

**Actuarial Society of South Africa**

October 2020

**Subject A311 — Actuarial Risk Management**

**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's comments:

*This question was bookwork requiring candidates to describe certain specific investment characteristics of corporate and government bonds, respectively, and to secondly contrast them. Many candidates seemed to focus mainly on the contrast aspect. Most candidates knew that government bonds are typically more secure, more marketable and have lower yields than corporate bonds, which is encouraging. But many unnecessary marks were lost due to not describing the characteristics for these investment classes as was asked in the question. This demonstrates poor exam technique rather than a lack of understanding of the content.*

i.

Bonds issued by a reputable government offer absolute monetary security of both income and capital. There is virtually no risk of default.

Corporate bonds are generally much less secure than government bonds. The level of security depends upon the type of debt security considered, the company that has issued the bond and the term of the bond.

ii.

Government bonds have excellent marketability. Investors can deal in large quantities with little (or no) impact on the price.

Corporate bonds are typically much less marketable than government bonds, primarily because the size of issue is smaller.

iii.

If conventional government bonds are held until redemption, the monetary amounts of income and capital are known and fixed. To this extent, the expected nominal returns are known at outset. The *actual* return however can be affected if the bond is sold before the redemption date. The real return is also uncertain at the outset. Given the low risk involved, the expected yield should be relatively low if compared to other asset classes like equities or property.

The gross redemption yields on corporate bonds are higher than for similar government bonds, compensating for the lower marketability and liquidity and the perceived additional default risk. The size of this yield margin depends on both the security and the marketability of the debt.

## QUESTION 2

### Examiner's comments:

*This question was generally well-handled by a majority of candidates, with the candidates able to generate a lot of different points on this topical issue.*

- *Demographics* locally might be significantly different to Europe...
  - ...e.g. much younger population, but also higher HIV/TB prevalence.
  
- *Mortality* is also expected to be different in one country to the next, as a result of differences in:
  - Occupations, genetics, nutrition, housing, climate, education, HIV etc.
  
- *Ability of the State* to afford to provide benefits might be different, ...
  - ...e.g. extent to which extra money can be borrowed might be different depending on existing government debt.
  - Also, *cost of living* might be relatively lower locally, making it easier to provide certain basic necessities.
  
- *The state vs. private healthcare dynamic and capacity* might be substantially different between nations, necessitating the creation of additional capacity if there are not enough facilities and/or doctors locally.
  
- *Cultural differences* might dictate the extent to which actions need to be legislated...
  - ...as opposed to just appealing to people to do the right thing.
  - An example is funerals where gathering in large groups is routine locally...
  - ...and hence require stricter and more explicit rules than in places where it happens infrequently.
  
- *Social trends*, for example nightclubs and the use of alcohol differ from one country to the next...
  - ...which may lead to limits on these recreational activities in one place that is not present in another.
  
- *Technology* might be available that enables the tracking of active cases (e.g. via cell phones) that are not available locally.
  
- *Infrastructure* such as road, rail and air networks play a significant role in the spreading of disease, ...
  - ...and the dynamics locally may be very different to Europe, e.g. crowded taxis and trains.

### QUESTION 3

#### Examiner's comments:

*Overall candidates did not perform well in this question with many candidates not applying their minds on what key risks a general insurer would have offering marine insurance. Perils are different to risks – many poor attempts listed different kinds of perils when asked to think through the key risks. Generally, part iii) of the question was answered better but some candidates struggled to separate the two reinsurance structures and compare against the option of no reinsurance.*

*Part i: Many candidates listing perils (e.g. Fire, piracy etc.) rather than giving key risks with examples as the question asked, and often candidates did not focus on the most important risks (e.g. Many stated Admin systems, investment risk). Candidates giving generic answers regarding risks without thinking through specific risks to a general insurer offering marine insurance*

*Part ii: Candidates generally performed poorly with many not thinking through what the disadvantages of not having reinsurance entails.*

*Part iii: Some candidates combined all the advantages and disadvantages without splitting out between the two reinsurance structures /options. Disappointing number of candidates referred to Quota Share option as being with an independent reinsurer i.e. not the parent, clearly showing that the question was not read properly. Many candidates wrote that XOL reduces claims volatility – this is not true. It does cap large claims but does very little to reduce claims volatility overall.*

i.

