

EXAMINATION - MEMO

11 May 2023 (am)

**Subject A311 — Actuarial Risk Management
Core Principles**

Paper Two

This subject report has been written with the aim of helping candidates. This report summarises the main points that the examiners were looking for and some common problems encountered.

QUESTION 1

Examiner comments: Parts (i) and (ii) were generally answered well, but it should be highlighted that many candidates don't understand the basic concepts of capital and capital requirements. Often capital is treated as synonymous with liabilities. Economic vs. regulatory capital is also not well understood. Part (iii) saw a range of responses, with better candidates taking the time to state a feature and then explaining why it gives rise to more/less potential risk.

i.

- Economic capital is the amount of capital that a provider determines is appropriate to hold in excess of liabilities...
- ...to cover its risks under adverse outcomes...
- ...generally with a given degree of confidence...
- ...and over a given time horizon.

ii.

- The standard model would require less work (expense!) than building an internal model.
- Company does not have the necessary expertise to build the model.
- Company does not have the necessary data to build the model.
- The insurance company would need to make sure that any model will be resilient over time...
- ...which will be easier with a standard model than with an internal model since regulator updates it.
- Time delays can be high to get internal model approved.
- The prescribed model fits well with the company's risk profile and they believe the results it produces are representative of its actual risk.
- A standard model may help address any concerns that the public may have with the company.
- The prescribed model produces a lower capital requirement.

iii.

Risk profile of the individual assets and liabilities in their portfolios are different

- Company A may have assets whose values are exposed to less price volatility compared to Company B, e.g. A has more money market and bonds compared to Company B, who might have more equities.
- Company A might have shorter duration liabilities where the values are more certain, compared to Company B liabilities.
- Company A might have more homogenous liabilities (e.g. funeral policies) and hence less volatile payments, compared to Company B liabilities which might differ greatly in amounts.
- Company B may also have more options and guarantees in their products,...
- ...which will lead to higher capital requirements relative to Company A.
- Company A's assets and liabilities are matched better than Company B,...
- ...which will lead to lower economic capital requirements since the values are moving together with market changes.
- Company B may also use more prudent assumptions in their modelling in general. (this point can also be made under other headings).
- Company A may have more (or different) reinsurance arrangements in place that limit the volatility in expected claims and/or limits overall downside claims exposure more than company B, which may reduce the capital requirement.
- Investment rating of the counterparties of Company A may be better than Company B.

Correlation of the risks

- Unlike Company B, Company A might benefit from risks that are negatively correlated...
- ...e.g. life assurance and annuity (longevity) risks.
- This negative correlation should lead to a lower economic capital requirement.

Business objectives

- Company B may have more aggressive growth and expansion initiatives than Company A...
- ...and hence require the business to have more capital on hand at all times.

Desired level of adverse financial deterioration that the companies wish to withstand is different

- Company A may for example model their capital requirement to remain technically solvent in scenarios based on 1-in-100 year outcomes.
- Company B may be more prudent and hold capital to be technically solvent based on 1-in-200 year events.
- Other criteria might also be different, e.g. protection of credit rating (Company A more willing to be downgraded than Company B say)
- Company A is worried less about its ability to maintain a certain dividend compared to Company B.

QUESTION 2

Examiner comments: Parts (i) was answered well in general, but many candidates spent a lot of time on point relating to modeling and/or recording and/or monitoring of risks, instead of required risk identification approaches. Many neglected to expand a bit on who might be involved and why. Part (ii) was answered better by those who knew the bookwork here, but others struggled with ideas beyond the basic impact of more natural disasters on a general insurer's results.

i.

Risk classification/categorization

- Broad categories/classifications exist of risks that most financial services providers are exposed to.
- These include risks such as Market risk, credit risk, liquidity risk, business risk, operational risk, external risk ($\frac{1}{2}$ each max 1)

Risk checklists

- There may be lists of risks that regulators believe are relevant to the business,...
- ...especially if risk-based capital requirements apply.
- Care should be taken since these lists may not be exhaustive.

Use risk identification techniques from project management

- Do a high-level analysis of the most obvious risks that the insurer is exposed to.
- Have brainstorming session(s) with senior internal people...
- ...as well as experts / external people familiar with Betasure's business.
- Supplement the results from the previous step(s) by doing desktop research...
- ...and learning more about risks identified by other insurers.

Use of consultants

- These would obviously need to have experience of the general insurance industry.
- One could also consider using the experience of staff that have joined from other insurers (financial services firm).

