosen confidence level [½]
- When carrying out stress testing, it is important to consider the relationships between risks [½]

Use of an Economic Scenario Generator (ESG) [½]

- An ESG is a model that generates values for economic variables (such as inflation, gilt yields and equity returns) [½]
- ESGs are often viewed as superior to stress tests as they use common drivers of market risk, such as inflation [½]
- An ESG defines the forms the variables may take and the relationships between them [½]
- ESGs can be very complex so it is important that the user understands the inputs and ensures that the ESG has been calibrated to reflect the purpose [½]
- The ESG will give a joint probability distribution of outcomes for the economic variables [½]
  For example
  - equity returns, yield curve shifts, credit spread shifts, credit defaults (and so on) and a point is chosen from the distribution that reflects the desired confidence level [½]
- The point will have been generated by a particular scenario [½]

For each method [Max 2½]

[5, Max 4]

(ii)

Stress testing

- Stress tests may be appropriate for insurers with standard investment portfolios [½]
- ..or where the insurer doesn't have material exposure to market risk [½]
- If capital model being used is deterministic it may not be possible to use an ESG [½]
- Insurer may not have the capacity, expertise or money for an ESG [½]
- We may also use stress tests to provide a sense check on the output of a more complicated market risk model, such as Economic Scenario Generator [½]
- Any other suitable arguments [½, Max 1]

Use of an Economic Scenario Generator (ESG)

- An ESG may be appropriate if the insurer has a complex investment portfolio [½]
- or that wants to more accurately model the relationship between its insurance policies and the economy [½]
- or that wants to use the model to support its investment strategy [½]
- Market risk is material to the insurer [½]
- Often viewed as preferable / superior to stress tests as more complete [½]
- Any other suitable arguments [½, Max 1]

For each method [Max 1½]

[3, Max 2]

[Total 6]

This question was largely bookwork and as such was well answered by candidates. Candidates discussing generic deterministic vs. stochastic modelling tended to score less well as the question asked for the answer to be tailored to Market risk. The core reading contains Market risk tailored examples,

Q3

(i)

Energy

- If oil prices fall dramatically then it is likely that oil production will reduce [½]
- as it is less profitable [½]
- Meaning that less insurance (smaller limits) will be required for the extraction, transportation and storage, and refining of oil [½]
- As market size won't instantly contract this is likely to drive premium rates down [½]
- Due to the lack of profitability it is likely that the companies will look to cut costs so excesses could go up [½]
- ...or they may come down if less coverage is needed overall [½]
- Propensity to claim is likely to increase [½]
- …and fraudulent and exaggerated claims are more likely [½]
- Overall frequency will depend on how these factors balance out [½]
- Increase frequency in energy liability claims are possible as cutting costs may lead to corners being cut [½]
- …which could also lead to a higher severity of losses [½]
- Likely that the loss ratio will be more large loss driven [½]
- The mix of energy producers, for example between those relying on oil and those using producing renewal energy, will have an impact [½]
- Any other suitable arguments. [½, Max 1]

Marine

- If oil prices are low then running marine vessels will be cheaper [½]
- If vessels are cheaper to run then the use of vessels is likely to increase for companies are able to be more competitive [½]
- which is likely to mean increase Marine policies exposure to risk [½]
- which could lead to an increase in demand for cover and premiums [½]

- If vessels are being used more due to increased demand then vessel upkeep is likely to suffer due to opportunity cost of spending time on upkeep if demand is higher [½]
- This is likely to lead to increased problems so increased frequency of hull claims in the future [½]
- There may also be an impact on the severity of claims [½]
- If vessels are carrying oil as cargo then it's value would fall, so claims cost for this would fall as value of cargo is lower [½]
- ..however if there is a higher demand for oil and more of this is transported there is the potential for an increase in oil spills and environmental liability claims [½]
- Any other suitable arguments [½, Max 1]

For each line of business [Max 4]

[8, Max 6]

(ii)

