Faculty of Actuaries **Institute of Actuaries**

EXAMINATIONS

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Subject 302 — Life Insurance

EXAMINERS' REPORT

Introduction

The attached subject report has been written by the Principal Examiner with the aim of helping candidates. The questions and comments are based around Core Reading as the interpretation of the syllabus to which the examiners are working. They have however given credit for any alternative approach or interpretation which they consider to be reasonable.

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Chairman of the Board of Examiners

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1 (i) dividend = $(V0 + P)(i \quad - i) + (q - q \;\,)\,(S - V1) + [E(1 + i) - E \;\,(1 + i \;\,)]$

$V0$ = value of contract at beginning of year on valuation basis.
$V1$ = value of contract at e nd of year on valuation basis.
P = Gross Premium
i = actual interest rate earned
i = valuation rate of interest
q = actual mortality rate
q = valuation rate of mortality
S = sum assured
E = actual expenses in curred under the contract
E = valuation basis expenses

(ii) **Policyholder Advantages:**

Bonuses are received earlier than under the additions to benefits method.

Bonus may appear fairer, and the bonus is more transparent.

Disadvantages:

Not what was expected when the contract was purchased.

Effectively reduces the premium and final benefit this may not be preferred, especially if the policyholder is targeting a maturity value for a specific purpose

There may be a reduced overall return due to non-deferral of surplus.

Company Advantages:

More marketable, so potential clients can more easily understand the basis.

Disadvantages:

This method reduces the capital to write new business. It constrains investment policy due to the limited deferral of bonus distribution.

It requires a payment system and increased administration generally.

The immediate payment is probably lower, which may reduce the attractiveness to policyholders.

The company would need to inform policyholders of the change, and would probably need to get their consent.

Question 1 was well answered by many candidates. In part (i) many candidates scored full marks and in part (ii) stronger candidates were able to give a wide range of advantages and disadvantages.

2 (i) The model needs to allow for all cash flows as they arise, and for the nature of the term assurance contracts and premium/ benefit structure.
Need to consider time period to be used for calculating cash flows

It needs to have model points representing the portfolio of business expected to be written

It needs to allow for any cash flows arising from any supervisory requirements to hold reserves and maintain a solvency margin

It needs to contain assumptions for items of experience including economic factors such as investment returns and demographic assumptions such as mortality and lapses. It may need to allow for the fact that these assumptions may vary over the duration of the policy. It also needs to allow for interactions between assumptions (e.g. interest rate & expense inflation)

It needs to allow for any options under contracts (e.g. option to effect new term assurance without providing further evidence of health)

It needs to be able to produce reliable output that can be audited However, need to consider accuracy/complexity versus speed/expense of calculation

(ii) Mortality

Assumption should reflect expected future experience. If company has sufficient data to make experience investigation for this contract credible, then would use this to make suitable adjustment to standard table

If there is insufficient data for this class, then a similar class of business could be used, although any adjustments to standard table should reflect this.

Need to take account any changes in target market, distribution channel, underwriting basis etc that may have affected the experience investigation, and which may not be repeated in the future.

Expenses:

The expense assumption should be based on experience that is recent, and this should be adjusted for known distortions over this period.

The expense analysis will split expenses by function and by whether the expenses are linked to premium or to contract.

Need to allow for any increase in expenses from period of investigation to present day.

Commission will be allowed for as paid.
Inflation:

Actual recent experience of company will be compared to current rates of price and earnings inflation.

Withdrawals:

Recent company experience would be used provided it is derived from credible data. If there is insufficient data, then could use experience from other suitable product.

The results of any analysis need to be assessed to see if they have been affected by any special factors such as adverse economic situation, changes in target market or distribution channel etc.

In part (i) most candidates identified the need for a cashflow model. Some explanations of the features required were, however, too narrow and did not draw out wider aspects of the model for example the need for variable or dynamic assumptions. In some cases candidates failed to highlight the fundamental need to make experience assumptions

In part (ii) most candidates identified the key items of experience for a term assurance product and the standard data sources for examining them. However, a lot of candidates lost marks by failing to describe how past experience should be adjusted in the light of future changes in order to make the assumptions suitable for pricing.