General comments on who might be involved in the process

- While senior employees in the company would generally take the lead with the risk identification process...
- ...it is essential that input is gained from people across all levels in Betasure.
- More junior staff might be better equipped to identify risks relating to operational issues for example.
- Regardless of the technique used, it might be necessary to engage with external experts on whether a certain risk should be included.

ii.

Physical risk

- These are first order effects of environmental changes such as pollution, land erosion etc.
- These might be chronic, e.g. global warming, rising sea levels...
- ...or acute such as extreme weather (e.g. floods, wildfires etc.)
- It is especially these acute events that can cause large concentration of claims for Betasure.
- Mitigation actions include reducing exposure by not insuring certain areas/risks,...

- ..., pricing increases to allow for increased frequency/severity,...
- ..., buying reinsurance to protect themselves from extreme events.

Transition risk

- Refers to economic, political and market changes as a result of efforts to counter climate change.
- This might lead to risk of some assets in the Betasure portfolio falling in value...
- ...as investors sell assets in companies that are not seen as “green”.
- Betasure as a company may also lose favour with potential clients if they are not seen as environmentally responsible.
- To protect their reputation they may need to stop writing business in certain sectors, e.g. fossil fuels.
- Mitigating this risk would require regularly revisiting the investment strategy...
- ...and being sensitive to the needs of current and potential clients,...
- ...including making changes to reduce carbon footprint (or embracing green technologies).

Liability risk

- Liability risks may arise from liability policies sold in the past...
- ...that are now being claimed on by entities (people, companies) suffering from the effects of climate change and seeking compensation.
- This might include claims due to the link between air pollution and adverse health conditions.
- It would be difficult to mitigate this, but one can consider seeing if reinsurance is available retrospectively...
- ...or paying a premium to transfer risks to another specialized entity to handle future claims.

QUESTION 3

Examiner comments: Candidates generally struggled a lot to articulate what exactly constitutes a bank's liabilities under part (i) often confusing the mortgages as liabilities instead of assets. The concepts of solvency and liquidity were also often used interchangeably. Admittedly, part (ii) was hard, being based on the concept of securitisation, which is not covered in much detail, but better candidates could at least explain the basics and make few observations on advantages and disadvantages.

i.

- Assets of the bank are the bonds they hold...
- ...as well as future income from the mortgage receivables.
- Mortgages are not liquid assets and hence this asset cannot be easily realized.
- Government bonds are generally liquid and can be sold.
- Given recent interest rate increases, the value of the bonds have fallen significantly...
- ...thereby reducing the value of the bank's assets.

- Liabilities are mostly made up of deposits from clients.
- The unexpected "run" on deposits means that the bank needs to have liquidity/cash available to repay depositors...
- ...and that more liquidity is required than generally allowed for.
- This means that they will need to sell the bonds at the low prices to raise cash...
- ...and hence crystallise their losses.

- In addition, given the difficult conditions in the tech sector...
- ..., there may be a spike in defaults on homeloans – thereby exacerbating the bank's cashflow situation.
- Higher interest rates also mean that those deposits that remain with the bank are accruing interest at a higher rate...
- ...thereby increasing the bank's liability.

- There may not be sufficient liquid assets (market value of bonds) to meet the outflows to clients.
- The bank would then need to raise liquid capital in some other way...
- ...for example loans from a central/reserve bank or other banks
- If this is not successful, the authorities would step in and close the bank (or the bank will fail).

ii.

How it will raise capital

- Securitisation will turn the illiquid mortgage book asset...
- ...into a tradable asset.
- The future receivables (interest and capital) on the mortgage book will be sold to investors...
- ...for an upfront cash payment.
- It is likely that a special purpose vehicle (SPV) may be set up to take over the mortgages from Techbank...
- ...and sell/issue the mortgage-backed securities (MBS) to investors.
- The SPV may be a separate legal entity.

Advantages

- Techbank will receive a liquid capital injection.
- This cash injection may be enough to keep the bank afloat.
- The default risk associated with these mortgages is passed on to the SPV investors.

- Depending on the structure, the SPV may be a separate legal entity to Techbank...
- ...so bankruptcy risk reduced which may make the 'sale' of the mortgage book more palatable to potential investors.