<u>If results are adverse</u>

- Customers may build up loyalty over time with established companies and so be less price sensitive than those with newer companies [½]
- ...meaning that they may be able to charge more so loss ratios may suffer less [½]
- If the company is established then it may have booked reserves higher than best estimate (margin) that it can release to free up capital [½]
- or have had time to build up specific additional reserves to cover events like this if that is allowed under accounting rules [½]
- A new company may struggle to raise additional capital to cover losses due to lack of track record of profitability that it can point [½]
- A new company may be more exposed to potentially being acquired [½]
- ...although may be a less attractive target than an established company [½]
- A new company is more likely to have weaker pricing as less data / experience leading to lower profitably and so are more impacted by any adverse changes [½]

<u>If results are advantageous</u>

- Established company may be able to more readily redeploy capital to the take on additional business [½]
- …whereas a new company is likely to be constrained by new business strain [½]

<u>More generally</u>

- If the company is established then it may be more likely to have a more diversified mix of business underlying it's marine and energy books meaning its results will be more stable [½]
- An established company may have stronger policy wording meaning that it may be less at risk of unintended coverage [½]
- Established companies are likely to be better at detecting fraudulent claims / have the money to invest in systems to do so [½]
- Any other suitable arguments [½, Max 1]

[7½, Max 2]

[Total 8]

Part (i) of this question was well answered by stronger candidates, with a number generating additional ideas not mentioned above that were given credit. Some candidates lost time by

focusing on the cause of the price drop rather than what a drop in price means for the Energy and Marine industries.
Part (ii) of this question was generally well answered with candidates being able to generate how impacts may differ.

Q4

(i)

- Get the results for the previous financial year, split by major business units [1]
- Lloyd's business is modelled on an underwriting year basis [½]
- Investigate what led to financial results seen in each major business unit by discussing with experts in the business [1]
- Extract full distribution of results projected from the previous year's capital model for each major business unit [1]
- Compare the financial results to the distributions to work out the return period of the results for each major business unit [1]
- Consider whether the return periods seem reasonable for each result given the results of the investigation and knowledge about what has happened in the year [1]
- If return periods don't seem reasonable then analyse what has led to this result based on their knowledge of what drove the year's financial results and own expert knowledge [1]
  For example, parameterisation, missing dependency, key variables not modelled as stochastic, unmodelled event, etc. [½]
- Lloyd's require Profit & Loss Attribution to be carried out [½]
- Any other suitable points [½, Max 1]

[8½, Max 4]

(ii)(a)

<u>Trade Credit</u>

- Underwriting results are better than expected on both a gross and net basis for Trade Credit [½]
- Reinsurance is loss making at the mean, both in expectations and actual results, which seems reasonable as would expect reinsurers to write profitable business on average [½]
- Any other suitable points [½]

[1½, Max 1]

<u>Kidnap and Ransom</u>

- Kidnap and Ransom gross and net underwriting results are similar to expectation [½]
- Gross and net loss ratios in reality are the same, which suggests that either no reinsurance was purchased, different to the plan suggested by the expectations [½]
- ..or that the percentage reduction in net claims is equal to the percentage reduction in premium used to pay for the programme [½]
- Any other suitable points [½]

[2, Max 1]

<u>Terrorism</u>

- Terrorism has a very high gross and net loss ratio compared to expectations [½]
- As the net is much lower than the gross is suggests a large amount of reinsurance [½]
- Any other suitable points [½]

[1½, Max 1]

Loss of Attraction

- Gross loss ratio is pretty close to expectation and has a low return period [½]
- Net loss ratio appears to be quite a lower than expected based on return period, suggesting the reinsurance has been more beneficial than expected [½]
- Any other suitable points [½]

[1½, Max 1]

Expenses

- Expenses are higher than expected for Trade Credit, Terrorism and Loss of Attraction and lower than expected for Kidnap and ransom [1]
- Any other suitable points [½]

[1½, Max 1]

(ii)(b)

Trade Credit

- All results are less than 1-in-10 return period which is near term and doesn't seem unreasonable [½]
- May be worth looking at expenses as combined result is adverse to expectations, whereas underwriting results are advantageous [½]
- Any other suitable points [½]

[1½, Max 1]