Major key risk for any general insurance policy is claims higher than expected in frequency and/or amount or premium charged not being sufficient to cover losses, due to

For marine insurance, this could be due to:

Large individual claims, such as loss of a ship at sea

Catastrophes, such as an oil tanker running aground leading to widespread pollution

Accumulations, such as a storm hitting a harbour and damaging many insured ship

Variable claims experience due to variable weather

ii.

MarineSure is hoping to avoid risk of insolvency ...

...from poor or variable claims experience by getting capital injections

... and avoiding having to bear all of the claims risk from own funds

...and avoiding risk of reinsurer default/credit risk

Extent of protection depends on parent company's financial strength and attitude to capital injections

Risks accepted include:

- Parent company unwilling to provide a capital injection
- If adverse claims experience affects both parent and subsidiary simultaneously, parent may be unable to provide MarineSure with capital when it needs it
- Risk to the group as a whole is not removed
- Accumulations or a catastrophe may be so significant that a cash injection would be insufficient

iii.

Quota share reinsurance policy

- MarineSure has higher confidence of being reimbursed in the event of even extremely adverse claims experience
- MarineSure can write more business with its available capital and get greater diversification
- This doesn't cap claims, as even 50% of a large claim may be too large for MarineSure
- MarineSure does now accept credit risk of its parent company being unable to meet its share of the claim cost
- If business is profitable, it is now ceding its profits to parent

Multi-layer excess of loss

- MarineSure is protected against large individual claims
- Doesn't protect against a poor claims experience generally
- MarineSure may still be exposed to claims in excess of the highest layer
- MarineSure is now exposed to credit risk from its reinsurers
- If business is profitable, it is going to cede profits to the reinsurers
- Access to expertise of reinsurers
- Write larger risks
- Layers still to be decided / negotiated / admin- could leave gaps

## QUESTION 4

### Examiner's comments:

*Parts i and ii: These questions were generally well answered.*

*Part iii: This question required, in addition to stating the merits of the 2 types of models, also applying the merits to evaluate the statement made. A number of candidates scored poorly because they did not follow this approach and merely compared deterministic and stochastic models. Those who followed the structure of stating the merits of each and then evaluating the statement tended to score well.*

i.

Parameters are fixed at outset ...  
Result of running model is a single outcome  
Potential variability is assessed by sensitivity analysis...  
... and scenario testing

ii.

At least one parameter is estimated ...  
... by assigning it a probability distribution  
Model run large no of times ...  
... with value of stochastic parameters randomly selected from their distribution on each run  
Outcome is range of values

iii.

#### Merits of a deterministic model

More readily explainable to non-technical audience ...  
... concept of variable as probability distributions not easy to understand  
Easier to understand what scenarios have been tested  
Cheaper and easier to design ...  
Quicker to run

#### Merits of stochastic model

Tests a wider range of scenarios  
Higher quality of result ...  
... but programming more complex and run time longer  
Depends on parameters used in any standard investment model  
Important to assess impact of financial guarantees ...  
... or investment mismatching

#### Evaluation of student's statement

Student is correct in that the stochastic model will provide richer information  
This alone doesn't make them better ...  
... as a model must be fit for purpose ...  
... and should only be as complex as necessary ...

... to provide the most important results

Overly complicated models will take a long time to develop and ...

... a long time to run

They increase the scope for model error ...

... and might provide spurious accuracy

For certain models, point estimates are necessary ...

... such as provisions ...

... and regulatory solvency

## QUESTION 5

### Examiner's comments:

*Part i: This was straight bookwork, and a number of candidates could not provide a sufficient response on the bookwork. Many candidates listed more than 6 points and thus would have wasted time or repeated the same point within their 6.*

*Part ii: This required an application of bookwork and expansion of the points in the course material. Most candidates answered the question in an insurance context and not a pensions context. A number of candidates incorrectly focused on how to set assumptions in a pension fund instead of the data issues.*

i.

