

# **EXAMINERS' REPORT**

*November 2017 examinations*

## **Subject F102 — *Life Insurance* Fellowship Principles**

### **INTRODUCTION**

The attached report has been prepared by the subject's Principle Examiner. General comments are provided on the performance of candidates on each question. The solutions provided are an indication of the points sought by the examiners, and should not be taken as model solutions.

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## QUESTION 1

i.

Factors to consider:

- Policyholders' expectations:
  - Established by the bonus philosophy including the split between current bonuses and terminal bonuses and the expected use of an Market Value Adjustment (MVA).
  - Policyholder Reasonable Expectations (PRE) will be informed by past bonus declarations and by what competitors are declaring.
  - Policyholders would also expect to see performance in excess of inflation.
- Investment returns:
  - Consider the actual returns earned as well as expected future returns.
  - The insurer does not want to distribute more than what it is earning, however, it is easy for policyholders to compare the bonus with an approximate investment return earned in the market and the ability to significantly under-declare is limited in times of good returns.
- Guarantees:
  - The insurer will need to meet any minimum guarantees.
  - Unitised With-profits (UWP) policies do not generally have significant guarantees, but the minimum rate that can be declared is usually zero.
- Funding level/free assets:
  - Does the insurer need to retain some of the investment return to boost the funding level of the portfolio?
  - Or can it increase bonuses from previous under-declarations?
  - Asset share will give an indication of the funding/maximum bonus that could be declared.
  - Bonus should also be sustainable, though there is more room for different annual declarations in UWP policies.
- Solvency
  - The bonus declaration should not impact the solvency of the company.
- Profits from other sources e.g. mortality, expenses:
  - Include these in the declaration as it is a mutual.
  - These are unlikely to be large, but could provide some additional benefit if experience was good.

ii.

Consequences of the error:

- This depends on the effect that the correct information would have had on the bonus declaration.
- If the bonus declared was at the maximum level possible, no action is required.
  - However, the insurer should use the correct asset shares as opening values for the new calculations.
- If the bonus could have been higher:
  - The insurer would have to decide whether to implement a higher bonus or not.
  - Regulations may require a correction to be made.

- A correction to in-force policyholders' records will be required.
- A revisit to the policies that had surrendered during the year will also be required.
- The amounts involved may be very small in the overall context.

[Total 8]

*Part (i) was very poorly answered by most candidates. Candidates did not appreciate the difference between setting a bonus philosophy and declaring an annual bonus within the established bonus philosophy. Very few candidates considered that the differences resulting from a UWP product and a surprisingly large number of candidates considered the shareholders in their declaration.*

*For part (ii) better answers recognised that this is not a large error and it may not have had any impact on the bonus declaration in the previous year.*

## QUESTION 2

i.

Checks include:

- Reconciliation of current data with data from the previous valuation using data movements.
- Check data movements against accounting data (e.g. movements off with claims paid).
- Consistency checks (e.g. average sum assured for each class of business is sensible and consistent with values from previous valuation).
- Check for unusual values (e.g. unreasonably large sum assured or low premium).
- Spot checks for accuracy for individual records using other records and administration files.

ii.

Determining policyholder liabilities for supervisory purposes:

The insurer may use the full data set of individual policies in-force at the date of the valuation of the supervisory reserves to calculate the reserves.

Alternatively, the insurer may use model points representing the in-force business.

Model points should be chosen to adequately reflect the distribution of the business.

The supervisory reserves determined using model points should not differ materially from the value that would have been determined if the full data set of in-force policies had been used.

The sensitivity of the results to the model points selected should be checked.

The results from model points would need to be scaled up to reflect the full in-force business of the insurer to reflect the total policyholder liabilities for the insurer.

For each model point or individual policy, project the future cashflows from the business, including expected premiums, expenses and benefits paid.

Allow for decrements of deaths, morbidity, lapses, and inflation of expenses.

Assumptions for mortality, morbidity (permanent disability), lapse and inflation need to reflect the best-estimate of the expected experience of the policyholder profile for the in-force business and the economic environment.

Assumptions for expense inflation should be consistent with the assumptions used for the discount rate.

The supervisor may require margins to be added to the best-estimate assumptions, due to the inherent uncertainty in the assumptions and cashflows.