Kidnap and Ransom

- Gross and net loss ratios are less than 1-in-10 return period which is near term and doesn't seem unreasonable [½]
- 1-in-30 return period for combined ratio may or may not be an extreme result so it depends on what is has happened as to whether this result is reasonable [½]
- Any other suitable points [½]

[1½, Max 1]

Terrorism

- All results are above a 1-in-100 so should be looked into [½]
- Given the class type, it is likely that results will either be very good, or very bad so this may not be unreasonable [½]
- Any other suitable points [½]

[1½, Max 1]

Loss of Attraction

- Gross loss ratio are less than 1-in-10 return period which is near term and doesn't seem unreasonable [½]
- The return period of the net results may suggest that the insurance modelling here should be looked into [½]
- It may suggest that the reinsurance programme is not working as expected or part of the programme is unmodelled [½]
- ...or that the parameterisation of the expected underwriting losses is different to the actuals
  For example
  - the split between attritional and large losses may be very different [½]
- Any other suitable points [½]

[2½, Max 1]

Expenses

- As all classes have similar expense ratios (27-30% per class on a net basis) added to loss ratio to make up the combined ratio, it may be that expenses in the plan are split based on net premium rather than the business unit in which they are incurred [½]
- Expense are often modelled deterministically and it may be that for this business that is not appropriate [½]
- Any other suitable points [½]

[1½, Max 1]
Each part [5, Max 4]
[8, Max 6]
[Total 10]

Candidates seemed to struggle generally with part (i) of this question. A number of students recognised that this question related to a backtesting type of exercise but few were able to describe how to carry it out.
However, most students performed well on part (ii) and were able to identify where results seemed reasonable and where they would like to do further investigation.

Q5

(i)(a)

Co-insurance

- An arrangement whereby two or more insurers enter into a single contract with the insured to cover a risk in agreed proportions at a specified premium [½]
- Each insurer is liable only for its own proportion of the total risk [½]
- The term is also used in direct insurance and reinsurance to describe an arrangement in which the insured or cedant retains a proportion of their own risk [½]

[1½, Max 1]

Lead insurer

- one of the co-insurers who takes on the majority of the risk and manages the outturn, while others subscribe on fixed terms [½]
- They are usually responsible for claims handling and hold more deciding authority in the claims settlement process [½]
- Lead insurers will advise reserves to the following insurers. It is common for following insurers to use the reserve advised by the leader, though some insurers do alter the reserve for contentious claims where there are issues such as policy coverage [½]

[1.5, Max 1]

(ii)

- As Company A does not have direct contact with the insured [½]
- Policy not booked into the system - at the time of writing the policy, Company A must have policy details before signing [½]
- An estimated premium figure must be allowed for in the premium projections when performing the claims reserving [½]
- If the policy details are not in the system, Company A can get an email confirmation on the premium details [½]
- Claims not booked into the system - IBNR needs to be increased accordingly either by a tail factor or a lump sum [½]

- If the same system is in place for several years, the link development factor patterns will pick it up [½]
- If this is a recent change, a separate model to estimate the potential from these claims should be built up [½]
- Closer coordination between the Claims, Underwriting, Distribution and Actuarial functions is needed to identify trends [½]
- If history suggests a certain proportion of claims come in as delayed, that proportion can be added on to the Best Estimate of usual IBNR [½]
- If Co-insurance represents an insignificant amount of overall business written by Company A, then the amount may be immaterial [½]
- Need to understand if the policies are being booked late into the Company A's Systems [½]
- If it is the case of Delegated Underwriting Authority, then there may be less information available about the nature of the risk [½]
- Depending on the mix of lead insurers the delays experienced on different policies may vary so approach may need to factor this in [½]
- Adjustments can be made to the tail factors [½]
- Central system may have patterns that can be used as a benchmark and adjusted using expert judgement [½]
- Credits for discussion of particular methods (e.g. stress testing, tail factor, etc.) [½, Max 1]
- Any other suitable arguments [½, Max 1]

[9½, Max 4]

(iii)

