**Actuarial Society of South Africa**

May 2017

# Subject A301 — 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.*

## GENERAL COMMENTS

## QUESTION 1

*Examiner's comments:*

*Only a minority of candidates managed to identify all the reasons for being concerned about lapse rates. The reasons for being concerned were split into 2 groups: some covering expense and mortality experience and the other group covering product and market reasons. The majority of candidates focussed only a single group of reasons and therefore only allowed themselves the opportunity to gain half of the total marks available.*

Selective withdrawals could result in a worsening of the risk profile (e.g. mortality experience may differ from that assumed)

- If expenses are not recouped up front withdrawals may result in the insurer incurring a loss
- Withdrawals may indicate that something is wrong with the product offering/level of premiums/marketing/distribution channel or that a competitor is offering a better product offering or lower premium rate
- They could indicate a loss of market share or that the insurer is losing competitiveness
- It is generally more expensive to attract new clients than to retain existing clients.
- A large number of withdrawals may cause a cash flow problem (if withdrawal benefits are paid)
- Higher withdrawal rates imply fewer policies in force – fixed expenses are thus spread over fewer policies and per policy expenses increase
- A large number of lapses would increase levels of uncertainty

## QUESTION 2

*Examiner's comments:*

*This question was done fairly well. Most students could have scored more for such a book work question. It appears like students are not reading or understanding the question before answering but are eager to write what they know without focusing on the answer for the question.*

*In part (i) students seemed to confuse expected inflation with the risk that the expected inflation could be different from actual inflation. Students also tended to repeat the same point in different ways. For part (ii) students were concentrating on downside risk rather than the uncertainty related to equity returns. In addition, students would repeat the same point under liquidity and marketability risks. In part (iii) students would tend to state a point of fact without stating the action the investor is supposed to take.*

i.

It is generally assumed that an investor would require his investment or capital to grow in real terms in order to keep up with inflation. Therefore, it requires capital to at least retain a constant purchasing power.

This naturally assumes that an investor has liabilities that are real in nature.

ii.

Possible default

Equity shareholders are entitled to share in the future profits of the company. Default risk can materialise if there is not sufficient profits to pay the expected dividends. In the extreme, the company can go bankrupt which might result in zero future dividend earnings.

Marketability

If the company is small or unlisted, then the marketability of the company's shares might be low. Therefore, if the investor needs to sell the shares (either for liquidity or other reasons), then he might not find an interested buyer, or might not find an interested buyer at a reasonable price.

High volatility of share prices and dividend income

Since the dividends are linked to the profits generated by the company, the dividends (and hence share price of the company) is exposed to macro and micro economic factors as well as other external influences. This might result in volatile dividend income and share prices, especially if compared to other asset classes like fixed income instruments.

iii.

Possible default

Consider canons of lending to reduce chance of default

Invest in blue-chip companies that are less like to default

Marketability

Invest in large cap or larger cap companies

Invest in listed shares (as opposed to unlisted shares)

Avoid situation where you need to sell share under unfavourable conditions (possibly postpone the sell until favourable terms are available)

High volatility of share prices and dividend income

Larger companies should provide more stable returns if contrasted with small cap shares

One can reduce volatility by investing in a diversified share portfolio

**QUESTION 3**

*Examiner's comments:*

*Candidates could have handled this question better. Most candidates focused on considerations for setting an investment strategy rather than determining an investor's risk appetite.*

- objectives of the project
- financial and economic objectives
- statements on how these objectives will be met
- breakdown of the work to be completed
- key milestones for project review
- quality standards for meeting the objectives
- project sponsor's role
- role of any third parties, eg consultants employed
- expected cost of the project
- need for insurance or reinsurance
- financing policy
- legal policy
- technical policy
- risk management policy
- communications policy
- IT policy
- conflicts of interest policy

**QUESTION 4**

*Examiner's comments:*

*Bookwork question which required solutions to be tailored using a university as an example of an organisation. Candidates who couldn't identify all four of the operational risk factors generally scored poorly. Those who could identify all of the factors scored most/all of the marks on offer.*

*Inadequate or failed internal processes, people or systems*

- Poor quality control of courses, lecturers and content, resulting in poor publicity.
- An IT failure shutting down the campus.