This risk margin would reflect the compensation required by the “market” in return for taking on uncertain aspects of the liability cashflows.

Projections would be done on a monthly basis for accuracy.

Cashflows will be projected until the last policy has gone off the books.

The net cashflow (benefits plus expenses less premiums) will be discounted using the risk free rate a discount rate as appropriate for a market consistent valuation basis.

The risk free rate may be determined based on government bond yields or swap rates if there is a sufficiently deep and liquid swap market.

The results should be checked for reasonability, e.g. by reconciling the results with the last supervisory valuation.

iii.

Mortality investigation process:

The whole life product for higher income customers is a well-established product and the new product has been sold for a number of years so there should be a sufficient volume of stable data internal data to use for this exercise.

Consider the period of data to be used for the product so that information is not outdated.

Divide data into homogenous groups: by product (higher income and low income), age, gender, sales channel, region etc.

Ensure that there are enough data in each group to make the analysis for that group statistically credible.

Calculate the crude mortality rate by taking the number of deaths divided by the exposed to risk for each homogeneous group.

Compare the results of the experience investigation with the mortality assumption and standard mortality tables.

Investigate whether there is any evidence of trends in the mortality experience.

Also investigate any unusual circumstances that could have affected the mortality experience.

iv.

Actions could include:

Change the assumptions used in pricing and reserving to reflect the actual mortality experience results from the investigation.

- Increasing the pricing assumptions and the premiums may result in lower business volumes and impact on the contribution of the premium income from this business to overheads.
- Higher best-estimate mortality expenses will increase the reserves for these policies, possibly impacting on the solvency position of the insurer.

Change the product design.

E.g. Increase the waiting period for the product for low-income consumers, to manage the risk of anti-selection.

- This may increase the reputational risk of the insurer when claims are denied in the waiting period.

Change underwriting and claims management processes.

Strengthen the claims validation process to reduce fraudulent claims.

- Increases reputational risk as above.

Introduce individual underwriting for product for low-income consumers.

- This will increase the cost of the product.
- This makes the sales process for these policies more onerous and time consuming and could lead to lower business volumes.

Other actions:

Try to target lower risk lives through the sales and market strategy and distribution channels used to market the product.

- May be costly and not lead to the desired results.

Stop selling the products.

- Consider the impact on the loss of premium volumes from this business on the contributions to the overheads of the business.

Continue to monitor the experience and only take action if the trend continues (or worsens) for a significant period.

Consider a reviewable premium structure

- Allows premiums to be increased in deteriorating mortality experience.

[Total 18]

*Part (i) was bookwork.*

*For part (ii) better performing candidates described the various aspects of the process (data, model, assumptions). Few marks were awarded for simple lists included in the solution as the instruction was to describe the process.*

*Part (iii) was generally well answered. Marks were not given for actions the insurer may take in response to the results as this is asked in part (iv).*

*Part (iv) was generally well answered; better candidates provided a wide range of potential solutions, and described the potential impacts of the actions that the insurer could take.*

### QUESTION 3

i.

Errors in unit pricing:

- Not changing the pricing basis when the flows for the portfolio change direction.
- Incorrectly allowing for taxation in the unit pricing process.
- Using the incorrect bid offer spread.
- Errors in the pricing of assets.
- Unfairly/inequitably treating policyholders due to timing mismatches or rectifying past errors.
- Inaccurate/outdated current asset and current liability values.
- System malfunctions or breakdowns resulting in delays in available pricing.

ii.

Risks faced by the life insurer:

Market risk

- The risk that the value of the assets reduces and therefore the future fees reduce.

Expense risk

- The risk that expenses incurred are higher than expected.

- The risk that expense inflation is higher than expected.
- This risk is further increased if the management fee cannot be increased.

#### Lapse risk

- The risk that policyholders leave resulting in a loss of the income stream.
- Further, given the high new business strain early lapses will result in significant losses.

#### Operational risk

- The risk that the funds are not appropriately invested to match liabilities.
- The risk that there are errors in the unit pricing process.

#### New business risk

- Due to the high level of new business strain, higher volumes than expected pose a risk to the solvency of the insurer.
- Due to only offering one portfolio, there is a risk that volumes are lower than expected and as a result overheads on the product are not recovered.