<u>Advantages</u>

- Claims Handling costs are saved [½]
- Company A may not have the technical expertise (underwriting capacity) to write the risks, but wants to start gaining exposure [½]
- May be able to gather useful claims history to start forming a better understanding of a line of business [½]
- Diversification benefit - despite not having expertise, maybe able to get the diversification benefit by being a following insurer [½]
- Marketing expenses can be reduced - the company doesn't necessarily have to produce all the marketing literature when writing only on a following basis [½]
- Underwriting costs are saved [½]
- If the lead-insurer is a reputable insurer, the following company may be able to obtain better reinsurance rates despite not writing it [½]
- Easier to enter into and exit lines [½]
- Any other suitable arguments [½, Max 1]

<u>Disadvantages</u>

- If following a mix of lead insurers, reserving philosophies of leads may be different [½]
- Little control over Claim Settlement [½]
- Little control over terms & conditions [½]
- Little control over reserving philosophy coming through from lead insurers [½]
- Not getting a first-hand experience [½]

- Potential lag in getting the claims information, resulting in an incorrect estimation of the Reserves in the short run [½]
- If we do a majority of our business using co-insurance as a follower, we may never fully learn the business on that line [½]
- It might become difficult to obtain Reinsurance as the Reinsurer may not like the fact that the primary insurer has limited control over underwriting and claims [½]
- If market is very competitive, lines may get signed down to very small amounts [½]
- Reliant on lead data quality which may be poor [½]
- Exposure to potential poor pricing by leads [½]
- Any other suitable arguments [½, Max 1]

Each section [Max 4]

[8, Max 6]

[Total 12]

Part (i), a bookwork question, was well answered.
Part (ii) was well answered by better prepared candidates who were able to identify how to address the additional uncertainty that exists when reserving as a following insurer.
Part (iii) was well answered by better prepared candidates who were able to generate a range of points in favour and against being a follow insurer. Candidates did not receive marks for points that would have impacted both lead and follow insurers in the same way.

Q6

(i)

- A soft market is when premium rates fall to the extent that the line of business is generally loss-making [1]

(ii)

- Any losses below £75m, Programme A is preferred as it is cheaper [1]
- Any losses above £650m, Programme A is preferred as has larger potential recoveries net of costs [1]

- Early on Programme B must become preferred as it has a lower excess, so solve Net Benefit B > Net Benefit A [1]
- Loss, x, will be between £75m and £100m as cost of both programme and reinstatement is the same [1]
- Net Benefit A will be cost = Loss of £22.25m [½]
- Net Benefit B will be (x-Excess_B)/(Lim_B) * (Lim_B-Reinst_B) - Cost_B [1]
- Solve simultaneously: -22.25 = (x-75)/(450) * (450-22.5) - 22.5 [½]
- X = £75.26m [1]

- Then Programme A must become the preferred option again due to extra limit. This will occur after £525m when Programme B is exhausted, due to its initially much lower limit [1]
- Net Benefit A will be
  - (x-ExcessT_A)/(LimT_A) * (LimT_A-ReinstT_A) + LimMain_A - ReinstMain_A - Cost_A [1]

- Net Benefit B will be
  - Limit - Reinst - Cost = 450 - 22.5 - 22.5 = 405 [½]
- Solve simultaneously
  - (x-500)/150 * (150-0) + 400 - 20 - 22.25 = 405 [½]
- X = £547.25m [1]

[11, Max 8]

(iii)

- Assuming losses occur in order stated [½]
- Top Layer Recovers
  - min(600 - 500, 150) = £100m [1]
- Drop Layer Recovers
  - min(75-25 + 60-25 + 50-25, 150) = £110m [1]
- Choose the Drop Layer [1]

[3½, Max 3]

[Total 12]

Part (i) was bookwork and was well answered.
Part (ii) was generally not well answered, common mistakes candidates made were forgetting to allow for reinsurance premium costs or reinstatements.
Part (iii) was better answered than part (ii) and was generally well done by candidates who attempted it.

Question 6(iii) Note: If a student stated that they are assuming that the drop is an aggregate and can apply to all losses once there are at least two rather than only being for all losses after the first then allow full marks for recovery of £150m.
There was also a typing error in this question, it should have asked how much the insurer, not reinsurer, would recover.