Disadvantages and risks

- Potential MBS Investors may feel the assets underlying the securitization (the homeloans) are too concentrated to a specific economic sector (which is already in difficulty).
- The bonds may be undersubscribed...
- ...or sell for less than anticipated.
- It is hence unknown how much cash will be raised from the mortgage securitisation (may not be enough).
- Techbank may receive less than the asset value of the mortgage book on their balance sheet.
- The securitisation will likely take some time to set up (legal issues etc.)...
- ...but Techbank needs cash immediately.
- The securitisation will have costs attached which need to be paid upfront and Techbank may not have the cash.
- This may improve liquidity but may not improve the solvency position of the bank...
- ...depending on the regulatory regime.
 - e.g. credit for future profits may already be taken under Solvency II
- The regulator may prohibit the structure...
- ...perhaps having attached all of the bank's assets after it closed the bank.

QUESTION 4

Examiner comments: Candidates did quite well on this question in general. Weaker candidates spent too much time in part (ii) on data relevance/errors/cleaning steps at the cost of showing some understanding of how the data would need to be structured to model the defaults and the steps that follow in the modeling process. Some also wasted time on discussing implementation of the model, which was beyond the scope of this question.

i.

Likely to provide

- Name, Surname
- Identification details, e.g. ID number
- Contact details, e.g. email address
- Confirmation of employment and/or income
- Banking details
- Income tax number

How data might be supplemented:

- ID/Passport number can be used to determine gender, age
- ID can be used to access credit score information
- If existing client of the bank, it can link to their other accounts.
- Might integrate with social media...
- ...and AI could be used to infer credit risk from social media posts etc.

ii.

- XCredit would likely need to decide whether all the data is relevant...
- ...as the data seems to be all credit products, which might include home loans and vehicle financing.
- It might be best to focus on smaller loan amounts for shorter durations.
- The data would need to be organised to show creditor information (“exposure”)...
- ...as well as the defaults, if any, at various durations.
- The data will be grouped into relatively homogenous risk groups using the most likely rating factors...
- ...which may include features such as loan size, duration, credit score, income, interest rate, etc.
- The groupings need to balance credibility...
- ...with having enough distinct cells to build a detailed model
- It is likely that some adjustments are required to the data, due to (credit in marking generally capped to three or so examples):
 - Past abnormal events, e.g. high/low interest rates compared to current rates.
 - Significant random fluctuations.
 - The way the data was recorded
 - Changes in the bank’s target market or risk appetite
 - Future trends not present in data.
- A model will then be constructed to predict the expected default rates...
- ...and possibly also the loss given default.
- It is likely that this will take the form of a logistic regression model (generalised linear model)...
- ...or other estimation techniques.
- The predicted outcomes will be compared to the actual outcomes...
- ...by running goodness of fit tests.

- ...and adjustments made where appropriate.

QUESTION 5

Examiner comments: Candidates did quite well in part (i) with most picking up on the benefits. Better candidates could outline some of the risks as well. Candidates struggled with ideas on part (ii) beyond the most obvious ones. Part (iii) highlighted the tendency of candidates to make questions more complicated than they are, with many missing the basic changes to the structure that can reduce the costs.

i.

Benefits

- The reinsurance structure should limit the total losses due to a concentration of claims (or non-independence) of claims...
- ...arising from a single catastrophic event.
- This will smooth profits...
- ...and possibly reduce capital requirements for DeltaSure...
- ...since they have a reduced risk of insolvency.
- There are no gaps in the structure, which is generally preferred.
- The fact that layer 4 is unlimited, essentially gives DeltaSure an upper limit of R200m exposure from a CAT event, regardless of the severity.
- The structure implies a somewhat diversified panel of reinsurers...
- ...which means there is less credit risk in the programme.

Risks

- Due to the 3+ claims requirement...
- ...this structure does not protect DeltaSure from single large losses...
- ...so the company is still very exposed to adverse profit/earnings/capital impact as a result.
- A retention of R200m on CAT events can be argued to still be very high.
- Given that there is no risk XL or proportional covers in place...
- ...there is unlikely to be significant capital requirement reductions as a result of this structure.
- The reinstatement premium will add to costs in the event of a catastrophe.

ii.

