

EXAMINATION - MEMO

10 May 2024 (am)

Subject A311 — Actuarial Risk Management Core Principles

Paper Two

EXAMINERS' REPORT

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 bookwork questions and well-answered. Part (iii) was poorly answered by most since candidates simply quoted the bookwork list on the 'requirements of a good model' whereas the question stated a very specific scenario and asked for "features and components" of this specific model. Many candidates simply focused on the 3 considerations listed in Part (iv), which did not attract any credit. Part (iv) was answered reasonably well, but many candidates failed to adhere to the "discuss" instruction and answers lacked sufficient detail to score well.

(i)

- A deterministic model is one where the parameter values are fixed at the outset of running the model...
- ...and the result of running the model is a single outcome (or single scenario).
- Sensitivity analysis and scenario testing can then be carried out to assess the potential variability of the results.
- A stochastic model estimates at least one of the parameters by assigning it a probability distribution.
- The model is run many times, with the values of stochastic parameters being selected from their distributions on each run.
- The outcome is a range of values, giving an understanding of the likely distribution of outcomes.

(ii)

- A deterministic model is more readily explicable to a non-technical audience.
- It is clearer what economic scenarios have been tested.
- The model is usually cheaper and easier to design,...
- ...and quicker to run.
- Users can get 'blinded by science' by complex models, assuming they must be working correctly, but without verifying or testing this.

(iii)

- The model should be stochastic...
- ...since a range of outcomes is required if one is to calculate losses with various return periods.
- Sufficiently large volume/range of outcomes are required to reliably generate values for the longer return periods.
- Since net claims are required it is likely that gross claims will be simulated...
- ...and then the reinsurance structure would be applied to arrive at net claims.
- Gross claims would likely be the result of stochastic claims frequency...
- ...and stochastic claims severity components.
- They write more than one class of insurance...
- ...so the impact of catastrophe losses will likely need to be quantified separately...
- ...since different events affect vehicles and property differently e.g. hail might cause extensive vehicle damage, but limited property damage.
- The model may need to consider different catastrophic perils separately...
- ...such as hail, flood, earthquake etc.
- The model would need to allow for the insurer's exposure as an input,...
- ...e.g. sum insured's, policy counts etc.
- They are still new, so their geographical footprint is limited,...
- ...but technically some catastrophic events are more likely in certain areas than others.

(iv)

Model documentation

- Critical for continuity, and QA/peer review.

- Especially given that it is a new model and company, it is likely that many refinements will take place.
- Each model should be accompanied by documentation explaining the purpose, rationale, and the methodology.
- May be required for regulatory submissions, audit queries, etc.
- The more complex the model, the more important and more detailed the documentation will be required to be.

Sensitivity analysis

- Especially important for deterministic models where single outputs are produced.
- If there are multiple parameters, this is useful/important for determining the financially most significant parameters.
- Enhances understanding of output variability.
- The greater the complexity of the model, the greater the importance of sensitivity analysis.
- Especially with this catastrophe model the choice of parameters may greatly impact the results...
- ...and hence the capital and/or risk management requirements.
- This may also be required for regulatory purposes.
- Useful for management decision-making when considering alternatives.

Flexibility

- Depends on the purpose and the use of the model.
- If used for multiple purposes, across time periods, products, etc. the flexibility required is more important,...
- ...as well as making it possible to develop and refine the model over time.
- The development of highly flexible models used for a once-off type analysis will likely not be worth the effort.
- This model is likely to be used for decision-making (e.g. reinsurance structures) and considering alternatives...
- ...and so it should be flexible enough to easily account for alternatives.
- However, straightforward models, designed for a specific purpose and a single use, may not require much flexibility.

QUESTION 2

Examiner comments: Part (i) was generally answered poorly. Most students did not focus on the most obvious point of profit margin being influenced by the need for risk adjusted returns and hence the risk of the line of business is critical to include. Some credit was given for other valid points (e.g. competition or loss leader related comments). Candidates did better in part (ii), but some still made contradictory statements such as “marketing the product to their existing client base”. In part (iii) many failed to do well as they did not provide advantages that the start-up would have that GrandSure would not. Points such as being innovative, doing research, moving into the market at the right time, adding features to the product etc. were not awarded marks as GrandSure would also be able to do these things and so was not a unique advantage for the start up.

