

EXAMINATIONS

September 1999

Subject 302 — Life Insurance

EXAMINERS' REPORT

General Comment (comments on individual questions appear at the end of each solution):

In general, this was a fair examination, testing some basic principles. Candidates who were well prepared should not have found it too difficult. Most questions were reasonably attempted with no particular question proving to be more difficult than the others.

As usual, easy marks appear to have been lost by candidates simply stating a number of general points rather reading and answering the questions put. More commentary rather than a list of bullet points is required when the question states “describe” or “discuss”.

- 1 (i) The model should be rigorously designed and adequately documented. This minimises the risk of an undetected error being present.

The model points used should represent adequately the underlying business. Thus, the output from the model will be a reliable indicator of the likely outcome in practice.

The parameters present in the model should allow for all the features that could have a bearing on the purposes for which the model is being used.

This enables the advice given from using the model to address all likely eventualities.

The values assigned to the parameters when using the model should take into account the particular features of the company in question and those of the environment in which it is operating.

Thus, the results from the model will reflect accurately the actual position of the company.

The results from the model should be capable of independent verification. This provides additional reassurance as to the accuracy and reliability of the advice given.

The results should be readily understood by the model's users.

If they are confusing or ambiguous, inappropriate conclusions may be drawn, and may be difficult to review.

Whilst it is important to achieve an acceptable level of accuracy, the model should not become overly complex.

Otherwise, it may take too long to run and be too expensive to maintain.

(ii) The following steps should be taken:

- Set a suitable group of model points to represent the business under consideration. These would either be based on an existing product, or set by reference to the characteristics of the target market.
- Set suitable values for the parameters used in the projection, such as unit growth rates, expense levels, decrement rates and, where appropriate, a basis for determining non-unit reserves.
- Determine a trial charging structure and profit criterion.
- For each model point, assume a tranche of identical policies are issued. Project the policies into the future allowing for decrements through death and surrender.
- Use the projection, the trial charging structure and the input parameters to obtain projected cashflows. These include transfers to and from non-unit sterling reserves.
- Discount the cashflows at the required risk discount rate and compare the result with the target profit criterion.
- Vary the charges until the profit criterion is met.
- Repeat the exercise for the other model points to obtain a comprehensive charging structure.
- Then consider the profitability of the product as a whole, using appropriate weightings for each model point. It may be necessary to accept lower levels of profit for some model points, provided the product meets the profit criterion overall.
- Check impact on overall tax and capital position of company based on expected business volumes
- Discuss the results with the Sales and Marketing area to assess the product's marketability. Hopefully, it will be possible to derive a marketable product which generates the required level of profit. Otherwise, it may not be possible to launch it.
- Consider the sensitivity of the profit to variations in the principal parameters that influence it.

Comment: This question contained a large proportion of the marks available and candidates clearly spent an appropriate amount of time on it. Whilst the principle requirements were well covered, the application of the model in setting charges were poorly attempted.

2 (i) Additions to benefits — reversionary/terminal bonuses

It would be inequitable to charge the whole of the cost to current policyholders when the new computer system will also benefit new business.

Part of the cost could be absorbed by charging future asset shares for the benefit of the computer through an annual depreciation charge — this will have a marginal impact on future reversionary bonuses.

Part of the cost could be offset against free reserves, but this would reduce the ability to use them for other purposes.

The anticipated long term yield from fixed interest investments is normally used as the basis for setting the reversionary bonus rate.

If the increase is expected to be permanent, RB rates will increase but the full amount may not be reflected in the current year as the bonus rates tend to be changed only gradually.

Unrealised gains which can vary from year to year tend to be paid out through terminal bonuses.

Again the terminal bonus rates tend to be smoothed but would be increased at least partly to reflect these gains.

(ii) Contribution method

These expenses will be converted into a per policy expense but again the cost would probably be spread over several years.

This would lead to a reduction in dividends for those contracts the system is used to administer.

The increase in investment income would increase investment surplus which would lead to an increase in the investment component of the dividend.