3 (i)

- Development expenses
- New business administration expenses
- Underwriting expense
- Initial commission
- Maintenance/renewal expenses
- Renewal commission
- Investment management expenses
- Claim expenses

(ii) The charges should match the respective expenses as closely as possible - both the timing and size of charges should be matched.

For example:

- Charges related to the size of premiu m match commission related expenses (e.g. allocation rate, bid/ offer spread).
- A fixed up-front charge for new business administration expenses.
- An annual policy fee increasing with inflation (e.g. average earnings inflation) for maintenance expenses.
- A fund-related charge for investment expenses.

The benefits of matching include:

- Immediate recovery of initial expenses reduces the initial financing requirement.

- Matching of renewal charges and expenses make it less likely that non-unit reserves are required, and hence also reduces capital requirements and releases profits more rapidly.

- Exact matching removes the sensitivity of the contract s profitability to variations in experience.

- In particular, it eliminates the company s exposure to the risk of early lapses.

Overall, matching can maximise profitability and/or policyholder benefits.

The charging structure also needs to be attractive to the potential market. Some types of charge, such as front end loads, are more obvious to the policyholder and hence can be less attractive (e.g. visible in low early surrender values).

The needs of the proposed target market should be taken into account. For example, if not financially sophisticated then they may prefer a simple charging structure.

The company will not want the structure and level of charges to differ too much from those of competitors.

The company should consider the extent to which it will guarantee the level of charges;

- Removing guarantees may reduce the overall reserves required to be held (including any additional solvency margin).

- But including guarantees could be more attractive to potential policyholders.

If the charging structure is guaranteed, it may be necessary to increase the charges further to allow for this.

It may not be possible to match the charges and expenses exactly for all contracts, for example large and small policies. The company must decide on the extent of cross-subsidy.

Administration and systems implications should also be considered. Existing system structures may limit the types of charge that can be used.

The company may wish to ensure that the charging structure is similar to that under any other unit-linked business that it already writes.

There may be regulatory constraints on the level of charges permitted.

Part (i) was well answered with most candidates picking up full marks. Answers to part (ii) were, however, generally much weaker, with many candidates failing to draw out clearly enough the importance of matching of charges and expenses. Most candidates did cover competitive considerations but only a few covered the pros and cons of using guaranteed charges.

4 The three operational stages of the control cycle are:

Specifying the problem
Developing the solution
Monitoring the experience

All these need to be set in the context of the general and commercial environment and operated in a professional manner.

Specifying the problem:

The problem facing the company is that its current reinsurance arrangements may not be striking the right balance between profit maximisation and risk mitigation. Only limited protection is given against more claims than expected occurring, because the company will pay up to the retention limit for each claim. - too many large claims might put solvency at risk.

But the reinsurer will need margins to cover its expenses and profit. Loading these on top of the company's margins may result in uncompetitive premiums. In any event passing risk to a reinsurer also involves passing profit potential.

Developing the solution:

The solution might be to set a retention limit that is the maximum that keeps the probability of insolvency below a specified level. An alternative approach is to set a retention limit that minimises the sum of the cost of financing a mortality fluctuation reserve below the retention limit and the cost of obtaining reassurance above it.

Whichever approach is adopted, a model of the company's business, together with stochastic simulation of claim rates, could be developed.

If the "ruin probability" approach is used, assets and liabilities also need to be modelled. The first step is to analyse the distribution of sums insured and hence mortality costs

The main difficulty here is lack of data. The company will typically know the number of lives covered by each scheme and the total sum insured, but may not know the distribution of sums insured by age, sex and occupation. It is likely to have fuller data on risks currently being reinsured, and will have underwriting data on lives exceeding each scheme's free cover limit. The choice of model points may therefore be fairly subjective.

The simulations can be run many times for various possible retention limits. The results will give either a probability of ruin or the size of the required mortality fluctuation reserve.

Monitoring the experience:

As more experience data on mortality is built up, the model points can be refined, and the parameters in the model updated. The model can then be re-run and a revised optimum retention limit determined.

The company then needs to decide whether to change its retention limit. There may be other factors beyond the mathematical theory that influence this decision. For example, marketing or competitive reasons.

Most candidates demonstrated good knowledge of the different stages of the control. Most candidates were able to describe the basic problem and the type of modelling exercise required but many failed to apply it to Group business and missed some marks for comments on issues particular to this type of contract.