(i)

The claims volatility of certain classes is more than others.

- Due to either volatility in the frequency of claims...
- ...or volatility in the claims amount.
- An example is motor having more claims but stable/known amounts...
- ...while a liability/casualty class may have fewer claims, but of very uncertain amounts.
- Another example is property that can have very large single claims (e.g. big building fire), while motor claims are typically limited to the value of the vehicle, which is seldom very large.

Some classes are longer tailed than others.

- This leads to more uncertainty in the ultimate claims liability.
- For example, a motor claim is known and finalised relatively quickly, compared to a liability claim...
- ...which might not even be known within a year or two (and finalised even later).

Some classes are exposed to accumulations of risk more than others.

- For example, heavy floods pose a larger risk to property than say motor vehicles in general.

A company might have more expertise in one class than another...

- ...or more volumes of policies (and hence data)...
- ...making it more predictable and hence...
- ...reducing the risk of poor underwriting outcomes and hence the required return.

Reinsurance might be more readily available for one class than another...

- ...offering more options to reduce volatility in results for that class.

(ii)

Experience and expertise in offering general insurance

- Insurer is established in the GI space, so are likely to have a good understanding of product, its main risks and any opportunities to enhance offering.
- Likely to understand policyholder behaviour, insurance risks, claims management techniques, regulation, etc. well when compared to a new insurer.
- Significant in-house expertise available with respect to product design and pricing compared to a new insurer who may not have the necessary experience/expertise.
- Their brand might also be well established/known,...
- ...which might make marketing easier.

Systems and processes already in place

- Already have trained staff with experience in this market.
- Already has distribution channels...
- ...underwriting processes,...
- ...and claims verification processes, etc. in place.

- Significantly easier/cheaper to leverage off these than setting them up from scratch.

Existing relationships with reinsurers, distributors, etc.

- May be able to negotiate better terms based on existing relationships, and/or past claims experience and stability thereof, compared to a new insurer with no relationships and likely volatile experience early on.
- Possibly existing channels can be used to reach the target market.

Capital availability and access

- Large insurer may have significant free assets it can employ,...
- ...or may be able to find additional capital with greater ease than a new firm would be able to give their track record
- This might make it very difficult for the new entrant to gain any market share through competitive premiums.

Economies of scale since already large size

- Large insurer may be able to offer cheaper simply because of their size and other operational efficiencies or synergies that can be achieved.
- The large size also means that they may be able to offer it at lower price than a new entrant – better reinsurance terms, less volatility, less systems development required, etc.
- Ability to sell more policies given size compared to a new company with limited capital and ability to take on risk.

(iii)

- New insurer is not tied down by legacy systems...
- ...so there is no need for the new product to conform to existing processes...
- ...and might be able to leverage new technology to build a cheap platform.
- New insurer can be very focused in its marketing and product development...
- ...without constantly being worried about impact on existing policyholders.
- Start-up insurers might have shareholders with very long-term view...
- ...that do not necessarily expect profitability on day one, allowing them to compete well with established players.

QUESTION 3

Examiner comments: Part (i) was well-answered for the most part, but many candidates lost marks by not including the detail contained in the glossary definition around deciding whether to accept the risk at all or, if so, the terms on which it is accepted. Part (ii) was answered well for the most part. Many also linked “financial underwriting” to “medical underwriting” tying mortality to income which is not the purpose of “financial underwriting”. Many candidates only focused on one important aspect, i.e. either affordability or appropriateness given need/situation, but to score well, a discussion of both was required. Part (iii) had reasonable answers from many candidates, with most understanding that a community rate will apply, and that selection may be a big problem, but answers lacked sufficient detail and discussion around both the rationale and the impact on PMI overall to score the full 7 marks. Points were not substantiated sufficiently. Many candidates seemed to think that protection of personal information was the rationale and that the insurers were not able to collect any demographic information. This is not the case; the insurer will have and be able to attain all this information but may simply not use it for individual risk assessments and subsequent individual pricing. They need to price for the average risk given the characteristics of their entire risk pool. Candidates going down this track tended to not score well.