The income is applied in proportion to the reserves for each contract.

The investment gains could be paid out in part as an increase in the investment dividend — possibly over a number of years.

This could also be used to increase terminal dividends.

Comment: Few candidates achieved a high mark with this question. There seemed to be a view that the rules for the contribution method are “set in stone” and that no judgement is involved.

- 3** (i) A prudent basis, rather than a best estimate, should be used and should include appropriate margins for adverse deviations.

Interest rates:

The rate of interest used in the calculation of reserves should:

- take into account the currency in which the policy is denominated
- have regard to the yields on the corresponding existing assets
- have regard to the yield that is expected on sums to be invested in the future

Where no explicit allowance is made for future bonuses, a rate of interest should be used which is lower than that suggested above by an appropriate amount.

A low interest rate is prudent.

Mortality:

Should be chosen prudently, having regard to:

- sex of the insured
- the type of insurance
- underwriting policy
- the territory of the person insured

A high mortality rate assumption is prudent except for annuity and PHI business, where a low rate is prudent.

Expenses:

Should be chosen prudently having regard to expected levels of administration costs and commission.

The net premium method defines the allowance for expenses to be the difference in value of the net and company premium.

This amount should not be less than the expected expenses determined above.

If a Zillmer is used, the allowance should not be more than the initial expenses actually incurred.

The overall reserve should have sufficient margins to allow for future inflation of expenses, which may be partly covered by a margin in the valuation interest rate.

- (ii) In some countries it is standard practice to price using prudent assumptions and then to use the same assumption for supervisory purposes.

This is suitable for with profits contracts as surplus will emerge from actual experience being better than the prudent assumptions.

This is less justifiable for without profits contracts, although it may still be used.

However the difficulties with this are from a pricing point of view rather than from the supervisory side.

In other countries a best estimate basis is used for pricing, incorporating a risk discount rate.

Such a basis would not be appropriate for supervisory reserves.

Comment: No major problems.

4 (i) Mortality/Morbidity

On death or when a critical illness claim is made a sum assured will be paid out which will be considerably greater than the unit fund.

In addition, the premium will be set such that on a set of assumptions the premium will be sufficient to support the benefits for whole of life.

The company will base the rates it will use for charging on any previous experience it has, on industry rates if they are deemed appropriate and probably with advice from reinsurers.

The extent to which the company can move from any "standard" rates will depend on:

- the volume of data and experience that the company has
- the standard of underwriting that the company uses and
- the type of salesforce and marketing being targeted.

The company will have to take into account future trends in medical treatments which could significantly alter the claims experience in the future, and the likelihood of epidemics.

If the company does not set the tables at the correct level it leaves itself at the risk of paying out more claims than it has costed for.

This is probably the biggest risk of this type of contract, given the uncertainty of future claims experience.

Expenses

When profit testing the contract, the level of charges will be set to recover the expected level of expenses.

These contracts will involve higher costs at the underwriting stage.

For critical illness, high claims cost when determining if the claim is legitimate.

Again any underestimation will involve reduced profits.

If the sales of the product are lower than expected, development costs may not be recouped.

Investment

As above, a premium will be calculated that will support the benefits in the future.

As part of this calculation the fund will be projected.

The investment rate actually earned over time will have to be at least as high as the rate used in the premium calculation or profits will be affected.

Persistency

Higher lapse rates at early years than that assumed in profit testing can affect profitability depending on the charging and surrender structure.

Capital strains

This class of business usually involves heavy costs at the start of the contracts due to both commissions and underwriting costs.

Higher sales than expected may put a strain on the company's resources.

Marketing

The company will have to be sure that the market understand the contract and in particular the concept of critical illness or sales may not be as high as expected.

(ii) Mortality/Morbidity

A high and consistent level of underwriting would assist with this risk.

The risk can also be reduced by reinsuring some element of the sum assured.

For critical illness a clear definition of what is a claim would be required because of the impact of advances in medical treatment and the difficulty of identifying what a particular client is suffering from.