#### Tax/regulatory risk

- There is a risk that changes in taxation or regulation reduce the profitability of the product.

#### Reputational risk

- Due to having only one portfolio, if the portfolio performs poorly, this may result in a mass exit of policyholders.

### iii.

#### Adding the three new portfolios:

##### Advantages:

- Increases the options available to the investor and therefore improves the ability to meet client needs.
- Improves competitiveness of the product.

##### Disadvantages:

- Additional administration complexity.
- Can result in mis-selling if advisors are not adequately equipped to give advice to clients which portfolio aligns with client needs and expectations.

#### Adding the guarantee:

##### Advantages:

- Competitive advantage over the offering from collective investment schemes.
- The market is sophisticated so it will be possible to hedge the guarantee.

##### Disadvantages:

- Will result in capital strain and volatility in profits if the guarantee is not hedged.
- Will require additional systems and staff who are able to determine the exposure of the guarantee and hedge this in the market which will be costly.
- Will result in additional costs to the policyholder which they may not clearly understand.

#### Reducing the management fee:

##### Advantage:

- May increase volumes as the product will become more competitive.

Disadvantages:

- May reduce profitability of the product if reduced margin is not more than offset by increased volumes.
- Whilst volumes may increase initially, competitors can easily reduce their fees with the result that the overall profitability in the industry reduces.

Changing the commission structure:

Advantages:

- Reduces the new business strain, capital requirements and lapse risk by better matching timing of cashflows.
- Lapse rates likely to reduce as distribution force will be incentivised to get policyholders to retain their policies.

Disadvantages:

- Distribution force unlikely to sell the product if competitor products offer upfront commission.
- Will need to incur system costs and administration costs to change commission structure.

[Total 14]

*Overall the question was well answered. Some candidates did not adequately understand unitised product structures. As an example, for the point on introducing guarantees on the product some candidates stated that the premium would need to be increased rather than the charge on the unit fund. There were also a few candidates who did not understand the unit pricing process and referred to errors that may occur in determining asset shares rather than unit prices.*

## **QUESTION 4**

i.

Coinsurance on original terms:

The insurance company sets the premium, and the reinsurance premium is in direct proportion to this.

The amount of commission agreed with the reinsurer sets the price of the reinsurance arrangement, and is usually very significant.

Coinsurance using level risk premium approach:

The reinsurer sets a level premium for its share of the risk, based on its share of the full sum assured.

The insurer then calculates its own premium rates in the knowledge of the reinsurance premiums it will be paying.

The reinsurance commission is usually not significant.

ii.

The main purpose of underwriting is to manage risk. This can be done in the following ways.

- It can protect an insurance company from anti-selection.
- Given that a reinsurer normally sees larger risks and more impaired lives, anti-selection is a concern for the reinsurer and needs to be managed.

- Financial underwriting will help to reduce the risk from over-insurance and is important especially with high sums assured.
- The underwriting process will enable a life insurance company to identify lives with a substandard health risk and can be used for making a decision to reject the proposal or to accept the proposal on special terms, on the appropriate price for the risk.
- For the substandard risks, the underwriting process will identify the most suitable approach and level for the special terms to be offered.
- These terms may be an additional loading on the premium or alternatively an exclusion cause (*or other valid terms and conditions*).
- Adequate risk classification within the underwriting process will help to ensure that all risks are rated fairly.
- Underwriting will help to ensure that actual mortality experience does not depart too far from that assumed in the pricing of the contracts being sold.
- Underwriting is the process that aligns the risks written by a company with the pricing performed by the actuary.
- Reinsurers also aim to manage their exposure to certain countries and occupations and will underwrite for these risks. Underwriting will allow them the chance to place exclusions for travel to certain countries and types of injuries obtained for certain occupations.
- Avocational underwriting also allows an insurer or reinsurer to manage their exposure to hazards pursuits.

iii.