(i)

- Underwriting is the process of consideration of an insurance risk.
- This includes assessing whether the risk is acceptable...
- ...and, if so, the appropriate premium...,
- ...together with terms and conditions of the cover.

(ii)

- Process of evaluating whether the level of cover requested is commensurate with or appropriate for...
- ...the applicant’s income/wealth (and/or the value of the items/assets/possessions they wish to insure).
- This is to avoid persons applying for levels of cover significantly above their income and expected earnings (or the value of their items/assets/possession).
- Financial underwriting seeks to avoid insureds or their dependents being significantly better off financially because of the insured event happening.
- Proper financial underwriting may also create an opportunity for an insurer to give good advice...
- ...since understanding the financial affairs of the insured puts the insurer in a better position to give the appropriate types of cover.
- Applying for excessive insurance may pose moral hazard and/or anti-selection selection risk
- Examples include:
 - Insuring items that you don’t possess.
 - Insuring income disability benefits at income levels higher than the person is currently earning (practically claims processes will pick this up), but it nonetheless may discourage a return to work.
 - Having excessive insurance coverage can result in a subconscious behaviour change, e.g. a nonchalant attitude towards insured items.
 - In an extreme situation a family member might commit a crime (murder) to benefit from high life insurance payouts (this can happen regardless of insured amounts though).
 - Knowing what other policies the client has can indicate potential risk of syndicate fraud (e.g. multiple funeral policies).
 - Individuals with information not available to the insurer, nor requested, may be incentivised to apply for insurance as a result, knowing their risk is higher than what is allowed for in pricing.
 - Knowing your dependents can be significantly better off financially may lead to increased risk of claiming (or non-disclosure) on mortality benefits (e.g. suicide).

(iii)

- Not being allowed to differentiate based on state of health, age and gender means that the PMI in this territory is “community rated”.
 - i.e. everyone pays the same (average) premium for the same benefits
- We know that state of health, age and gender definitely impact expected PMI claims experience.
 - e.g. if you are in a poor state of health or of higher age, it is expected that you will have higher claims.
 - *(other examples are fine, max 1 mark for examples).*
- This average premium will thus be too low for older and sicker individuals...
- ...and young females (higher likelihood of pregnancy and associated expenses),...
- ...and too high for healthy, young individuals.
- There is thus significant cross-subsidies within the PMI pricing.
- This makes PMI insurance very attractive for older and/or sicker individuals or those wishing to have children.
 - And less attractive to younger, healthier individuals.
- The rationale behind the legislation is to ensure that the old and sick are not declined cover based on their state of health or age...
- ...and that they are not charged excessive premiums as a result of their risk.
- These are the people who need the health insurance most...
- ...and being able to access and afford PMI cover via community rated premiums is a form of social solidarity.
- The impact of this regulation will depend on whether PMI insurance cover is voluntary or compulsory.
- If voluntary, young, healthy individuals may opt out of obtaining cover on the basis of it being more expensive than their risk poses.
 - This creates a phenomenon where the average price has to increase, and it becomes further unattractive to younger and healthier lives.
 - At the extreme, this can make the whole offering unsustainable as eventually only the old and the sick will have demand for PMI and the price would be unaffordable.
 - But it is likely that many individuals are willing to pay the extra premium to cross-subsidise older individuals, given that in future they will benefit from the cross-subsidies.
 - Also, there is a level of uncertainty, i.e. car accidents, unexpected illness, etc. which younger, healthier individuals would like to insure against, albeit at a higher price.
- If there is some form of compulsion, it will force younger, healthier individuals to be part of the risk pool,...
- ...which will help reduce the price overall for all who have PMI coverage.