Q7

(i)

- Correct market inefficiencies and promote efficient and orderly markets [1]
- Protect consumers of financial products [½]
- Give confidence in the financial system [½]
- Help reduce financial crime [½]
- In order to contribute to economic growth, allocate resources efficiently, manage risk and mobilise long-term savings, the insurance sector must operate on a financially sound basis [½]
- A well-developed insurance sector also helps to enhance overall efficiency of the financial system by reducing transaction costs, creating liquidity, and facilitating economies of scale in investment. [½]
- A sound regulatory and supervisory system for insurance helps sustainable growth and healthy competition in the insurance sector [½]
- Key objectives of regulation and supervision are to promote efficient, fair, safe and stable insurance markets and to benefit and protect policyholders [½]

[4½, Max 2]

(ii)

- Keep market unregulated [½]
- Voluntary codes of conduct [½]
- Self-regulation [½]
- Statutory regulation [½]
- Mixed Regimes [½]

[2½, Max 2]

(iii)

<u>Keep market unregulated</u>

- Has no cost to insurance companies so may be a popular incentive [½]
- …and if less bureaucracy [½]
- Potential for other regimes to blacklist the country impacting the viability of companies having a head office in your country [½]
- Likely to encourage if there are other benefits, such as a low tax regime [½]
- If less regulation, allows group to focus on funding subsidiaries as priority which is an advantage if local market isn't material to insurer [½]
- Risks of negative association for insurer with an unregulated regime [½]
- Any other suitable arguments [½, Max 1]

<u>Self-regulation</u>

- Likely to be less costly than statutory regulation [½]
- ...and less bureaucracy [½]
- As insurers are industry experts, should be beneficial if insurers are reputable [½]
- Likely to appeal to insurers [½]
- Potential reputational risk for insurer depending on outside views [½]
- Any other suitable arguments [½, Max 1]

<u>Voluntary codes of conduct</u>

- May be popular as not legally bound, although sign-up is recommended [½]
- Will be some associated cost, but burden will vary depending on set up [½]
- ...and if less bureaucracy [½]
- Potential reputational risk for insurer depending on outside view of code that is set up [½]
- Any other suitable arguments [½, Max 1]

<u>Statutory regulation</u>

- May discourage companies due to costs of compliance with regime [½]
- If rules are contradictory to requirements made by other regimes then likely to discourage companies [½]
- If large amount of bureaucracy likely to deter companies from moving there [½]
- If done well, could be seen as a centre of excellence which may encourage companies to move there [½]
- Insurers likely to expect some regulations which will lower reputational risk of setting up [½]
- Opinion may be influenced by how involved the industry are and ability to influence regulator [½]
- Any other suitable arguments [½, Max 1]

Mixed Regimes

- Depending on which parts are taken will be a mix of the above [½]
- Often tax is a large driver for deciding on where to base a business [½]
- May be generally discouraged from moving generally due to cost of making change [½]
- and potential lack of skilled people that exist in already set-up regimes [½]
- Often viewed a best of both worlds [½]
- Any other suitable arguments [½, Max 1]

Per regime [Max 1½]

(iv)

Advantages

- Can observe how regime has worked in the other country [½]
- …meaning that they can evaluate the ability of regime to satisfy regulatory objectives easily [½]
- …and can make small tweaks to improve it if needed [½]
- Teething issues will have been smoothed out [½]
- and can use lots of resources from existing regimes [½]
  For example, copying handbooks [½]
- May be able to get support of regulators in other countries to implement [½]
- May be able to get an equivalence agreement with other regulators that could result in advantages for companies with head offices based elsewhere [½]
- Quick and easy [½]
- Cheaper than building from a new administration from scratch [½]
- Any other suitable arguments [½, Max 1]

Disadvantages

- Unlikely to satisfy previously mentioned objective of head offices moving to country [½]
- as why would they move to Country A when they can go to a country with a more established version of a similar regime [½]
- …which may mean money is spent setting up the regime without achieving the objective so may need to offer additional benefits, such as tax incentives [½]
- Sudden material change in regulations may be difficult for existing insurers in Country Z to deal with [½]
- which could lead a reduction in insurers being based there, the opposite of the original intention [½]
- Regimes in other countries may not be appropriate for market conditions in Country Z [½]
- Regimes in other countries may not align with laws in Country Z [½]
- Could become beholden to country copied [½]
- Doesn't work if regime copying is viewed negatively [½]
- Potential adverse impact on relationship with country copied [½]
- Any other suitable arguments [½, Max 1]

Each part [Max 2]

[4, Max 3]

[Total 13]

This question was generally well answered by all candidates. Part (i) and (ii) were standard bookwork so candidates generally scored highly. Parts (iii) and (iv) were generally well attempted with candidates showing the ability to evaluate regimes and their implications.