- The underwriting cycle might have turned...
- ...and the reinsurance market is experiencing a hardening of rates...
- ...perhaps as a result of reduced competition...
- ...or as a result of reinsurance losses elsewhere in the world.
- Reinsurers may have revised their risk assessment of CAT exposure in South Africa in general,...
- ...and hence adjusted rates upward.
- There are new emerging risks in South Africa that reinsurers are not keen to be exposed to.
- ...or reinsurers are simply providing less capacity for covering CAT risk in South Africa.
- The broker indicated total premium, so one would need to consider whether it is all layers' cost...
- ...or just certain layers (e.g. the unlimited cover in layer 4).
- It might be that some participants in the layers have withdrawn and replacements cannot be found at current terms.

iii.

- Increasing the attachment point from R200m to a higher amount.
- DeltaSure can participate in losses in each/some layer(s)

- Removing unlimited upper limit, after which losses revert to DeltaSure.
- Excluding certain events from the CAT, perhaps events that reinsurers are uncomfortable with (e.g. loadshedding).
- Increase the reinstatement premium.
- Reduce the hours from 72 to fewer hours to cover potentially fewer claims.
- DeltaSure can consider testing the waters with another reinsurance broker to see if they might have access to reinsurers offering better terms.
- DeltaSure can look into ART products to see if cheaper options are available to carry some of the CAT risk, which may include
 - Post loss funding
 - Securitisation
 - Insurance derivatives and/or swaps

QUESTION 6

Examiner comments: The unfamiliar setting made the question undoubtedly difficult, but it was good to see that many applied common sense and basic principles from the professionalism chapter to generate some valid ideas under part (i). Under part (ii) weaker candidates would propose some areas that were just too far outside the actuarial skill set and scored poorly. As often impressed during feedback sessions, candidates should try and keep things simple and stick to the basics.

i.

Aside from the comments below, the following general observations also apply:

- It would generally be totally unacceptable to commit to a certain amount/standard of work for a client,...
- ...and then essentially give them significantly less of your time and attention.
- It is likely that one can learn something from using such an AI,...
- ...perhaps factors not considered, or modelling options not explored,...
- ...but to use results “as is” without review or insight will be unprofessional.
- Furthermore, regulations and other information might be outdated, given the lag between the AI’s learning period and the period to which the advice and models will apply.
- There is furthermore legal and ethical considerations when feeding an anonymous website KappaLife’s data, some of which might be very sensitive.
- It would probably be best to disclose the use of this tool in the engagement with the client.

From the comments on how to give actuarial advice (chapter 1)

- You would need to consider all stakeholders affected by your advice, which include:
 - Policy holders, shareholders, life office, regulator, fund managers. ($\frac{1}{2}$ each, max 1)
 - While Z-Chat may consider some, it is highly unlikely that all angles will be covered.
- Gather all relevant information about the client that will have an impact on the advice given.
- Some information will be objective, e.g.
 - Financial accounts/statements, statutory submissions, risk report, product specifications, minutes of meetings ($\frac{1}{2}$ each info source max 1)
 - Some of these might be easily provided by Z-Chat,...
 - ...while others are not in public domain...
 - ...and other information might be outdated.
- Other information will be subjective and not easily obtained e.g.
 - attitude to risk, ethical considerations with investment classes
- You would need to ensure there are no conflicts of interest,...
- e.g. your company may offer investment management services (or modelling software services) as well.
- If conflicts of interest exist, these must be disclosed...
- ...and ways to avoid/mitigate risk should be put in place (Chinese walls, appoint independent third party)
- Z-Chat will not be able to identify all conflicts of interest, or suggest ways to manage them.
- A professional approach would be to make sure that the model review work is undertaken by someone with suitable experience and expertise.
- If any new modelling is done, this must also be done by someone with suitable experience.
- Even if Z-Chat builds a good model, can it be explained to the client...
- ...and does it make sense?
- It is likely that all work will need to be peer reviewed in any case,...
- ...which will be difficult to do with models written by a black box.

- All professional conduct standards set by local actuarial and others bodies would need to be adhered to...
- ...and these might differ by region/territory, with Z-Chat not adhering to standards applicable in your territory.
- Updates to regulation/best practice might also have occurred since 2020 when the model trained.
- Assumptions made should be relevant to the circumstances of the client...
- ...and reasons for assumptions should be explained...
- ...including implications of alternative assumptions.
- Z-Chat may assist with coming up with assumptions, but these will need to be vetted by an actuarial professional close to the business.
- In the final report one would need to provide all information needed for client to reach an informed decision...
- ...in an understandable and clear format.
- Z-Chat may or may not explain the pertinent matters clearly.
- Actuary/consultancy will provide advice only...
- ...with the final decision remaining with the client.

ii.