The chief actuary would need to consider the following

- What the cedant's motivation is for the request to reduce the underwriting requirements.
- Consider the effectiveness of the existing underwriting requirements.
- If the insurer's current underwriting guidelines are appropriate and consistent with those used by reinsurer.
- Determine whether the current underwriting practice is still appropriate and whether the market is happy with this.
- Consider whether a change in the underwriting approach is necessary due to different underwriting practices that have evolved in the market and advances in medical technology.
- Consider the extent of the proposed change:
  - Identify what the reduction in underwriting would entail, is this limited to underwriting questions on the application form or does it also include less onerous medical reports or specialist testing or a combination of both.
  - Consider whether limited underwriting applies to all products or only a limited set of products.
- Consider the importance of underwriting to this business:
  - Consider the type of products being written. Some products will require more underwriting than others, e.g. Income Protection products. However, there may be ways to increase premiums to account for the extra risk taken on.
  - Consider the distribution channel and type of lives purchasing the product.

- The level and amount of underwriting carried out by competitors.
- Being slightly different from the market standards may lead to an accumulation of anti-selection. Underwriting attempts to minimise this by evaluating the risks associated with each case.
- Consider other ways to assess and manage the risk with reduced underwriting
  - Consider the type of information that will no longer be obtained through underwriting and determine if there are alternative methods of obtaining the information.
  - Consider alternative ways to manage the risk e.g. limit sum assured.
  - Whether insurer is open to the idea of managing the risk in alternative ways by adapting product terms, e.g. adding pre-existing condition terms.
  - Look at implementing decision tree underwriting processes where only certain medical, lifestyle or financial underwriting is conducted when specified answers to certain questions are given.
  - Data analytics to identify preferred lives for reduced underwriting.
  - Proxies for managing risks.
- Consider the underwriting expertise/experience of the insurer's team and whether the team is likely to be able to effectively implement alternative risk mitigation measures.
- Determine the potential impact on the reinsurer's book and look to see if there is a possibility for cross-subsidies.
- Consider the reinsurance structure. If a quota share agreement is in place then both the insurer and reinsurer have a vested interest in managing the risk. If a surplus treaty is in place, then the insurers risk is limited and there is more incentive for the reinsurer to manage the risk appropriately.
- Identify if there are any regulatory restrictions on underwriting.
- The reduction in underwriting expenses e.g. few medical examinations compared to the increase in risk of anti-selection and increase claim costs by not underwriting.

[Total 17]

*Part (i) was bookwork and was well answered.*

*Part (ii) was relatively straight forward, but some candidates failed to cover a sufficient range of relevant points. Candidates needed to be brief in their explanations and some candidates wasted time giving too much detail on financial underwriting and then failed to give a sufficient breadth points on general reasons for underwriting.*

*Part (iii) was poorly answered. Again many candidates did not cover a sufficient range of points to do well in the question. Many candidates did not consider the impact of a change in underwriting on the claims experience of the insurer and then how this will influence the reinsurer's decision. The majority of candidates failed to consider other ways of managing the risk of anti-selection (e.g. introduce a waiting period) or using alternative sources of information to assess the risk of the potential policyholder. A number of candidates missed the basic points of reasons for requesting the change and whether the proposed new approach is consistent with market practice.*

## QUESTION 5

i.

Similarities in product design:

- The **definition** of disability would be broadly the same, viz. temporarily or permanently unable to do one's job/occupation.
- The **sum insured**/benefit level would be similar, and linked to an individual's remuneration, with an appropriate replacement ratio.
- A claim, once in payment, would usually **increase**, with inflation, or at a fixed percentage.
- The benefit **term** would be similar, up to normal retirement age:
  - However, for the group product there will be **less, or no, flexibility**, with the employer choosing the retirement age.
- Both products would have the option of paying a **partial benefit**, if the claimant is able to return to work on a part-time basis.

Differences in product design:

- It is likely that the **deferred period** will be longer for the group product, typically 1, 3 or 6 months. For individual products the waiting period is typically 7 days or 1 month.
  - *Reason.* Formally employed people usually have significant paid sick leave, hence the longer waiting period. Self-employed people, who purchase income protection, typically don't have sick leave and hence need a pay-out from as early as possible.
- Individual products are typically "**priced for life**" and will often have 5 to 10 year premium **guarantees**. Group products are priced on an annually renewable basis, with at most a 3 year rate guarantee.
  - *Reason.* This is how group products have traditionally been priced, and it is usual to get a re-rate, and perhaps move the scheme, every several years.
- The **definition of income** may be different.
  - *Reason.* For group products the definition will generally be linked to how the company defines remuneration. For individual (self-employed) people the calculation of income is more complex and will often include a benefit to cover the expenses of the company, on a temporary basis.

ii.

