

Actuarial Society of South Africa

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Subject A311 — Actuarial Risk Management

PAPER ONE

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 a clear book work question. Those who prepared well were able to score well on this question. Candidates sometimes missed marks for not listing all the points under each definition. Candidates who performed exceptionally well on this question were able to list all the required points specifically for the definition of stochastic value.

- i. This is the price originally paid for the asset and is often used for fixed assets in published accounts.
- ii. Written up or written down book value is historic book value adjusted periodically for movements in value.
- iii. The market value of an asset varies constantly and can only be known with certainty at the date a transaction in the asset takes place. Even in an open market more than one figure may be quoted at any time.
- iv. In accounting terms, fair value is the amount for which an asset could be exchanged or a liability settled between knowledgeable, willing parties at arm's length.
- v. These are an extension of the discounted cashflow method in which the future cashflows, interest rates or both are treated as random variables. The result of a stochastic valuation is a distribution of values from which the expected value and other statistics can be determined.

QUESTION 2

Examiner's comments:

Overall, this question was answered relatively well. Credit was given for valid points that were not in the model and credit was given for suitable explanations. Some of the solutions provided were extremely lengthy explanations for the factor identified - the question clearly stated that the explanation should be brief. Candidates are encouraged to answer succinctly, based on the mark allocation of the question to ensure that their points are presented and considered appropriately.

A substantial number of solutions did not provide a suitable explanation relating to the effect of the factor on equity levels and did not get credit. Some solutions merely stated that if factor X changed/increased/decreased, equity levels would then change/increase/decrease e.g. a decrease in short-term real interest rates increases equity levels – such explanations also did not get a mark.

A substantial number of solutions mentioned economic factors that were not major, as required by the question, but which had an indirect impact on equity levels e.g. institutional investor demand, supply-related factors, investors risk appetites, regulation impacts, fiscal changes

Expectations of profits

It is investors' expectations of future corporate profitability and the value of those profits which largely determines the general level of the equity market.

Real interest rates

Low real interest rates should help to stimulate economic activity, increase the level of corporate profitability, and hence raise the general level of the equity market. Also, the rate of return required by investors should be lower, so the present value of the future dividends will be higher.

Inflation

Equity markets should be reasonably indifferent towards high nominal interest rates and high inflation. If the rate of inflation is high, the rate of dividend growth would be expected to increase in line with the return demanded by investors.

Equity risk premium

The equity risk premium is the additional return that investors require from equity investment to compensate for the risks relative to risk-free rates of return. The equity risk premium fluctuates from time to time, depending on the overall level of confidence of investors and their views on risk.

Real economic growth

In general, real dividends, and therefore the fundamental value of companies, would be expected to grow roughly in line with real economic growth. Therefore changes in investors' views on economic growth have a major effect on the level of the equity market.

Currency

A weaker domestic currency makes exports more competitive, so profits should be increased and profits earned in other currencies are more valuable when converted into the domestic currency. A weaker currency makes imports more expensive - this is bad for corporate profits to the extent that firms cannot pass the higher costs of imported raw materials through to consumers. Higher costs of raw materials also lead to inflation. However, if manufactured imports are more expensive, the market share of domestic firms should increase.

QUESTION 3

Examiner's comments:

- i) *Straightforward bookwork question that was directly from the notes. Most candidates knew the definitions.*
- ii) *Most candidates were able to name the relevant asset classes. Many candidates struggled to mention the correct reasons those asset classes would be held. i.e. show understanding of matching DB liabilities. Many candidates confused the investment strategy of a DB and DC scheme.*
- iii) *Many candidates struggled to list sufficient relevant points and display the general understanding that experience was worse than assumptions.*
- iv) *Most candidates managed to list several points. However, prioritizing the eight most important assumptions was a struggle.*

i.

Defined benefit scheme

A defined benefit scheme is a scheme where the scheme rules define the benefits independently of the contributions payable, and benefits are not directly related to the investments of the scheme.