QUESTION 4

***Examiner comments:** Candidates clearly knew what parts (i) and (ii) required, but few provided enough points for the marks available. Part (iii) was a part of bookwork that is not discussed often and many candidates could not even define it in very basic terms.*

(i)

- **Demographic scenarios**
 - mortality rates being lower or higher than expected.
 - future mortality improvement rates being higher or lower than expected.
- **Economic scenarios**
 - Reinvestment rates being higher/lower than expected.
 - Yield curve movements impact on the profitability/mismatch risk of the products
 - Scenarios may include changes in level and/or shape of the yield curve.
 - Benefit escalation rates being higher/lower than expected
 - Expense inflation being lower/higher than expected.
- **Business scenarios**
 - expense per policy being higher or lower than expected.
 - new business volumes being higher or lower than expected.
 - Average lump sum premium per policy being higher or lower than expected.
 - Mix of business being different than expected
 - E.g. males vs. females or socio-economic classes etc.

(ii)

- Upfront commission
- Policy setup expenses.
- Ongoing benefit payment expenses.
- Annual benefit renewal expenses.
- Termination expenses when annuitant dies.
- Administrative overhead (offices, valuation team, management etc.)
- Marketing/sales expenses.
- Investment management expenses/fees.

(iii)

- Marginal costing is when each new policy sold/added only needs enough expense provision...
- ... to cover the variable costs attributable to it.
- Since only the variable expense margins need to be included in the product pricing...
- ...this could result in lower pricing for the product in comparison to the market.
- This would enable larger volumes of business to be written.
- Might also be simpler to calculate the allowance for expenses this way.
- Works when a company's fixed costs are covered by expense margins from business already/currently on the books.
- Each new policy would make a loss if the pricing does not cover the variable component in full.
- May require updates to new business expense allowance if there is a reduction in existing business (or mix)...
- ...since new business will now be required to contribute to fixed costs as well.

QUESTION 5

Examiner comments: This question had a large bookwork component, and well-prepared candidates did very well. In part (i) a common issue was not drawing attention to the **financial** position of the insured. In some cases, perhaps due to the word “indemnity”, candidates focussed on discussions about professional indemnity type policies. Most examples given were valid, but some gave examples from outside general insurance or gave examples that were not clear. Part (ii) was answered well, especially when all the headings were considered.

(i)

- The principle whereby the insured is restored to the same...
- ...financial position after a loss as before the loss.

Examples would be:

- paying out the income lost by a business as a result of a fire.
- paying out the market value of a car that was written-off in an accident.

(ii)

Policy holder must have an interest in the risk being insured to distinguish between insurance and a wager.

- The policyholder must have an interest in the claim event not happening.
- This is true in this case, since the organiser will be liable to pay a big amount if the lucky shot is made.
- However, one can also argue that given the spectacle/entertainment value of it, they might actually want the contestant to succeed.

Risk must be financial and reasonably quantifiable nature.

- The risk is financial because a cash prize, car or other asset will have a financial value.
- It is quantifiable by default since the prize will be known upfront.

The amount payable in the event of claim must bear some relationship to the financial loss incurred.

- Again, trivially true, since the insurer will simply pay out the value of the prize itself.

Individual risk events should be independent of each other.

- The probability of one participant achieving the lucky shot is unlikely to affect another’s chances of success.
- Different sporting events are also further independent of each other.
- Company may restrict the prize to only one per event.

Probability of risk event occurring should be small.

- All the example mentioned are very rare and quite hard to achieve.
- It is likely that BigSure will require the lucky shot to not be trivial...
- ...and may for example require the golf hole to be of a certain minimum length...
- ...or the lucky throw to be from a certain minimum distance.
- The number of attempts per event may be limited.
- Only non-professionals (amateurs) may participate.

Large numbers of risks should be pooled to reduce variance.

- It is arguable whether this would hold true since the number of insured events may be limited.

- The variance of BigSure's outcomes is however smaller than that of the individual insureds.

Should be ultimate liability on the liability undertaken by insurer.

- The liability per event is finite by design.
- The insurer may limit the number of claims per event.
- Since the cover is per event, the insurer can withdraw from this market almost immediately if necessary.

Moral hazards should be eliminated as far as possible.

- It would generally be difficult to make a fraudulent claim for such a shot,
- ...especially given the large number of likely eyewitnesses.
- The insurance may require it to be recorded...
- ...or certified by someone (e.g. golf club captain).