*Dominance of a single individual over the running of the business*

- Someone in a position of power e.g. chancellor who's influence is not kept in check and making questionable decisions
- May also possibly relate to a political / student leader having too much influence in student actions

*Reliance on third parties to carry out various functions for which the organisation is responsible*

- Security provider failing to provide adequate security or protection to students
- A cleaning company not keeping facilities clean / hygienic

*Failure of plans to recover from an external event*

- Not having a contingency plan in place for when a natural disaster strikes the area and classes have to be suspended.
- Changes in the political landscape not being addressed or considered

**QUESTION 5**

*Examiner's comments:*

*Most students managed to define this correctly. A majority of students did not discuss the economic benefits of regulation but they did indicate the situations in which self-regulation could be beneficial.*

*Advantages and Disadvantages: The students scored very well in this part of the question*

*ii)*

*Direct costs: A few students did not clearly distinguish between administrative costs and costs of complying and therefore lost these marks*

*Indirect costs: The students that did not score well in this question failed to explain the different indirect cost factors sufficiently.*

*Overall: This was a straightforward bookwork question and most students scored well.*

i.

- A self-regulatory system is organised and operated by the participants in a particular market…
- …without government intervention.
- The incentive to do so is the fact that regulation is an economic good…
- …that consumers of financial services are willing to pay for and which will benefit all participants.
- An alternative incentive is the threat by government to impose statutory regulation…
- …especially if a satisfactory self-regulation system isn't implemented

**Advantages**

- System is implemented by the people with the greatest knowledge of the market…
- …who also have the greatest incentive to achieve the optimal cost / benefit ratio.
- Should be able to respond rapidly to changes in the market
- Possibly easier to persuade participants to co-operate with self-regulation system than with a government bureaucracy

**Disadvantages**

- The "regulator" can be consider too close to the market it is regulating…
- …and the danger exists that the regulator accepts the industry point of view and not necessarily those of third parties and / or clients.
- This can lead to a weaker regime with low public confidence in the system.

ii.

Direct costs of regulation include:

- Administering the regulation. This includes, for example, collection and examination of information provided by market participants and otherwise monitoring their activities.
- Compliance for the regulated firms. This includes, for example, maintaining appropriate records, collating the requisite information and supplying it to the regulator and/or the investor.

Although the actual expense for these are typically incurred by financial providers, in practice, most of these direct costs are borne ultimately by the investor in the form of higher charges and fees for the financial services that are purchased. It can also be borne by the consumer in the form of higher taxation to fund the regulator.

Indirect costs of regulation can arise from:

- an alteration in the behaviour of consumers, who may be given a false sense of security and a reduced sense of responsibility for their own actions.
- an undermining of the sense of professional responsibility amongst intermediaries and advisors**.**
- a reduction in consumer protection mechanisms developed by the market itself**.**
- reduced product innovation**.**
- reduced competition

**QUESTION 6**

*Examiner's comments:*

*This question was answered reasonably well by most candidates.*

*A common mistake in part (i) was to mention risks that the company would bear, e.g. investment and expense risk, while the question asked for risks the company would insure, ie death and disability.*

*Many candidates also mentioned dread disease in part (i).*

*In the comparison of the risk with the general population many candidates referred to the average age of professional rugby players that is lower than the average for the general population and concluded that mortality risk would be lower. We can assume that age will be used as a rating factor and that this point is not relevant. Similar any comments about gender.*

*In part (ii) many candidates missed the obvious factors like age and sum assured.*

*Part (iii) was answered well although some candidates only focussed on the bookwork ways to mitigate risks and didn't provide specific reasons why it would work in this case.*

*This question had more available marks than the allocated 11 which helped candidates to score well.*

i.

Risk of dying

- probably lower than the general population because these are professional sports people so generally in good health & fit
- probably lower than general population because they will have a doctor on the team to diagnose and treat anything that might arise (early detection likely)

Risk of disability √

- higher as rugby is a contact sport and players get injured frequently despite them been generally in good health
- will depend on the definition of disability and whether it includes both temporary and permanent disability

There is an accumulation risk as the team will travel together (planes, busses etc). This is also likely to be a higher risk than the general population as they will no doubt travel more.

ii.

1. Age of players (or average age of team) – the older the team/players the more likely they are to get injured
2. Past claims experience of team – this will probably be the best guide to future experience as it will indicate how well looked after the team are by the medical team
3. Size of sum assured / replacement ratio – if a player gets a benefit close or the same as they would have earned if they were playing, it will incentivize players with small injuries to claim.

4. Other lesser important factors such as waiting period; payment duration etc.

iii.

1. Reinsure – risk is then transferred to the reinsurer and the risk of incorrect pricing is then transferred to them.
2. Limit the benefit amount – a lower benefit amount will limit the maximum potential loss for the company and therefore lower the risk.
3. Limit the benefit term (if it is an income benefit) – a shorter benefit term will hopefully encourage the players to return to playing quicker but even if they don't it will also limit the total amount paid (see 2 above).
4. Exclude anyone who has been injured previously from claiming again either at all or at least claiming for the same condition. This will reduce the number of higher risk people and therefore lower the risk for the company.
5. Try to insure more than just one team. The larger the pool of insured lives the lower the volatility and therefore the risk decreases.