It could remove the guarantee and put a review in this contract whereby the premium could be increased or the sum assured be reduced due to actual factors being different to those assumed in the premium calculation.

Expenses

A tight control over expenses needs to be maintained together with regular reviews to ensure that the actual expenses are consistent with loadings.

The clear definitions for critical illness claims described above would also assist in keeping claims expenses down.

Investment

It would be appropriate to put a review in this contract whereby the premium could be increased or the sum assured if required due to actual factors being different to those assumed in the premium calculation.

Persistency

Careful monitoring of the lapse rates particularly by sales channel and agent is required.

The surrender basis may have to be amended, or commission scales adjusted, due to lapses being inconsistent with those used in the pricing.

Capital strains

Reassurance finance could be used if the profits flow through in the early years of the contract to repay that finance.

This is particularly true if the charging structure is such that the profits emerge in the early years in force.

This means that cash borrowed is not building up interest for too long.

Note this capital will possibly be more efficiently accessed than shareholder funds or money from the Estate.

Comment: This question tested candidates understanding of actuarial risk. Those doing well here tended to do well elsewhere.

- 5** (i) The principles that a company would follow are as follows:

The lump sum paid should not consistently be greater than the earned asset share at the date of discontinuance.

The method and basis used to calculate the lump sums should enable the company to retain a level of profit that is consistent with that retained on non-discontinued contracts

and is consistent with the company's philosophy on how profit accrues over the lifetime of a contract.

At early durations in force, the lump sums should appear reasonable compared with the premiums paid, after making some allowance for expenses.

The scale of values should be consistent with the amount due to be paid on the maturity of the contract, that is there should be no discontinuity at maturity.

The scale used should be consistent with any values disclosed either in the company's literature or specifically to the policyholder at the point of sale.

A company may not wish to appear to be too out of line with the practice of its competitors with regard to the amounts paid on discontinuance.

A company may wish to consider the auction value of its contracts, if such exist. The company would probably not wish to pay out more than these.

The scale of lump sum values should not change too frequently, due to the administrative work involved.

Although the values will usually be calculated by computer, it is desirable that they should not be excessively complicated to calculate.

- (ii) Given that the company will be holding, in respect of a particular contract, assets equal to its reserve, one can see the logic behind the consumer group's suggestion.

BUT this logic is flawed as the reserve will be calculated so that the probability that the liabilities cannot be met is less than some adequately small figure.

Hence the reserve does not represent a realistic value.

In particular, the reserve will be much greater than the earned asset share for most non-linked contracts near to entry, mainly due to the inability fully to allow for acquisition expenses in calculating reserves for supervisory purposes.

For many contracts the reserve may even exceed the earned asset share for a large part of the term.

Hence, the first two principles will not be met.

The third principle will clearly be met, but the values will look highly attractive to policyholders.

This could lead to significant losses being made by the company from early discontinuances.

The lump sum values will be automatically consistent with maturity values for most contracts.

The main exception will be with profits contracts where surplus is distributed using the “additions to benefits” method and a terminal bonus is given.

The reserves for such a contract could be significantly less than its realistic value and will not be consistent with the amount that would be paid at maturity.

Provided that appropriate disclosure is made, the scale of values would be consistent with disclosure information.

Differences between companies in their reserving bases would be automatically reflected in the lump sum discontinuance terms. Hence, competition could lead to problems for a company in choosing its reserving basis.

Given that reserves would usually be higher than realistic values under the proposal, there is unlikely to be an auction market.

The last two principles are likely to be met without problem.

Comment: Generally well attempted.

- 6** There may be a significant change in the mix of business by nature or size leading to changes in the risk profile or capital needs of the company.

The company may not have the resources to meet these changes.

A change in the mix may cause a mismatch between the expense allowances within the charging structure and its actual expenses.

There may be a change in the mix by distribution channel.

This could invalidate the pricing assumptions such as mortality, morbidity and expenses.

The office will have finite resources to cover capital and administration requirements.