5 (i) Projections will allow the actuary to assess the ability of the company to withstand future changes in both the external economic environment, and also its own experience. This will enable the actuary to advise the company of the suitability or otherwise of any proposed course of action. For example the actuary may use projections in considering bonus rates on with profit policies, investment strategy or the appropriateness of new business plans

Solvency projections may be a regulatory requirement or recommended by professional guidance

(ii) The immediate supervisory solvency position will be affected by changes in net new business strain. After a long period of stability, there is likely to be a steady state, with strain arising from the most recent year s new business, and repayments from the surplus arising from previous years business.

With a sales force of half the previous size and no increase in average production, new business will reduce by half.

It is unlikely that acquisition expenses will reduce by half because, even if the company had reacted quickly, there would be some expenses that could not have been reduced. Examples might be some management overheads and the costs of maintaining sales offices. Even so, acquisition expenses would be much reduced simply because there are fewer salespeople to pay.

Reduced new business will lead to lower reserving strain.. Therefore the new business strain from the most recent year s business would be reduced, but the repayments from previous years would be unchanged. The net effect of these would be positive cash flows. Thus the solvency position on the supervisory basis would improve.

(iii) In the short term the improvement would continue. The speed of the increase in free reserves on the supervisory basis would depend on the profit profile of the business written in particular how quickly the new business strain is repaid.

Acquisition costs per policy sold will increase as described above. Expenses would be greater than the premium loadings for them. There would also be pressure on maintenance costs expressed per policy. As the number of in force policies reduces, the company will lose economies of scale. Again expenses are likely to be greater than the loadings for them.

So, the profit produced from each new policy would be reduced or might even turn into a loss. This would cause the solvency position to deteriorate in the medium term. In addition the lower volumes will reduce total profits.

The increased renewal costs for the existing business would have to be allowed for within the expense margins in the valuation basis. This would cause an increase in policy liabilities and immediate deterioration in the solvency position as soon as the change is recognized in the valuation basis.

It is possible that, after two or three years of improvement, the solvency position would deteriorate rapidly. Although this could be accelerated if this causes bad publicity and brand damage.

(iv) Any of the proposed courses of action would need to be tested by projecting the solvency position forward.

Possibilities are:

Reprice new business to allow for increased expenses but this might make the contracts unmarketable.

Try and relocate the remaining sales people into fewer offices, and with less management to reduce overheads.

Try recruitment ideas, or more efficiently try ideas to increase average production per sales person e.g. by advertising or other corporate promotions. Consider sales through other sales channels or into other target markets.

Increase variable charges for existing business, if any. The ability to do this might be constrained by PRE.

Consider merger or acquisition activity.

Consider closure to new business completely to remove all new business costs and strain.

Seek capital support from shareholders while possibilities are considered, trialled and implemented.

Most candidates described in general terms why projections of future solvency are useful but some lost marks by failing to give examples of exercises for which they would be useful.

In part (ii) most candidates were able to interpret correctly the impact on solvency the cut in salesforce would have. Only the strongest candidates showed good understanding of the impact on overhead expenses would be different to that on sales expenses though.

In part (iii) again many candidates deduced the right overall impact on solvency. However, many candidates again failed to identify the impact that overhead costs would have given the reduction in scale. In addition very few recognised the need to increase the allowance for renewal costs in the valuation basis and the significant impact that this would have. In general marks for part (iii) were very low.

In part (iv) stronger candidates gave a wide range of ideas for future actions. A number of candidates gained marks for discussing ideas to increase sales or profits on the current business. Stronger candidates also gave wider options when solvency is threatened including seeking additional capital, merging and closing to new business. Some candidates however scored badly by jumping straight to the more extreme options like closing to new business without considering any of the ways of incrementally improving the operation.

6 (i) Reasons for underwriting:

To protect company from anti-selection .This includes from seriously impaired lives that the company would want to decline nnd by identifying lives for whom special terms should be quoted.

To identify the best approach and level of charges where special terms apply.

To classify risks to ensure that standard and impaired lives are treated fairly.

To help ensure that morbidity experience does not depart far from pricing assumption.

To make it easier or cheaper to get reassurance

To reduce risks arising from over-insurance on large proposals.