Defined contribution scheme

A defined contribution scheme is a scheme providing benefits where the amount of an individual member's benefits depends on the contributions paid into the scheme in respect of that member, increased by the investment return earned on those contributions.

ii.

- fixed-interest bonds to match benefits guaranteed in monetary terms
- index-linked bonds and equities to match benefits guaranteed in real terms (for example linked to price inflation or salary growth) and expenses
- some cash, for liquidity to meet immediate pensions and expense outgo and uncertain outgo, for example any death benefits.

iii.

- Investment returns were lower than expected
- Contribution (employer/sponsor or member) levels were not sufficient to cover benefits provided
 - Required contribution levels were incorrectly estimated
 - Benefit payments were higher than expected (mortality or morbidity incorrectly estimated)
- Fund expenses were higher than expected
- Exits from the scheme were higher than expected while scheme was underfunded

iv.

Liabilities

- The level (parameters) of benefits provided for active members, deferred members and current pensioners
- Mortality/morbidity rates
- Membership details (current members, new members and exits)
- Expenses and expense inflation

Assets

- Future contribution rates (sponsor/employer and member)
- Strategic asset allocation (to obtain asset class splits)
- Project asset returns for relevant asset classes

General

- Risk discount rate

QUESTION 4

Examiner's comments:

*This question required students to go beyond their bookwork and ensure that they are answering the specific question asked. Exam technique was critical to ensure that students were able to formulate enough points to score well in this question. Students needed to ensure that they asked the question in terms of why reinsurance but particularly in terms of why **surplus** reinsurance, why **treaty** reinsurance, why for a **general insurer**. Majority of students struggled to provide enough points to get all the marks.*

- The company may require a reduction in claims volatility.
- Since a surplus treaty shares a variable percentage of each risk with the reinsurer, the expected variance of future claims should reduce.
- This should hence also smooth profits...
- ...reduce the risk of insolvency...
- ...and hence reduce capital requirements.
- The surplus treaty will work well if the company has very heterogeneous risks (e.g. commercial lines vs. personal lines)...
- ...since they can cede a large percentage of the larger, more volatile risks...
- ...and retain more of the smaller risks.
- This is also more flexible than a quota share where the same percentage of every risk is reinsured.

- Although a very large claim might still be large even after allowing for reinsurance recoveries...
- ...there is some protection from large individual losses provided by a surplus treaty.
- Since the insurer can assume less risk on the larger risks, this should enable the provider to write larger risks...
- ...and also more risks...
- ...for the same amount of capital.

- The insurer could also have used a facultative arrangement to insure larger exposures on a case by case basis,...
- ...but a surplus is administered automatically, simplifying the administration...

- ...and guaranteeing capacity (within treaty terms of course).
- A proportional reinsurance contract (like a surplus treaty) with more substantial and consistent premium volumes...
- ...might have been a requirement to obtain access to the expertise of the reinsurer...
- ...such as administration, pricing, claims or underwriting support (any one or more).
- The profit sharing arrangements might have been better than non-proportional arrangements with similar outcomes.
- Surplus reinsurance may be more cost effective compared to the other types of reinsurance offered
- Writing of more risks allows the insurer to increase the diversification of their portfolio.

QUESTION 5

Examiner's comments:

Most candidates managed to list multiple stakeholders. However, very few candidates managed to adequately explain the impact the proposal would have on the stakeholders.

The stakeholders and the impacts are:

Current / deferred members of defined contribution funds and their dependants

Members will no longer be exposed to investment risk, but will also lose the opportunity to enhance their retirement provisions if the fund earns higher returns than their salary progressions

Members will no longer be exposed to longevity risk

Members will also have a better understanding of how much their pension will be after retirement

Greater security for dependants, if death benefits are based on accrued / projected pension

Members who withdraw from the fund may get poorer payouts

Members will need to be educated to understand DB Funds

Retired members receiving in fund annuities from defined contribution funds

They may need to transfer to underwritten annuities, which may give them increased security