**QUESTION 7**

*Examiner's comments:*

*This question was bookwork, and candidates generally performed well, as expected. There were, however, some exceptions and some candidates scored marks for lucky guesses. In part i and part iii marks were not awarded for merely stating keywords with no context whatsoever, e.g. "options/guarantees" or "new business" - I expected candidates to demonstrate that they understood what they were listing, e.g. say something along the lines of: "To be able to offer capital intensive products with options/guarantees"; or to "finance new business/strain"*

*This poor form of exam technique cost some students unnecessary marks, but encouragingly, the overwhelming majority of candidates did not fall into this trap.*

*In part iii, students also lost marks due to not recognising that some of the reasons listed in part i are also, in fact, benefits to having significant excess capital.*

i.

1. Cushion for unexpected events
2. Pay for future liabilities as they fall due
3. To grow or expand / Finance new business
4. As start up capital (will finance costs before revenue comes through)
5. Required by regulator
6. To finance known losses (for example to finance a loss leader product) or to finance losses incurred (for example due to adverse claims experience)
7. To write business containing guarantees as it requires higher solvency margins
8. To obtain a good credit rating (demonstrates financial strength)
9. In order to have more investment freedom including the ability to mismatch to obtain higher returns

ii.

1. Share capital
2. Policyholders
3. Reinsurers (through financial reinsurance)
4. Securitization
5. Subordinated debt (into a holding company)
6. Derivatives
7. Past profits

iii.

1. Investment freedom
2. Gives you more freedom strategically
3. Protects against volatility
4. You can be less risk averse
5. Allows you take on more volatility
6. Allows you to write large amounts / deal sizes
7. Allows you to write more risky products
8. Can use it as a marketing advantage
9. Regulator might give you more freedom

**QUESTION 8**

*Examiner's comments:*

*i.*

*Not as well answered as expected. Candidates who applied a logical (SYSTEM T) framework to their answers were generally able to score enough points for a pass. As is often the case, students did not write enough to generate the required marks (20 points at half a mark per point). Points were consistently lost for not discussing various components of yield - running yield, gry, real vs nominal - or mixing these up. Many students did not read the question carefully and included a detailed description of credit ratings and the factors affecting these in their solution. Knowledge of how bonds are taxed was also poor.*

*ii and iii*

*Candidates were familiar with the canons of lending and scored good marks for this bookwork. There was a split between candidates who were able to apply the canons to the situation described in the question, and those who merely listed the generic bookwork points around the canons. Most candidates considered the "purpose" of the investment from a purely socio-economic aspect (ie building roads is good for SA) rather than considering whether there was investment merit in the purpose (the purpose/business model being to build a road and collect toll fees) - the latter being what a potential investor should consider. Part (iii) was generally well answered, however certain candidates simply extended their discussion from part (ii) instead of focusing on the liabilities and requirements of the investor described in the question.*

i.

*Security*

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.

*Yield – running yields*

Historically, running yields on conventional bonds have typically been higher than running yields on equities and property. This is because income on equities and property is expected to grow over time, creating capital gains. Conversely, since the income stream on a conventional bond is flat and the scope for capital gains is limited (if the bond is held to maturity), income levels tend to be higher.

*Yield – real vs nominal*

If bonds are held until redemption (with no default risk materialising), 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 achieved might, however, be uncertain:

- If an investor bought an n-year bond to meet an n-year liability, the coupon payments would have to be reinvested on terms that are not known at the outset.
- If an investor plans to sell before redemption, the sale price is not known at the outset.
- Any defaults from the issuer will also impact the actual return achieved.
- The real return (i.e. the return in excess of inflation) is uncertain. If inflation turns out to be higher than expected at outset, the real returns from conventional bonds will be lower than originally anticipated.

*Yield – expected return relative to government bonds*

The gross redemption yields on corporate bonds are higher than for similar government bonds, compensating for the lower marketability and the perceived additional default risk. The lowest yield margins will be for larger issues from companies with high credit ratings.

*Spread – volatility of capital values*

Market values will fluctuate from day to day if there are changes in the supply and/or demand. Quite large shifts in market value are possible with less liquid, long-dated stocks.

The risk of falling market values may be a problem for:

- investors who need to prove financial strength by reference to the market value of assets (e.g. general insurers);
- investors who have to sell at the lower market prices (e.g. if an investor is required to meet a liability earlier than anticipated).