Q8

(i)

- A way of tapping into the capital markets for reinsurance coverage instead of traditional reinsurance [½]
- These Cat bonds allow (re)insurers to transfer high severity low probability catastrophic risks to the capital market [½]
- …and spread them among many investors, who all buy only small proportion of the risk [½]
- A Special Purpose Vehicle is usually created to hold the premium and the investment. [½]
- The investment usually earns interest, which is passed on to the Bondholders [½]
- if the specified catastrophic risk is triggered, the bondholders typically forfeit the interest and principal on the bond to the (re)insurer [1]
- The claim payout is usually determined based on a pre-agreed criteria, often linked to some form of an 'index'
  For example, category of the hurricane, or magnitude in the case of earthquakes, rather than on its own losses [½]
- The payout will then be used to pay claims [½]
- If there is no catastrophic event, or trigger event before the maturity date of the contract, investors receive their principal investment at maturity on top of the interest payment they have received [1]

[5½, Max 4]

(ii)

<u>Advantages</u>

- Better pricing may be available than on reinsurance markets when the reinsurance market is hard [½]
- Increased capacity - sometimes traditional reinsurance may not be having an appetite for certain risks [½]
- Objective criteria when paying out the loss amounts and less ambiguity [½]
- Collateralized protection through the use of Special Purpose Vehicle, traditional reinsurers more likely to default [½]
- Usually written for multiple years, locking down the premiums [½]
- Source of diversification for the cedants [½]
- From the view point of buyers of Cat bonds, it provides them with a completely diversified source of risk and return since cat losses aren't correlated with investment markets [½]
- Any other suitable argument [½, Max 1]

<u>Disadvantages</u>

- As with normal reinsurance, profits are ceded in good years [½]
- Might not always be available [½]
- Pricing can be quite volatile depending upon the recent events [½]

- Insurer may lack knowledge to adequately price [½]
- Terms and Conditions can be stricter since capital market investors are not very well versed with Insurance [½]
- In case a catastrophe does occur, it can be quite disastrous from the investor's perspective, and can dry up the liquidity in the cat bond market in the subsequent periods [½]
- Administrative work will be higher compared to the traditional reinsurance, since capital markets are involved. More disclosures may be required and there could be data privacy issues if the data has to be shared with the clients to prove validity of claims [½]
- Ordinarily, there won't be a reinstatement [½]
- Can be more difficult insurers to model in their capital models and reserves [½]
- Accounting process may also be more complicated [½]
- Any other suitable arguments [½, Max 1]

Each part [Max 3]

[6, Max 4]

(iii)

- 5 years of history may not be sufficient, especially when trying to build a stochastic claims model for catastrophe exposure [1]
- Might have to use proprietary catastrophe models [½]
- Need to understand the geographies where it is exposed to most [½]
- Selecting the correct stochastic distribution can be a challenge, especially if there is not sufficient volume of data… [½]
- ...Particularly fitting the correct distribution to the tail will be critical [½]
- May have to use Copulas to do frequency Severity joint modelling [½]
- There may not be any hurricane events in the data [½]
- Not all categories of hurricanes might have happened over the past 5 years - Cat Bonds usually pay losses based on indexes which in this case could be the category of the hurricane [½]
- May have to consider any changes to the policy limits [½]
- Will have to incorporate the losses that exceeded the threshold so ensure Ground up losses are used and not Net losses [½]
- Stochastic Claims model come with certain limitations:
    - There could be a parameterization error and model error which needs to be accounted for [½]
    - If the data is not good enough, stochastic models can underestimate the volatility in the data, so might have to supplement with external data, or give up the idea altogether [½]
- While trying to predict the future loss using historical data, inflation must be allowed for in the model [½]
- Try to use exposure instead of premiums when trying to come up with a model involving claims, as premiums may not necessarily be representative [½]
- Consider the claims environment [½]
- Potential impacts of climate change [½]
- If data is used need to consider making adjustments to reflect trends [½]
- Will need to develop most recent losses to ultimate if using own data [½]
- Any other suitable arguments [½, Max 1]