Data inaccurate or incomplete  
Data not credible due to insufficient volume  
Data not sufficiently relevant to intended purpose  
Data not reflecting what will happen in future  
Data groupings may not be optimal  
Data not available in appropriate form for intended purpose

ii.

#### Quality of data

Data supplied by contributors to database may be inaccurate  
Data may be incomplete  
Data quality depends on quality of all contributors' data systems  
As more companies contribute, more likely that one will make a mistake and invalidate the whole data set  
Data likely to be outdated due to time taken to collect and process

#### Relevance

Data may not be sufficiently relevant to intended purpose ...  
... such as data and experience for other pension schemes may not be comparable to this scheme, or  
... if the company employs a different socio-economic mix than industry average, or  
... nature of scheme benefits different from industry average, or  
... extent to which membership is voluntary or compulsory relative to average  
Industry-wide data may include only a subsection of schemes and they may not be representative of the market as a whole

#### Format

Data may not be available in an appropriate form  
Data stored by companies may not be the same  
Chosen data groups in the industry data might be sub-optimal for this scheme  
Coding used for factors by which data is split may vary between schemes  
Schemes may use different definitions of benefit  
Industry-wide data is usually at a less detailed level than available internally

#### Credibility

Volume of industry-wide data may still not be credible for some groups ...

... particularly if the valuation requires assessment under extreme conditions

#### Future

Past data may not reflect what will happen in future, due to...

- ... past abnormal events
- ... significant random fluctuations
- ...changes in way data was recorded
- ...changes in the balance of any homogenous groups
- ... medical changes
- ... social changes
- ... economic changes

#### Overall

Lack of confidence in the data will reduce confidence in the valuation result

## QUESTION 6

### Examiner's comments:

*Part i: This question was not well done by most candidates. Candidates did not focus on the information provided in the question and tended to comment about currency which would not have been possible to deduce from the question. Candidates tended to concentrate on actual cashflow matching without focus on key aspects on nature and term. Few candidates were able to generate points that could speak to capital management implications of this investment strategy.*

*Part ii: Most candidates did very well in this standard book work question. There is limited number of candidates who confused themselves by interchangeably commenting on assets and liabilities. Some of the candidates tried to explain or describe and did not stick to what the question had asked. This has the challenge of wasting time during the exam.*

i.

- The nature of the company's liabilities include different components:
  - o Benefit payments are relatively fixed in monetary terms, with only the timing potentially uncertain.
  - o Expenses are real in nature.
- Each of these profiles ideally require assets that match these criteria. Benefit payments are probably better matched with fixed-interest assets. The expenses require a real asset, and equities might therefore be relevant, but it is only for a portion of the liability profile.
- Therefore, a portfolio of equities does not feel appropriate to back this company's liabilities.
- The above might therefore result in very volatile earnings, or even introduce higher risk of insolvency, especially given that this is a small insure.
- A portfolio of only equities is very risky. This, coupled with the mismatch risk, might require that the company requires a large amount of excess capital to ensure solvency requirements are met.
- The higher level of capital requirements (and the costs associated with this) might result in unfavourable pricing of the life company's products.
- Regulation might not allow a portfolio of only equities.

ii.

- the nature of the existing liabilities – whether they are fixed in monetary terms, real or varying in some other way
- the currency of the existing liabilities
- the term of the existing liabilities
- the level of uncertainty of the existing liabilities – both in amount and timing
- tax and expenses – both the tax treatment of different investments and the tax position of the investor need to be considered
- statutory, legal or voluntary restrictions on how the fund may invest
- the size of the assets, both in relation to the liabilities and in absolute terms
- the expected long-term return from various asset classes
- accounting rules
- statutory valuation and solvency requirements
- future accrual of liabilities

- the existing asset portfolio
- the strategy followed by competitors
- the institution's risk appetite
- the institution's objectives
- the need for diversification

## QUESTION 7

### Examiner's comments:

*This was largely a bookwork question and most candidates performed well with this question. Some candidates lost marks for focussing too much on product features and neglecting to discuss each criteria of insurable risk in turn.*

*The policy holder has an interest in the risk*

- If the policy holder and insured life is the same, then this requirement is automatically met...
- ...since the insured would not typically want to die...
- ...and it is reasonable to expect a dignified/formal funeral and leave some money for family or friends.
- There may be limitations on the relationship between the policyholder and the life assured(s).