(ii) Questions on proposal form for each life assured:

Name
Address
Sex
Date of birth
Relevant details of doctor
Height
Weight
Tobacco consumption (normally daily)

Alcohol consumption (normally weekly)
Country of residence
Occupation
Hazardous pastimes (e.g. parachuting, flying)

Insurance history whether an application ha s previously been declined or subject to special terms.

List of other similar policies either in existence or applied for.

Health questions that may include:

- Whether you have any current symptoms.
- Whether you have had any illness in last 5 years requiring medical investigation or treatment.
- Whether any immediate relatives have died as a result of hereditary disorder before age 60, say.
- Whether you have ever tested positive for HIV or any other conditions.
- Whether you belong to identified high risk groups such as intravenous drug users, or similar lifestyle information.

Reason for proposal or other financial underwriting information.

(iii) Insurance intermediaries will want the underwriting process to be as quick as possible. Getting doctors reports will generally slow the process. Therefore, all other things being equal, the company will not want to set its limits too low relative to the market as it may find that intermediaries place business elsewhere.

Conversely, if the company sets its limit too high then it may risk anti-selection. Setting a higher medical limit will reduce the number of reports requested and reduce underwriting expenses. However, the limits must be consistent with the morbidity assumed in the pricing basis. If a high limit is chosen, then the underlying morbidity should be assumed to be heavier than if a lower limit is used.

In addition, the company may seek guidance from reassurers in setting the new limits

To evaluate the impact of choosing a higher limit, the company could take a sample of, say, 100 existing cases with sum assured above the old limit but below the proposed limit. For these cases, compare the present value of any additional loadings with the expenses incurred.

If the savings are more than the value of the loadings then the increase is sensible. If not, then the company could either reduce proposed level until equivalence is reached or increase premiums to reflect the likelier heavier morbidity.

(iv) One method is an addition to the premium charged for the risk. This may be by an addition to the decrement rate of a flat rate (usually expressed as a rate per thousand sum assured). Alternatively, the underlying decrement rate may be loaded by an additional percentage.

A second method is a debt or lien on the sum assured. In this method, the benefit paid in the event of a claim is reduced. The extent of the reduction may be fixed or reduce over time if the additional risk is thought to have a select effect. The reduction may apply for a temporary period.

A third method is an exclusion clause. Under this method claims that arise due to specified causes or pre-existing conditions are not paid.

Part (i) was well answered with a number of candidates scoring full marks. Part (ii) was also fairly well answered with many candidates showing good knowledge of underwriting information sought.

In part (iii) most candidates understood the need to consider competitive and profitability aspects when considering a change in medical limits. However, many candidates did not give enough detail to score well. With regard to the competition, few candidates discussed the practical issues including the impact that the time it takes to underwrite policies can have on intermediaries. In addition, many candidates described a standard profit testing approach or complex stochastic modelling exercise to project future profitability when in this instance using standing data from recent proposals would have given good information for this purpose.

Most candidates answered part (iv) well showing good knowledge of the different approaches to loading policies.

7 (i) The basic risk is that the company will not price the product appropriately. This is likely to be as a result of inappropriate assumptions in its pricing basis

Mortality

The company is exposed to the risk of mortality experience being higher than the level assumed in the pricing. This could arise due to:

- Under-estimation of the underlying mort ality experience within the overseas territory.
- Insufficient allowance for the impact of fatal diseases prevalent in that country (e.g. AIDS).
- Anti-selection by the insurance intermediaries and/or policyholders.
- Fraudulent death claims.

There will be country specific factors such as political unrest or natural disasters

There is the risk that mortality is overstated in the pricing basis and hence the product looks too expensive and sales are low.

Lapse

If actual lapse rates early in the term of the contract are higher than those allowed for in the pricing, then the company will make a loss, because significant expenses are incurred up front for this type of contract (commission and underwriting).

If actual lapse rates later in the contract term are lower than those allowed for in the pricing, then the company will make lower profits than anticipated.

There is also a risk of anti-selective withdrawals, whereby healthier lives choose to lapse if they can obtain lower premiums elsewhere, leaving higher mortality lives remaining.