[10½, Max 6]

[Total 14]

Candidates generally did well on parts (i) and (ii) being able to generate a number of points. Well-prepared candidates additionally did well on part (iii), with less well-prepared candidates focused on generic model setting up comments rather than tailoring their answer to the specifics of the questions.

Q9

(i)

Assumptions

- No delays in construction [½]
- No change in underlying portfolio mix [½]
- Assume no cancellations [½]
- Assume no change to terms and conditions [½]
- Assume no maintenance period for the construction projects [½]
- Any other reasonable assumptions not stated in the question [½, Max 1]

[3½, Max 1½]

	AY	2012	2013	2014	2015	2016	2017	2018	2019
UWY	GWP								
2012	400,000	80,000	80,000	80,000	80,000	80,000			
2013	500,000		100,000	100,000	100,000	100,000	100,000		
2014	400,000			80,000	80,000	80,000	80,000	80,000	
2015	300,000				60,000	60,000	60,000	60,000	60,000
2016	200,000					40,000	40,000	40,000	40,000
2017	200,000						40,000	40,000	40,000
2018	150,000							30,000	30,000
2019	150,000								30,000
		80,000	180,000	260,000	320,000	360,000	320,000	250,000	200,000

- Correctly deriving the Gross Earned Premium (GEP) by dividing the Gross Written Premium (GWP) by 5 and spreading across consecutive 5 accident years starting with the year of underwriting. For each correct year [½, Max 2]
- Correctly calculating the Earned Premium for 2012-2019 Accident Years (AYs). For each correct year [½, Max 2]

The loss amounts by Accident Years are already given in the question, need to divide them with the correct premium to get the following answers:

AY	Loss	Premium	AY LR
2012	13,000	80,000	16.3%
2013	41750	180000	23.2%
2014	83300	260000	32.0%
2015	186150	320000	58.2%
2016	267300	360000	74.3%
2017	247400	320000	77.3%
2018	191900	250000	76.8%
2019	133950	200000	67.0%

- Correctly calculating the Accident Year Loss Ratio (AY LR) for each of the AYs 2012-2019. For each correct year [½, Max 2]

[7½, Max 7]

(ii)

Claims		AY											
UWY	GWP	2012	2013	2014	2015	2016	2017	2018	2019	Incurred UWY Loss Ratio			
2012	400,000	13,000	39,000	78,000	182,000	260,000	264,000	264,000	264,000	66.0%			
2013	500,000		15,750	47,250	94,500	220,500	315,000	320,000	320,000	64.0%			
2014	400,000			12,800	38,400	76,800	179,200	256,000	256,000	64.0%			
2015	300,000				9,300	27,900	55,800	130,200	186,000	62.0%			
2016	200,000					6,300	18,900	37,800	88,200	44.1%			
2017	200,000						6,000	18,000	36,000	18.0%			
2018	150,000							4,800	9,600	6.4%			
2019	150,000								4,950	3.3%			
Total		**13,000**	**54,750**	**138,050**	**324,200**	**591,500**	**838,900**	**1,030,800**	**1,164,750**				
AY		**13,000**	**41,750**	**83,300**	**186,150**	**267,300**	**247,400**	**191,900**	**133,950**				

- Calculating the correct incurred Underwriting Year (UWY) loss ratios for all years. For each correct year [½, Max 2]

Incurred Underwriting Loss Ratios									
UWY	GWP	2012	2013	2014	2015	2016	2017	2018	2019
2012	400,000	3.3%	9.8%	19.5%	45.5%	65.0%	66.0%		
2013	500,000		3.2%	9.5%	18.9%	44.1%	63.0%	64.0%	
2014	400,000			3.2%	9.6%	19.2%	44.8%	64.0%	64.0%
2015	300,000				3.1%	9.3%	18.6%	43.4%	62.0%
2016	200,000					3.2%	9.5%	18.9%	44.1%
2017	200,000						3.0%	9.0%	18.0%
2018	150,000							3.2%	6.4%
2019	150,000								3.3%