Retirement funds and trustees

The boards of the trustees may need to be amended to allow for the greater employer involvement that comes with a defined benefit arrangement, so the employer might appoint senior executives to the board

Trustee training on the terminology and mechanics of defined benefit funds will need to be provided

Costs will increase as a result of more advisory parties being involved and more complex work being involved, e.g. valuations. These increased costs will ultimately be carried by the employer

Employers

Employers with defined contribution funds will face investment risk, and risk having unfunded liabilities represented as a liability in their accounts

This will force them to have a more active role in the fund management and investment philosophy

They will carry an open-ended liability

New entrepreneurs and other employers without any retirement funding will not be inclined to offer retirement funding to their employees, due to the investment risk, so there may be less retirement provision made for the workforce as a whole

The regulator

The regulator will need to approve all the new rules and the benefits on conversion

This would be a major task, and the regulator will need to recruit additional staff to be able to issue approvals timeously

Defined benefit schemes require annual valuation reports to be submitted to the regulator

Staff will need to be trained on defined benefit arrangements as this is a lost skill

Government

The government will need to write the legislation to bring this change into effect, together with the regulations explaining how it will operate

Actuaries

Implementation of this legislation will require much in the way of actuarial resources

Defined-benefit schemes require much in the way of actuarial involvement

Greater demand for actuaries with valuation skillset with a resulting skills demand / supply mismatch in the short to medium term

Administrators

Systems and processes may need to be amended or developed. This will increase their costs, which will ultimately be transferred to the fund and add to the employers' costs

QUESTION 6

Examiner's comments:

This was a straightforward bookwork question and most candidates scored very well. A few candidates did not consider that this was a life company and mentioned points relevant for short term insurance.

i. Investigations

Pricing

Reserving

Capital requirements

Investigating DewLife's resilience to adverse future experience

Determining the optimum reinsurance strategy

Determining the most appropriate underwriting policy

Asset-liability modelling

Analysis of surplus investigations

Setting discontinuance terms

ii. Corrective actions

Reprice the product

increasing the price will improve the profitability ...

... but this may result in lower sales and higher withdrawals

... so investigate the pricing of your competitors to see if you can afford to increase rates

... you may be able to increase rates for certain groups (e.g. young ages only or smokers only)

Make underwriting more stringent

if mortality is causing the losses

Redesign the product

create some differentiation in the product design ...

... to address needs of target market

Change the sales strategy

sell via more profitable channels or ...

change the target market

Withdraw from this market

focus resources on other more profitable lines

... might be too drastic if this is a major line of business

Do nothing – this might be a temporary problem

QUESTION 7

Examiner's comments:

- i. Most candidates did know the bookwork associated with this knowledge component.*
- ii. Candidates knew the bookwork around the ACC and were able to reproduce this but were poor at applying the ACC to the specifics of the question – i.e. for an investment strategy. Answers were therefore mostly generic.*
- iii. Many candidates answered a different question “why should the investor include equities in the portfolio” using SYSTEM T to explain the characteristics of equities. For those who did identify the correct list to apply to the solution (factors to consider when developing an investment strategy for an institution) they did not apply the list to the specifics of the question and did not generate enough ideas under each heading to get enough marks.*

- i. A provider (investor) should select investments that are appropriate to the nature, term and currency of the liabilities and the provider's (investor's) appetite for risk.

Subject to the above, the investments should also be selected to maximise the overall return on assets, where overall return includes both income and capital.

- ii. General commercial and economic environment

The initial starting point is the general commercial economic environment against which assets and liabilities are traded and valued. i.e. The factors and conditions (such as economic, legal, political, and social circumstances) that generally affect everyone in an industry or market in more or less similar manner. Stakeholders should be considered, for example, trustees, employees etc and the impact on them.

Specify the problem

Specify the problem by having a clear objective for the long term asset liability portfolio. The investor must be aware of what their investment objective is e.g. to match liabilities or to simply outperform a target. And also a clear identification of the risks that they are faced with.