Should be existing data to enable insurer to estimate the likelihood of occurrence.

- There will be a lot of sport statistics to estimate the likelihood of hole-in-ones etc. in professional sports.
- For amateurs the probability will almost surely be less.
- Either way, some assumptions would likely be required.

QUESTION 6

Examiner comments: Many candidates did not read the question and assumed the underlying liabilities were actual medical-related claims, not just the contributions to a medical scheme. Many marks were lost as these liabilities are quite different. Under part (ii) many candidates did not seem to understand the basics of cashflow matching. Many mentioned that the solution was not liquid or that it lacked diversification. These points suggest no understanding of matching of assets and liabilities. Few made reference to the valuation of assets and liabilities - although this information is given in the question. Many answers also assumed that the “company” was an insurer and referred to “required capital” but nowhere in the question is this suggested. In part (iv) some marks were scored for mentioning differences in inflation type, rebalancing and costs, but generally too few points were made for 4 marks. Few considered the liability profile of a portfolio of bonds compared to the profile of the liability.

(i)

- Nature: the nature of the liability is real as medical contributions increase every year...
- ...but increases are typically in excess of inflation due to underlying medical costs.
- The term of the liabilities is very long term.
 - The employee’s remaining working lifetime plus their lifetime after retirement.
- Some cashflows could be paid in 60 or more years’ time.
- Whereas others may be in payment already.
- The currency of the liability is in local currency.
- The timing and amount of liabilities is highly predictable.
- This together with the longer term reduces the need for liquidity.

(ii)

- Equity portfolio provides real returns which is appropriate for the liability.
- Especially since returns from equity portfolios is expected to be higher than inflation over the longer term which helps with the growth of the liability.
- Offshore equities represent a mismatch in terms of currency.
- This could introduce some volatility to the funding level – but there is surplus which can absorb this.
- May be opportunity for higher returns in overseas equities.
- Need for liquidity depends on how many benefits are currently in payment. This should not be a large component of the liability.
- Both equities and benchmark bond are highly liquid
- Bond is likely to provide stable returns – diversifying from equities.
- But term is much shorter than the liability.
- If interest rates go down the liability will increase by much more than the bonds.
- Mismatch in terms of nature of liability as bonds provide nominal returns.

(iii)

- The assets and liabilities will behave in the same way when interest rates and inflation change.
- If the actuary continues to value the fund using the same approach then asset and liability cashflows (which should be similar) will be valued off the same yield curve.
- This will mean that the funding level will be immune against changes in market values of assets.
- The approach also eliminates liquidity problems when meeting liabilities as they fall due.
- Accounting regulation may require the liability to be recorded on the company accounts in which case a matched approach would reduce any impact on the balance sheet.

(iv)

- Long term of liability – there are unlikely to be bonds of long enough duration to match the cashflows.

- This will be expensive - yields on inflation-linked bonds are lower than returns on existing assets.
- Adopting such an approach will therefore cause the actuary to value the liabilities at the lower ILB yields and possibly remove much of the surplus.
- But funding level will remain stable going forward.
- Inflation linked bonds cashflow profile is linked to normal not medical inflation.
- In order to perfectly match, they will need to adjust asset proceed cashflows for expected medical inflation.
- This will require an assumption for future medical inflation, which will be difficult.
- Profile of cashflows from bonds is quite different to the profile liability cashflows and it would be quite difficult to structure the portfolios so that profiles match.
- This can be given to a specialist to manage – but will introduce extra costs.
- Will need to “rebalance” on a regular basis for mortality experience, new entrants etc....
- ...and the process would require ongoing management.