- Calculating triangle diagonal incurred underwriting year loss ratios as above or calculating link ratios. For each correct diagonal / link ratio year [½, Max 3]

- 2012-2015 Underwriting Years appear to be almost fully earned, and the ultimate loss ratios for those underwriting years are hovering between 62-66% [½]
- Noting that the 2016 Underwriting Year loss ratio is currently running at 44.1% which is comparable to the older Underwriting Years at the same point in time [½]
- Noting that the 2017 and 2018 Underwriting Years are also running at a similar loss ratio to previous years at this point in time [½]

- Based on this, commenting that the current Underwriting Years seem to be trending in the same way as previous years and there doesn't seem to be any deterioration in like-for-like performance [½]
- Commenting that the future development of more recent underwriting years is still uncertain, but trends seem to be in line [½]
- CUO's statement seems reasonable [½]
- ...unless there are equal and opposite trends that cancel each other out [½]
- Any other reasonable assumptions not stated in the question [½, Max 1]

[9½, Max 6]

(iii)

- Whilst underwriting year loss ratios do not appear to be increasing, the accident years are increasing. As accident years rely on earning patterns and underwriting years don't this may suggest an earning pattern mismatch between the exposure measure (premium) and the losses [1]
- Premiums are being earned evenly over the duration of the project, but… [½]
- ...Losses appear to be unevenly spread, with more of them occurring towards the later part of the construction project [½]
- This can be observed by the link patterns and incurred underwriting loss ratio patterns seen in (ii) [½]
- This sounds reasonable since the more advanced stage a construction project will be in, the higher the exposure [1]
- Were premium to be written at the same level over time, then we would expect the accident year loss ratios increase at the start and stabilise [½]
- ...caused by a cross subsidy occurring as the more recent years where there are lower claims subsidise the older years that will experience higher claims [½]
- However as Gross Written Premium in the later years is reducing this doesn't happen and the issue is exacerbated [½]
- There could be another unrelated reason, such as a claims trend being more exaggerated than has been priced for [½]
- Any other suitable arguments [½, Max 1]

[6½, Max 3]

(iv)

- To avoid the issue of under- and over- earning, one could use a non-linear approach to earning the premiums [½]
- The pattern should show the earning pattern increasing over the period of the project [½]
- One way could be to use the historical claims occurrence data to understand the 'seasonality'/ the claims occurrence pattern and earn the premium in the same proportion over the project duration [1]
- If this pattern is consistent year on year, it will be a good proxy to use [½]
- However, this could be done using a benchmark or market data [½]
- …as company may not have sufficient own data in eight years [½]
- Alternatively, one can use the Construction Project Plan to see how the exposure builds up over the duration of the project [1]
- This can be based on the increases in sum-insured over time, % project completed, Value at Risk during the various phases of the project etc [½]

- However, the appropriateness of this will depend on the homogeneity and number of risks as it may not be appropriate if the business writes a large number of small heterogenous risks unless [1]
- Any other suitable premium earning method (not covered above) [1]
- Any other arguments in support [½, Max 1]

[8, Max 4]

(v)

- The Principle of Consistency is the key principle that the CFO should be concerned about [1]
- If the premium earning basis is changed, it can make the AY loss ratios incomparable with the older years [½]
- While the LR% changes are due to a change in accounting principle of earning, various stakeholders can read this as an Underwriting change [1]

[2½, Max 1]

[Total 21]

[Paper Total 100]

Part (i) was better answered than part (ii). A common mistake made by candidates in part (i) was to not read the assumptions that candidates were told to make in the question and make their own assumptions. Students who didn't do any calculations for part (ii) struggled to generate many points.
Well prepared candidates were able to generate points for parts (iii) and (iv), even if they had struggled with the earlier calculation parts by considering the class of business being discussed.
Part (v) was generally well answered.

END OF EXAMINERS' REPORT