*The risk is of a financial and reasonably quantifiable nature*

- The probability of death is reasonably quantifiable.
- The benefit takes the form of a funeral and a lump sum which are financial and quantifiable.
- It might be necessary to specify upfront what is meant by and included in the "funeral" that is provided.

*The claim amount must bear some relationship to the financial loss incurred*

- The funeral costs will directly compare to the costs the family would have incurred themselves in the absence of this benefit.
- The lump sum however may be a complete windfall payment for the beneficiary,...
- ...but may also make up for the lack of income that now arises as a result of the death of the family member/friend.

*Individual risks should be independent*

- For single life policies this requirement will be automatically met.
- There might be some concentration risk in the event of a family all being insured on the same policy (e.g. dying in a car accident).
- It isn't clear if the product is offered on a group basis, but even then it is likely to still be insurable under this criteria.

*Probability of the event occurring should be relatively small*

- Although death is certain, the risk associated with timing still makes it insurable.
- At younger ages, the risk is generally small.
- The policy may need to exclude deaths as a result of natural causes (or suicide) at shorter durations to exclude giving cover to individuals who know they are about to die and then selecting against the insurer (see similar point under moral hazard and don't award points twice).

*Large numbers of similar risks should be pooled to reduce variance*

- The company would expect to sell this to the general population and reach a large audience with its marketing campaign.

- The product also has broad appeal, especially for markets where medical underwriting may not be popular or feasible.

*Should be limit on ultimate liability undertaken*

- The funeral and lump sum constitutes a defined and limited liability per risk.

*Moral hazard should be eliminated as far as possible*

- Given the limited underwriting, there is significant risks of anti-selection and/or moral hazard.
- Individuals that are very sick or about to commit suicide may take out a policy...
- ...and hence a waiting period for natural cause deaths and suicide may be imposed (also see earlier comment).
- Underwriting at claims stage would be required to validate the veracity of claims information and/or circumstances.
- To some extent, the fact that there is a funeral paid for makes the moral hazard harder than say just a lump sum being paid out,...
- ...but scope still exists for collusion between funeral houses and individuals/syndicates to take out policies and fake deaths etc.

*Should be sufficient data in order to quantify risk*

- Mortality data is readily available, either from local mortality studies, in-house or from reinsurers.

## QUESTION 8

### Examiner's comments:

*Part i: Was generally answered well, with many candidates able to generate some practical examples. Some focused too much attention on what happened and how, instead of indicating how such event leads to a financial loss to the insured.*

*Part ii: Answered reasonably well, but in many cases candidates still focus too much attention on just one detail e.g. pricing, instead of covering a wide range of ideas relevant to managing this risk. The question itself required considerations around design, price and risk management and candidates who tried to address all three did better. (There was no need to address each separately with its own control cycle as there is of course overlap between them). Better candidates often made more practical application throughout and appreciated that this type of product is not one to use detailed technical rating with and requires a more pragmatic approach with increased focus on underwriting and monitoring.*

i.

- Costs associated with identifying and rectifying any IT security breaches.
- Costs of replacing damaged/corrupted hardware.
- Losses as a result of the business being interrupted by a Cyber attack.
- Legal costs e.g. fines as a result of fines imposed by the regulator.
- Losses as a result of intellectual property being stolen.
- Reputational costs associated with the loss of client information.
- Third party damage, e.g. onward transmitting of virus.
- Theft of funds through unauthorised transactions.

ii.