- Asset liability matching
- Liability valuations
- Embedded value calculations
- Reinsurance arrangements / modelling
- Product design
- Expense analyses
- Asset management strategies
- Experience analyses (e.g. lapses, mortality etc.)
- Analysis of surplus
- Income statement, balance sheet forecasting (although overlapping a bit with current work).
- Information on regulatory developments and/or impact on their business.
- Assistance with statutory returns.
- Assisting auditors with preparing financial statements.

QUESTION 7

Examiner comments: Weaker candidates showed a lack of understanding of the difference between a rating factor and a risk factor under part (i). Many would write at length on things that are risk factors (often peripheral at best) but miss the key idea that rating factors are objectively measurable things that you can plug into a chart/formula/structure and get a premium. Many rating factors mentioned were impractical and/or impossible to measure, at the cost of very basic things being missed. A surprisingly small number of candidates clearly wrote down “sum insured” as a rating factor. Part (ii) was well answered by students who knew the reasons for underwriting well and who could then extend those ideas to this unfamiliar setting. Part (iii) was easy and most did well.

i.

Rating factor / Policy Features	Reason
Buildings’ sum insured	Measure of exposure
Contents sum insured	
Business interruption sum insured	
Annual turnover/profit/wages	
Location/Area	Some areas are more/less exposed to theft risk. Firefighting response better/worse in some areas Flood risk differs by area Other perils may also be affected by area, e.g. lightning, earthquake.
Construction features	e.g., a thatch roof might be a bigger risk and charged a higher premium
Business interruption indemnity period	Providing cover for shorter periods after suffering a loss likely to be cheaper.
Perils that will trigger business interruption claims	Exact wording and causes of interruption may increase/decrease the probability of a claim.
Past claims of business	Measure of how well the company manages its risk.
Additional covers taken on the policy	Extensions of cover may be present that add to the expected claims cost or create potential for more claims (e.g., costs of clearing the site or putting out the fire, costs of renting replacement equipment etc.)
Excesses payable in the event of a claim	Higher excesses mean the client retains more risk and/or the company has fewer claims,... ...both of which lead to lower premiums.

ii.

Underwriting protects a provider from anti-selection.

- It will be impossible to ask every question on a proposal form,...
- ...and hence a site visit will help the company identify additional risks not initially considered.
-

*Underwriting will enable the insurer to classify risks into homogenous groups, ...
...that should have standard (or generally similar) rates.*

- A site visit will, at the very least, confirm the rating factors used...
- ...and confirm whether this restaurant’s exposure is comparable to similar restaurants insured in the past.
- This will ensure the risks are rated fairly.

Underwriting will enable the insurer to identify risks for which special terms need to be quoted, ...

...as well as the most suitable approach to take when special terms are required.

- For a general insurer these might include premium loadings,...
- ...or additional risk management requirements,...
- ...such as fire extinguishers, sprinklers alarms, general housekeeping requirements, etc.
- Additional excesses might also be imposed for certain risks that are below the insurer's standard.
- A site visit will ensure the requirements are reasonable,...
- ...and/or identify further risks that need addressing.
- In some cases, the risk might be declined as it does not meet the company's insurance criteria.
- The company would generally aim to keep these at a minimum to avoid creating unnecessary burden for the client.
- It might be to the client's benefit (e.g. lower premiums, excesses) if their risk management is clearly better than average.

Underwriting will help to ensure that claims experience does not depart too far from that assumed in the pricing.

- Pricing assumptions are generally considered in combination with the underwriting approach used.

For larger proposals, financial underwriting will help reduce the risk from over-insurance.

- In the case of property insurance, underinsurance is also a significant risk.
- A site visit might assist the client in ascertaining accurate values for its buildings and contents.
- The business interruption sum insured may be set with reference to recent company financials...
- ...and it is essential to have reasonable sum insured values for business interruption to avoid moral hazard.

iii.

Public liability insurance

- cover to indemnify the restaurant against legal liability...
- ...in the case of the death or injury of a third party, e.g. a client, perhaps due to something like food poisoning.

Employers liability insurance

- cover to indemnify the restaurant in the event of legal liability to an employee or their family...
- ...for death or injury of the employee while at work, due to negligence on the side of the employer.

Motor insurance

- Might be comprehensive or third party only
- Provides cover for loss or damage to their vehicles, including liability to third parties.

Fidelity guarantee

- Provides cover against losses due to theft or fraud by dishonest employees.