Assumption setting:

- Consider your company's **existing** individual life experience but making sure that there is **enough** data, over enough time.
- You will use this data for **mortality** rates (pre-claim), **disability** inception rates, and **termination** rates (death and return to work).
- An allowance must be made for any **differences** in the product design, for example a longer deferred period will have a significant impact on both the incidence and termination rate and in the **target market**. For example, there may be more manual/blue collar workers in the group market.
- If the **guarantee** period is shorter than for the individual life product, then you will need to adjust that assumption (reduce the loading).

- For **expenses**, you could look at your recent expense investigation but allowing for the fact that there may be some significant differences, for example **commission** structure may be different, there should be some economies of scale.
- You need to allow for any **regulatory** or tax differences between the two products.
- You need to ensure that the past data is **relevant** for forward projections, which it may not be as income protection experience is linked to the performance of the economy.
- Your **investment** and risk discount rates will be broadly similar to what you use for the individual product, perhaps with a slightly higher risk discount rate (RDR) to allow for the uncertainty
- You will probably need to involve **reinsurers** who have experience in this market, particularly since the insurer may not have sufficient internal data and experience to make necessary adjustments for changes in the product.

[Total 12]

*Part (i) was very poorly answered by most candidates. Better answers discussed the product features and gave the reasons for the differences as asked. Weaker answers rambled on about various aspects of managing the products.*

*For Part (ii) better answers started with inception and termination rates. A surprisingly large number of weaker answers started with a mortality assumption. The better answers also described how the assumptions would be set.*

## QUESTION 6

i.

Principles:

- Take policyholders' reasonable expectations into account.
- At early durations, the surrender values should not appear too low compared with premiums paid taking into account any projections provided at the new business stage.
- At later durations, surrender values should be consistent with projected maturity values.
- Surrender values should not exceed earned asset shares, in aggregate, over a reasonable time period.
- Take account of surrender values offered by competitors.
- Should not be subject to frequent change, unless dictated by financial conditions.
- Should not be excessively difficult to calculate, taking into account the computing power available.
- Should be capable of being documented clearly.
- Should avoid selection against the insurer.

ii.

Assumptions:

Interest rates:

- It is likely that LifeCo covers the without-profit liabilities with fixed interest investments, chosen to give a reasonable matching by term.
- We can expect that the average duration for someone of Joe's age is longer than what is expected in Joe's specific case.
- So we expect that XYZ likely uses an interest rate assumption corresponding to a shorter duration.
- Whether the annual interest rate used in the calculation is higher or lower would depend on the shape of the yield curve(s).
- However, we can generally expect that there is less of an effect of discounting in the calculations of XYZ compared to LifeCo.

Mortality rates:

- The basis will be based on their expectation of future mortality, which may or may not be the same as the pricing basis.
- LifeCo is likely to use a standard basis of mortality to calculate the prospective value of policies.
- The basis may even allow for lighter mortality as it would not expect ill-health policyholders to lapse.
- This will have the effect of extending the expected future lifetime of the policy.
- This in turn will produce a corresponding decrease in the surrender value.
- XYZ is likely to perform this calculation using a specialised mortality basis derived specifically for Joe.
- This is something that will not be present in LifeCo's calculations.
- Medical underwriters at XYZ may have given input on both the shape and the level of the future mortality.

- Given that the actual future outlook is so poor, we can expect that LifeCo has a much shorter expected future lifetime in their calculations.

Expenses:

- LifeCo would need to include a regular/annual expense assumption in their prospective calculation.
- There will also be an expense incurred on the death of a policyholder which needs to be included in the calculation.
- These assumptions will be set with reference to their most recent expense investigations.
- The ongoing and terminal expenses contribute to a larger surrender value.
- Margins will not be included here as it will only make the prospective surrender value larger.
- XYZ Brokers will need to include a significant upfront expense in their calculation, since they would need to perform substantial underwriting even to be in a position to offer terms.
- Once a policy is purchased, however, the ongoing expenses should be quite minimal compared to LifeCo's, since they only have to administer the premium payment of the policy.
- They may also have an expense on the insured's death.
- However, this should be minimal since the life office itself will do all the claims underwriting and investigations etc.
- In the case of XYZ, the lack of significant expenses contribute to a potentially better offer.