Expenses

Since premiums are guaranteed throughout the term, there is no opportunity to change the expense loadings once the contract has been written. Under-estimation of expenses will therefore reduce profits. Similarly, under-estimation of future inflation will reduce profits.

The risk is increased due to the fact that the company has no experience of writing this business in this territory, and so has nothing to base the cost estimates on.

If sales of the product are lower than expected, then product and system development costs may not be recouped. There will also be a smaller portfolio over which to spread overhead costs.

The operation would need support in early years until economies of scale are achieved. This should be recouped over the life of the operation.

Marketing

This is a very price sensitive product, particularly when sold through insurance intermediaries. If too few contracts are sold, the impact on expenses is as described above. If too many contracts are sold then, depending on the exact regulatory requirements, there may be a strain on capital resources.

If the average size for new policies differs from that assumed when pricing the contracts, this will affect profitability.

The company should bear in mind that the intermediaries may not be regulated to the same extent as in the head office territory.

As new to the market in this territory, is there sufficient understanding of the target market?

Regulatory

The company is exposed to the risk of changes in the regulatory environment which may reduce the attractiveness or increase the cost of this type of product (e.g. taxation changes).

Currency Risk

There may be a currency risk when repatriating profits.

(Note: investment return is not considered to be a key risk for this type of product, therefore no bonus marks for discussing it).

(ii) **Mortality**

In order to reduce the mortality risk, the company should:

- Obtain and analyse information on the mortality experience of the territory, and in particular of the target market, if such experience data is available.

- Add an appropriate loading to the mortality rates used within the pricing in order to allow for uncertainty

- Develop rigorous underwriting processes and acquire underwriting expertise in that territory.

The company could also:

- Reinsure (a large proportion of) the mortality risk until the company has sufficient of its own experience.

- This would also enable the company to obtain assistance from the reinsurer for pricing and underwriting.
- Include exclusion clauses for certain diseases.

- Operate only in certain geographical locations within the territory, and/or decline certain occupations.

- Underwrite at claim as well as inception, in order to avoid fraudulent death claims.

- Consider offering a renewable/reviewable rather than guaranteed premium term assurance product, so that the premium could be amended after each five year period (say) in order to reflect better the actual mortality experience.

- Consider employing its own medical staff to ensure consistency of assessment.

- Impose a maximum sum assured

Lapse

Lapse rates should be monitored. The analysis should be performed by duration. Premium rates should be revised if actual lapse rates turn out to be inconsistent withthose used in the pricing.

Ideally, lapses should be analysed for each insurance intermediary separately, so that "churners" can be removed from the sales support network or remunerated at lower rates of commission. In addition, training may be provided to those distributing the company's products such that the companies own sales standards are maintained

A commission clawback structure should be developed and enforced, although the company should bear in mind the need to remain competitive (assuming that other companies already offer this product).

Expenses

A tight control over expenses needs to be maintained, particularly given that the operation may be very distant from head office. Regular expense analyses should be performed in order to ensure that expense loadings remain appropriate.

The company might also consider revising the product structure using a unit-linked approach such that expense charges to policyholders can be varied.

Marketing

Realistic sales forecasts are important (also relevant to expense risk). The company should investigate the potential size of the target market and its average disposable income. It should also investigate new business volumes and premium rates of any similar products already offered in that country.

The company should develop good relationships with the overseas intermediaries, in order to reduce the chance of anti-selection or fraudulent activity.

Capital strain could be reduced by putting into place financing reassurance arrangements.

Currency Risk

Currency swaps may be used to mitigate any currency risk

Regulatory

It is difficult to mitigate this risk for existing business, but premium rates for new business should be reviewed regularly in the light of regulatory developments.

Answers to question 7 were varied. Most candidates identified the most important basis elements that represented risks and gave some discussion of mortality, expense and lapse risks. In addition some candidates identified wider issues with overseas countries such as regulatory or tax issues. However, only a few candidates expanded their discussion of basis elements beyond bookwork responses. For example, few included issues that may be particular to overseas countries eg mortality risk from natural disasters or local diseases.

In part (ii) most candidates described the standard risk reduction tools such as reinsurance and underwriting. Discussion of reinsurance was detailed but few candidates covered details of possible underwriting approaches and lost marks. In addition, further marks were available for discussion of actions to understand better the local market and work with distributors in it.

END OF REPORT