*Term*

Bonds can be classified as:

- shorts (< 5 years)
- medium-dated (5-15 years)
- long-dated (> 15 years)
- undated or irredeemable (no redemption date).

*Expenses*

For corporate bonds, the margins between buying and selling prices are typically wider than for convention government bonds.

*Exchange rate – currency risk*

There will be a currency risk for an investor who is investing in bonds denominated in one currency but who has liabilities denominated in another.

*Marketability*

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

*Tax*

The taxation of the income and capital gains will depend on the tax regime of the country concerned. There will typically be both an income component (coupons) as well as capital gain (redemption value or sale price).

ii.

*Is the character and ability of the borrower satisfactory? Is he trustworthy?*

Although the national road agency is a large entity, the lack of the government's backing does affect the trustworthiness of the agency. One should therefore investigate the credit experience of the agency in the past, taking into account when the agency itself was able to deliver on its commitments, compared to when the government stepped in.

*Is there a valid purpose for the loan and is the money to be put to good use?*

The purpose of the finance project is theoretically sound – in return for an investment in infrastructure, the agency can expect the payment of toll fees to earn a return on their investment. However, the practicality of this has been questioned recently due to potential inability to recoup these toll fees from

consumers. One would also need to investigate the details of the investment to ascertain whether the expected income earned on the toll fees will provide a reasonable expected return on the investment.

*Is the amount that is being borrowed reasonable given the purpose it is being put to?*

The detail of this was not provided, and one should therefore consider the impact of this once the details are disclosed. Given the size of the project, one would expect a fairly large amount to be involved in this transaction.

*Does the borrower have the ability to repay?*

The ability to repay would depend on the financial strength of the agency during the bond term, as well as the success of the project – both in terms of timing of implementation as well as the ability to recoup the toll fees involved. Given that the government will not stand in if a default occurs, one should carefully investigate these factors and the likelihood of success.

iii.

- The appropriateness of the risk-return profile given the risk appetite of the shareholders of the life insurance company.
- The nature of the liability – nature, term, currency and degree of uncertainty.
- Existing and future liability profiles should be considered.
- Any statutory, legal or regulatory requirements for the assets of a life insurance company.
- Appropriateness of the new investment given the existing asset portfolio.
- Level of diversification achieved by including the new investment, or alternatively the level of concentration risk that this might introduce.
- Potential opportunity cost – hence the presence of other, more appropriate investment opportunities available.
- Strategy followed by similar funds or competitors.

**QUESTION 9**

*Examiner's comments:*

*Part (i) was answered well in general. Most student could generate a few reasons for the change in part (ii), but the better candidates identified that the initial pricing may have been prudent and that some of that extra profit may be used to give additional benefit to the client in the form of a lower excess. Poorer students failed to comment on the fact that a lower excess structure will have either an impact on profitability and/or the premium required from the policyholder.*

*Part (iii) required application of the bookwork on model buiding. Poorer students simply jotted down headings from the bookwork, with very little application and scored poorly. A large proportion of candidates struggled to articulate what it is that the model should try to produce or achieve. The better candidates spent more time on this and hence laid a foundation on which to build additional ideas and*

*scored better. The main focus should be profitability, but credit was given to other valid ideas as well (e.g. return on capital, cost of implementation, ruin probabilities etc.)*

*Well prepared students identified that the stochastic elements are most likely to be the claims frequency and severity and expanding on these components of the model generally also resulted in better marks being obtained. A very large number of students went into detailed discussions of the requirements of a good model or how/where to source it, which wasn't the crux of the question. Student who spent a disproportionate amount of time expanding on one element, e.g. validating/sourcing data often left out important comment on other areas e.g. what is actually being simulated and what to do with the output.*

*Applying their minds to what pieces of information can easily be sourced from the last pricing exercise, got the better students generating more ideas on how to get practical answers from the model and how some of these assumptions need to be adjusted (e.g. frequency).*

*Part (iv) was answered well, but few could generate enough ideas to get the full marks available. The idea of the question was not to provide the requirements of a good report, but rather what the required information/output was to include in the feedback to assist with a decision. There was also a lot of repetition of ideas e.g. providing "percentiles of profit" and "giving the distribution of profit" come down to the same thing.*

i.

- It reduces moral hazard by incentivising the client to also try and avoid a claim…
- …since the client will also incur some sort of loss at claims stage.
- One can argue that it also removes the administrative burden of the insurance company having to deal with small claims, allowing more resources to focus on larger claims.
- The premiums may also be more marketable, since an excess may bring premium s down.

ii.