Inflation:

- The assumed inflation rate would probably be chosen to be consistent with the interest rate/investment return assumption by both companies.
- Alternatively, the expenses can be discounted using a real interest rate.
- This may or may not be the same depending on the assumed expected average future duration of the policy.
- We would expect that XYZ is a lot less exposed to inflation risk than LifeCo, since their view of the future lifetime is much less.

[Total 16]

*Part (i) was generally answered very well, with most candidates getting the majority of the marks on offer. A general observation that can be made here is that some candidates still write too much for the simple "state" instruction, wasting valuable time.*

*Part (ii) was mostly poorly answered. Candidates who structured their answers using the main assumptions as headings did better. The focus was on comparing assumptions and not discussing the merits of a prospective surrender value calculation, as the latter was provided as a given in the question. Very little practical thinking and application was demonstrated in general.*

*A common error was candidates assuming that somehow XYZ Brokers need to estimate what the life office's expense and investment assumptions should be, when they clearly need to use their own. Most candidates also did not write nearly enough for the number of marks on offer.*

## QUESTION 7

i.

Matching investments:

- Hence care costs are linked to a combination of:
  - Living costs (food, clothing, heating and amenities) which may be linked to Consumer Price Inflation (CPI).
  - Housing costs (rent, mortgage payments, property rates and taxes) may be linked to CPI.
  - Personal care costs (i.e. carer or nursing costs) may be linked to average salary inflation (or higher due to scarce skills).
  - Other needs may include intermediate/recuperative care costs (following an acute event requiring hospitalisation) may be linked to medical inflation.
- Care costs are therefore likely to increase somewhere between CPI, salary and medical inflation, and unit-linked fund assets should be invested in assets that can be expected to generate similar returns:
  - Equities and property can be expected to generate positive real returns over long periods, however market values can be volatile over short/medium terms.
  - Offshore equities and property provide diversification benefit, and some protection against inflation (if this is caused by weakening currency, which may be important for medical inflation).
  - Developing market equities and property might provide enhanced returns (due to faster growing economies) but returns may be very volatile (hence exposure should be limited).
  - CPI-linked government bonds (smaller extent), since some costs are expected to increase by CPI.
  - Direct property has the disadvantages of high dealing costs and low marketability, so a small fund may consider investing property indirectly.
  - As the fund is small, exposure to these asset classes should be via collective investment schemes in order to benefit from diversification.

ii.

The two main methods are:

- Market option pricing method.
  - Consider market prices for options that replicate the guarantee, for example European put options on interest rates, call options on bond prices, or swaption prices (for a swap to receive fixed and pay variable).
  - Options terms (interest rate, duration) should reflect the annuity guarantees.
  - If market prices are not available estimates can be provided by market participants.
- Stochastic simulation method.
  - Using a stochastics model of interest rates project interest rates (bond yields) to those ages where the option could be exercised.
  - Assess the probability of interest rates falling below the guaranteed rate, and the average difference, and apply to projected fund values to estimate the potential cost.
  - Calculate a discounted value of the potential cost.

iii.

Investment implications:

- The insurer's charge for the guarantee (which flows into the non-unit fund) should be invested to match the potential cost.
- As the potential cost of the guarantee increases when interest rates fall, the charge could be invested in:
  - Long-dated bonds (however this won't provide a sufficient hedge).
  - European put options on interest rates.
  - Call options on bond prices.
  - Swaptions (for a swap to receive fixed and pay variable).
  - Futures (long on bonds, or short on interest rates), however this hedge is unlikely to be perfect.

[Total 15]

*This question was relatively poorly answered.*

*For part (i) many candidates did not discuss the nature of long-term care costs in sufficient detail as a basis for the selection of the assets for the unit fund. Many candidates failed to link their solution to the considerations for a unit-linked fund. Some candidates gave vague points e.g. increase by inflation (rather than price inflation or CPI).*

*For part (ii) and (iii) many candidates failed to give the full description of the appropriate option.*

**END OF EXAMINERS' REPORT**