QUESTION 7

***Examiner comments:** Candidates generally did well with part (i) of the question, but better answers incorporated the information about the investment company being new to property into their answers. Part (ii) on the actuarial control cycle was answered reasonably well, but many students still don't know the headings accurately and most actually missed the point about the need for ongoing valuations, focussing almost exclusively on the initial purchase price instead. Many candidates seemed to have jumped into the question without taking a step back and trying to understand what you would need to do practically to get to an answer. Those who kept things simple and focussed on the discounted cashflow model and the various components thereof did better.*

(i)

- Many properties are too big for most investors to afford them on their own so indirect would give that opportunity.
 - This may be more significant for this company as the fund allocation to property will be low as its starting out.
- Diversification is important and indirect property investment would allow for a well-diversified property portfolio.
 - Indirect property investment would be able to pool many properties into a fund.
 - Diversification through an indirect property fund will be good for a new firm as it affords the ability to learn about multiple types of properties.
- It's costly and takes a lot of time to buy and sell properties due to their lack of marketability.
 - It would become very costly to do this for a few properties in a direct portfolio and when you are setting up the fund with no internal expertise
- Properties tend to be unique and so valuing them takes time and is costly.
 - It would become very costly to do this for a few properties in a direct portfolio.
- Deep expertise is required to manage properties and tends to be different for different property types.
 - Many direct investors will not have the specialist expertise.
- Through indirect property investment, the investor loses control and may not be able to influence the decision of the fund.
 - This might cause issues as investments might be made that do not align with the investors' values.
 - This maybe on issues like sustainability or having tenants from particular industries.

(ii)

Specifying the problem

- The value of the property will be the present value of net future cashflows generated by the property.
- The discounting will be done at the rate of return that the company wishes to generate on property investments.
- Agreement on the time horizon of holding the investment may be required.
- Any models developed should be flexible enough to be updated regularly...
- ...and used for a variety of property investments.

Developing the solution

- The following cashflows would need to be included in the projections:
 - Current level of rental income
 - Future rental increases...
 - ...and the frequency thereof
 - Parking income.
 - Assumed level of unoccupied space
 - Expenses of running the property
 - Expense inflation for the property
 - Anticipated capital expenditure on the building (further development etc.)

- A risk discount rate (or curve) would need to be set which will take into account:
 - The risk-free discount rate.
 - Additional return required for property investment by the asset manager
 - Allowance for uncertainties in the valuation.
- Obtaining all the information required may require significant research into the tenants and their contracts.
- There may be market values available for this and similar properties to compare against.
- The discounted cashflow model will be set up to create monthly cashflows...
- ...and the present value calculated over the selected time horizon.
- There may need to be allowance for the attractiveness of the area itself, which may increase/decrease the valuation.
- It is likely that some sensitivity and scenario testing on key parameters will be required.
 - such as discount rate or vacancy rates (one example is fine)
 - and scenarios of high/low economic growth or interest rates.

Monitoring the solution

- Actual cashflows would need to be tracked and compared against the assumptions in the valuation model.
- Especially rental income, vacancy rates assumptions would need to be updated regularly.
- Overall footfall in the shopping centre would be good to know as it gives an indication of the popularity of the property.
- It would be important to monitor the overall performance of tenants in the buildings, especially the big anchor tenants...
- ...perhaps by researching the accounts of public companies...
- ...that will give an indication of their financial strength and/or expansion/contraction plans...
- ...which may place some of the anchor tenant income at risk in the future.
- Monitoring market values of similar properties in the vicinity would be useful to gauge the direction of the market.

General economic and commercial environment

- Retail is very exposed to economic growth.
- If consumers are under strain, then tenants might also see reduced income...
- ...increasing the pressure on their bottom line and putting rental income at risk.
- This might be either through lower expected rental increases, or higher vacancy rates.
- There are also certain shops that might be falling out of favour (e.g. tobacconists)...
- ...or a shift towards online purchasing of certain goods...
- ...which may put downward pressure on the value of the investment.
- The legal framework of property ownership, including rights of tenants...
- ...and responsibilities of commercial property owners need to be understood.
- Understanding what other asset managers are doing w.r.t. property investments.

Professionalism

- Given that asset manager likely is investing other people's money, there is a duty of care to make sure the valuations are reasonable and based on factual information.
- There may be professional guidelines applicable in both the calculation of the values...
- ...as well as the communication thereof.
- An actuary might very well need to consult with lawyers to understand the underlying rental agreements...
- ...to understand the risk of actual values deviating from expected due to clauses/options etc. in the contracts.
- It is very likely that many of the assumptions in the model would be open to discussion or disagreements...
- ...which would require a professional response/engagement.