This leads on to consideration of the assets available, including internationally and in relation to solvency/risk tolerances and whether any deviations are permitted.

Developing the solution

In developing the solution consider the nature of the liabilities/target to match/outperform with the assets available to develop an asset liability model.

Devise a model using available tools e.g. individual expertise or software packages to select individual stocks, if active investment or indices to track if passive investment.

At the same time keep in mind the nature, term and currency of the liabilities and/or risk tolerances/constraints of the institution.

Monitoring the experience

Once built, test the model and feed back the results into the cycle with regular monitoring against the objective. The initial stage of this may involve back-testing the model against historical investment experience. There would also need to be regular on-going testing to react to changes in market conditions and expectations. Monitor and feed results back on an ongoing basis so that stakeholders are continually informed and can make decisions.

Are the assets still a match for the liabilities, that the indices are still appropriate and that the portfolio is still within risk tolerances so that the portfolio remains optimal.

Professionalism

At all times act in a professional manner. This includes adhering to professional guidance, obeying Chinese walls and insider dealing rules, ethical/socially responsible investments and corporate responsibility.

iii. The nature, term and certainty of the existing liabilities

The nature, term and certainty of the liabilities should be compared to the return and risk characteristics of equities. There might have been a reason that bonds were chosen in the past (possibly due to a good match), and the change in profile should be considered if equities are introduced. *(Note that currency is not relevant for this question as liabilities and assets are both South African-based)*

Statutory, legal or voluntary restrictions on how the fund may invest

Regulation might influence the investments that an institutional investor can hold. This change might therefore have been triggered by a change in regulation that requires further diversification, or introduced equity as a new permissible asset class. This might also impact the statutory valuation basis and solvency requirements.

The size of the assets, both in relation to the liabilities and in absolute terms

Since the investor already invests in government bonds, it is likely a relatively large investment portfolio – the absolute value of the portfolio is therefore unlikely to prohibit equity investments. The size of the investment portfolio relative to the liabilities might indicate whether there is some additional investment freedom to take on the additional risk that equities will introduce.

The institution's risk appetite

The introduction of equities can materially impact the risk profile of the investment portfolio, especially given the move away from a bond-only portfolio. This should therefore be compared to the risk appetite of the institutional investor and whether the investor can stomach the additional volatility.

The expected long-term return from various asset classes

Given the additional risks involved, it is reasonable to expect a higher expected return on equity investment. This additional expected return might therefore benefit the investment portfolio, provided that the risk appetite is considered.

The need for diversification

The introduction of a new asset class will naturally bring diversification benefits to the investment portfolio. This should be beneficial, provided that it still provides a reasonable match for the liabilities.

The existing asset portfolio

The practical aspects of transitioning an investment portfolio from a bond-only composition to equities should be considered.

Tax

Both the tax treatment of bonds vs equities and the tax position of the investor need to be considered. There is likely a difference in the treatment between bonds and equities, and this can potentially therefore play a meaningful role in the decision.

QUESTION 8

Examiner's comments:

Part (i) was generally well answered, but some candidates only provided the most basic features of motor third party and hence lost out on a mark. Some also failed to provide distinct examples of third party liability, with both examples given typically being that a vehicle caused property damage to a third party. Part (ii) was answered to a reasonable standard, but students would have generally benefited from a wider range of ideas. Many missed the fact that the target market, and hence the associated risk, is likely different for the direct channel when compared to the agency channel. Part (iii) could have been answered better, with many candidates making very generic comments and not clearly demonstrating exactly how the model will work and what the required inputs and outputs from it will be.

i.

Features

- Motor third party liability insurance provides indemnity to the insured (owner of the vehicle)...
- ...against compensation payable to a third party...
- ...for which the insured is held legally liable.
- Legal expenses related to the incident are usually also covered.
- In some countries the cover may be compulsory.
- There may or may not be an upper limit on amount of compensation.
- An excess may be applicable.