#### *Specifying the problem*

- The client is paying a premium in return for transferring the risk of losses as a result a security breach of its IT systems to CorpSure.
- The problem is to determine a product design...
- ...and premium rates that:
  - o deliver a required profit (or return on capital) to CorpSure,
  - o doesn't expose Corp to risk beyond their risk appetite, and
  - o are marketable/attractive and meet the needs of brokers and/or prospective clients in the market place.
- The product design would also need to be administered successfully.

#### *Developing the solution*

- The product will likely require a complex policy wording that defines the insured events...
- ...and responsibilities of the insured party.
- It is likely that a relatively simple pricing model would be required,...
- ...that gives a view of future experience (e.g. frequency and severity of claims),...
- ...as a function of certain risk factors, e.g. sum insured, type of industry etc.

- This pricing model would also combine the risk cost with expenses (recurring and upfront)...
- ...and profit requirements.
- Model likely is simple enough to be developed in house, but commercial ones may be sourced if necessary.
- This model would require some assumptions about future experience.
- Pricing and contract design will likely be difficult and require a lot of assumptions...
- ..., since no in-house or even local experience would be available.
- CorpSure may engage with their reinsurers (or consultants) that have knowledge of cyber insurance,...
- ...to help design and/or price the product.
- Significant judgement will be required around how to allow for uncertainty,...
- ...e.g. additional margins, higher profit loadings, limits on cover etc.
  
- The actuary would also need to engage with the underwriters of this cyber insurance product...
- ...to ensure that the underwriting is consistent with what is allowed for in the pricing.
  
- To help manage the risk, it is likely that reinsurance would be required for this product.
- The levels of reinsurance required will be informed by the risk appetite...
- ...and capital/solvency considerations of the company,...
- ...e.g. the maximum retention on any one event (other examples may also be appropriate).
- It is important that pricing and product design takes into account the cost and terms of reinsurance...
- ...as a mismatch may expose the company to unnecessary risks.
  
- It is likely that the actuary may prepare some test cases that check what the profitability and capital outcomes might be under various scenarios.
- Given that this is a large company, they may even consider surveying existing, long-term clients to find out what type of cyber related losses they've experienced in the past.
- CorpSure would also need to upskill/train the broker sales channel to understand the product properly...
- ...to enable them to give appropriate advice.
  
- CorpSure would also need to put in place an agreed procedure on how to investigate, process and settle claims.

### *Monitoring the experience*

- It may take quite some time for credible volumes of exposure/claims data to build up, especially if there are very few policies sold and/or claims made.
- Emerging experience should be compared with what was expected when the pricing was initially done.
- If experience is significantly different to what was expected, the premium rates for new business might need to be adjusted...
- ...and existing business would likely be revised on the policy anniversary.
- Experience might also be different to expected due to issues around poor/inadequate underwriting,...
- ...either at inception or during the claims processing stage.
- It will also be important to understand whether the needs of the clients are met...
- ...perhaps by regularly engaging with brokers,...
- ...and constantly looking at the circumstances surrounding and outcomes of claims.
- It is possible that competitors enter this market as well and their actions and product designs should be noted.

- CorpSure would need to monitor the competitors' product design and pricing.
- In some cases changes may be required to enable them to remain competitive,...
- ...for example reducing any margins for prudency or lowering the profitability requirements.
- Any emerging trends in frequency and/or severity of certain risk events.

#### *General economic and commercial environment*

- Being aware of any regulatory requirements around the sale of products such as these.
- How this product may change CorpSure's capital requirements.
- The appetite for cyber products in the local market...
- ...and how this is influenced by general economic conditions e.g. GDP growth etc.
- Understanding how to reach CorpSure's current and potential future policyholders.
- Emerging technology and developments that can have a bearing on the security of systems.
- Assets available for insurer to invest in.

#### *Professionalism*

- Actuary to adhere at all times to professional conduct standards...
- ...including guidance on matters relating to pricing and product development.
- It is imperative for the actuary to thoroughly understand any assumptions that are made,...
- ...especially given the lack of data and uncertain nature of a new product.
- It is likely that the actuary would engage with lawyers, underwriters and IT professionals...
- ...and should uphold high standards of professional conduct and respect for the opinions of others.
- Actuary should keep principles of treating customers fairly in mind.