- The rest of the market / competition may be moving towards offering similar, more attractive terms…
- …hence making it harder to market / sell the product…
- …or even just to compare quotes if the market is doing something different.

- It may have been as a result of regulatory changes (or by instruction of an industry body).

- There may have been an increase in client complaints.

- If U-sure elects to do this without changing the price…
- …one can argue that they are actively decreasing their margin
- …perhaps to increase sales…
- …or to give up margins for prudence in their initial pricing basis…
- …especially since they might have been overly prudent, given that they are a new company…
- …and could be a target for anti-selection by the market.
- One can make a case for sacrificing margin on the motor book to attract more profitable property business.
- …and could be a target for anti-selection by the market.

iii.

- The purpose of the investigation is essentially to measure the increase in the expected cost of insurance claims to be paid by U-Sure…
- …and what impact this will have on the profitability of the book…
- …and whether a change in premium would be required.
- …since we expect the average claim to increase since the excess payable is now smaller.
- We would likely want to measure this both at the portfolio and at the individual risk level
- We will collect data on the exposure that we want to include in the analysis…
- …which should enable us to calculate the premium charged for each risk.
- We will also collect data on the actual claims corresponding to the exposure above.
- …which will require information on the current rating factors being used.
- The claims data may possibly be adjusted for inflation.
- Motor claims amounts are a function of frequency AND severity of claim events…
- …and hence it is reasonable to expect the stochastic model to contain a probability distribution (density function) for frequency…
- …to simulate whether an event occurred or not (the incidence of events)…
- ...as well as a distribution for severity to simulate the amount of a claim.
- We would expect these distributions not to be the same for each risk / vehicle…
- …and would use the relevant rating factors per risk to set the parameters of these distributions.
- We would rely heavily on the work done for the most recent pricing exercise to assist with setting these distributions and parameters.
- The historic excess may have resulted in claims not being submitted below the existing threshold…
- …so the frequency distribution would require some adjustment in lieu of the claims between the old and new excess structures.
- The claim amount generates should ideally be gross of any excesses…
- …after which we apply the respective excess structures
- Correlation between variables is unlikely to be a significant/important consideration (alternatively: may possibly be ignored) for pricing personal lines type business…
- …since these type of insured events are usually uncorrelated to each other.
- Although a sophisticated model may incorporate catastrophe events…
- …and one may want to allow for some relationship between claims cost, inflation and time horizon.
- We should perform a goodness of fit test by running a recent / past year through the model and comparing the actual with expected/modelled results
- If the results are unsatisfactory, we may need to revisit the parameters and/or choice of distribution for our frequency and severity models (i.e. fit a new model)
- - The current book of business can then be run through the model…
- …where for each risk/policy/vehicle we simulate whether a claim has happened and if so, what the amount was…
- …by random sampling from the distribution/density functions applicable for each risk.
- We can then apply the existing as well as proposed excess structure…
- …and calculate the difference in the claim paid by U-Sure.
- For each iteration we can also keep track of what the overall difference across the entire book was…
- …or what the resultant profit/loss was
- We would produce a summary of results showing the distribution of additional claim costs…

- …or the additional premium required to keep the profit constant.

*The suggested comments above are not exhaustive and credit was given where appropriate and where candidates took a different approach, e.g. modelling solvency or balance sheets, but the crucial idea is really the impact on profits and/or premium.*

iv.

- Include a distribution of how much overall additional claim payments are expected…
- …and provide summary statistics such as percentiles / quantiles / deciles etc. to give an idea of the range of the outcomes.
- Provide similar summary statistics on the overall claims…
- …and/or combined ratio of the company.
- …perhaps by assuming the premium income of the current mix of business…
- …or alternatively, making (and showing) a projection of the anticipated increase / decrease / change in mix of future business.
- Provide a breakdown of how much (individual) policyholders are saving at claims stage as a result of the reduced excesses.
- If it is decided that the policyholders will need to pay for the reduced excess, we would need to know the impact on the risk and/or office premium that the policyholder will need to pay.
- …which may be done by showing the distribution of expected increases faced by individual policyholders.
- Provide statistics on the expected increase in frequency…
- …perhaps by showing what percentage of claims that were previously below the excess (hence no payment) are now above the proposed excess.
- …and how this increase in frequency translates to costs e.g. claims handling etc.
- The expected profit margins under each structure and well as the distribution of the overall profit margins realised.

*Credit was only given once for mentioning the distribution of a metric as well as the average outcome. Thereafter the question was looking for distinct ideas for outputs / ratios / amounts to be included.*