Examples

- The driver is negligent and crashes into another vehicle...
- ...causing damage to the vehicle that must be paid for by the person responsible.
- The driver is negligent and crashes into a pedestrian...
- ...causing an injury for which the victim must be compensated.

ii.

- There is the risk that the new channel is not successful in generating sales...
- ...leading to overhead expenses and/or initial setup/financing costs not being recovered.
- Expenses with setting up and marketing the new channel may be higher than expected.
- The target market reached by the new channel may be significantly different to the existing channel...
- ...and may be higher risk than the existing business, leading to underwriting losses...
- ...which would be exacerbated by the fact that the premiums are potentially lower.
- Direct channels may sometimes also expose the insurer to more moral hazard and/or anti-selection risks.
- There is a very real risk that existing policyholders in the agency channel may switch to the direct channel...
- ...and cancelling their policies and switching to similar policies, but at a lower cost.
- There may be some reputational risk involved as a result of the differential pricing.
- There is a risk that policies cancel/lapse at too early durations on average...
- ...and hence not having enough older policies to cross-subsidise the newer ones.
- The existing business can also become less profitable.
- There is the potential for operational risk, e.g. computer failure in the call centre that will affect sales and/or service levels.
- Actions of competitors may threaten the success of the new channel.

iii.

- The model needs to generate future simulations of premiums, claims and expenses...
- ...and discount them back to the present time...
- ...possibly using a risk adjusted discount rate.
- The model would need to calculate expected cashflows at each future interval of time...
- ...which may be set to be monthly or annually.
- The model can model the individual policies from the agency channel already on the books or model points scaled up for the existing exposure.
- It is likely that model points are required for the new channel as the channel is new...
- ...and results scaled up for the expected future exposure from this channel.

An assumption would also be required as to the size and mix of new business coming onto the book in each future year.

- For each interval we need a projected premium.
- This might be obtained by simulating whether the policy is in force or not...
- ...and, if in force, calculating the premium payable by the policy.
- The lapse experience investigation should give some indication of the probability of lapse/cancellation rate...

- ...by duration, policy profile and renewal increase size.
- An assumption is likely required to adjust this (probably upwards) for the new channel.
- One can then use this probability to stochastically simulate whether a policy cancels or not in a given year.
- Some dynamism is required since a policy that has cancelled should not have premiums in the subsequent intervals (although technically you can have reinstatements).
- An assumption is also required around the rate at which premiums are increased at renewal/anniversary.
- It will be useful to make this assumption a variable input into the model...
- ...since cancellation rates and ultimate profitability will be sensitive to this number.

- For each interval we also need to simulate a claim amount.
- The incidence of a claim can be simulated with reference to the frequency models in the pricing...
- ...and the amount might come from simulating from the severity model distributions in the pricing models.
- It will be necessary to make assumptions around how this might be different for the direct channel.
- For example, the channel might attract generally higher risks with a subsequent impact on say severity.
- One can also consider allowing for excesses and other recoveries (e.g. third parties) reducing the claim amounts, if these are not in the severity models already.
- There might be a need for correlation/dynamism in the model whereby a policy gets cancelled e.g. in the event of a write-off...
- ...or where a policy gets an above average increase (or reduction in no-claims discount) at the policy anniversary after a claim occurred.

- Expenses can be allowed for as a flat percentage of premium, a fixed amount per policy or a combination of the two.
- Claims expense may also be modelled explicitly as a percentage of claims or a fixed amount per claim.
- An inflation assumption is required to escalate the expenses at future durations.

- Although the pricing was recently reviewed, we can consider running the model using data from a recent underwriting year or two and compare to the actual outcome to check the overall model output.

- Contingency margins may be added to some of the simulated claims figures to allow for uncertainty.
- Sensitivity analysis on the key parameters such as cancellation and claim rates will be useful to understand the results.

- Running the model many times, each time sampling randomly from the chosen distributions...
- ...we can derive a distribution of modelled net present values.
- Result should then be summarised, perhaps using percentiles, and presented to management...
- ...along with comments on how to interpret the results and any shortcomings in the approach.