The volumes of new business sold may exhaust the available resources.

Comment: There were only a few marks available but a number of candidates missed out on fairly easy marks regarding new business strain.

- 7** (i) The first step is to analyse the distribution of the mortality costs on various assumed retention levels.

The main difficulty is normally the lack of detailed 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.

It will however have fuller details of risks exceeding its current retention limit, and will have underwriting information on lives exceeding each scheme's free cover limit.

One approach is to keep the probability of insolvency below a specified level.

A model of the business together with stochastic models of claim rates and the company's assets and liabilities is built. Allowance would be made for any changes in underwriting costs and profit commission as a result of the change in retention.

Paucity of data may make determination of the model points fairly subjective.

Using simulation techniques a retention limit that leads to a ruin probability of say less than ½% can be determined.

An alternative approach is to consider the sum of the cost of:

- (a) financing a reserve for mortality fluctuations on the retained business and

- (b) obtaining reinsurance — which allows for the reinsurer's expenses and profits.

And to set the retention limit to minimise this cost.

To determine (a) it would be necessary to build the simulation model described above.

The levels adopted by competitors would be taken into consideration.

(ii)	Total Claim	Direct Writer	Reinsurer A	Reinsurer B
(a)	£90,000	£60,000	£30,000	
(b)	£290,000	£80,000	£96,667	£113,333
(c)	£1,000,000	£80,000	£333,333	£586,667
(d)	£1,200,000	£200,000	£400,000	£600,000 L4

- (iii) Assuming life cover of four times salary the surplus treaty will only become exhausted at claims of £1.02m, implying a salary of £255,000.

Thus we are dealing with a handful of individuals in each employer — possibly only the top executive.

The company could seek a second surplus treaty with another reinsurer covering claims in excess of £600,000.

Alternatively, if the number of affected risks is few, facultative reinsurance could be sought for each case as it occurs.

The relative costs of the alternative arrangements compared with the administrative work involved will drive the decision.

Comment: This question proved quite difficult as it tested more understanding and application rather than pure bookwork knowledge.

- 8 (i) The question states that assets be valued at market value. This would need to be specified in more detail as
- for listed securities these will normally be a spread between buying and selling prices — mid-market value could be used
 - for many assets there may not be a market value so further guidance is needed, e.g. property to be valued by professionals or by using PE ratios

Certain assets would be deemed inappropriate for life companies to hold to meet their liabilities, e.g. collectibles, yachts, time-share properties, precious metals as their value is too volatile/risky. Such investments could be deemed illegal or discouraged by not allowing a value to be placed on them.

There would be rules for depreciating capital assets.

The legislation should try to restrict the concentration of risk. This would be done by limiting the values (as a proportion to the liabilities of the company) which can be placed on certain types of assets, individually and/or collectively.

The risk of default would also be limited by restricting the values which can be placed on assets which depend on a particular counterparty.

- (ii) **Mortality/Morbidity** — A requirement for prudent assumptions including allowance for future adverse changes in experience (e.g. AIDS for assurances or mortality improvement for annuities) taking account of the country of residence of the policyholder.

Interest Rates — A maximum interest rate depending on yields on existing assets less some prudential margin (say 5–10% minimum but more for high risk assets) to allow for the risk of reduction in yield obtained.

Also have conservative assumptions about the (unknown) investment return on sums to be invested in future in each relevant currency, with possible blending in over 2–5 year period

- an overall limit to yield on existing assets less a prudential margin could also be applied
- hypothecation of assets to different groups of contracts could be allowed for the purpose of this assessment of interest rates.

Bonuses — Declared bonuses would be valued as part of the guaranteed benefits.

The valuation should have regard to the custom and practice of the company with regard to the manner and timing of the distribution of profits.

It would normally be quite unreasonable to require explicit allowance to be made for current rates of reversionary bonus in conjunction with a valuation interest rate that is much lower than the rate of investment return currently being earned.

A solution might therefore be to reserve for the level of future bonus that could be reasonably expected on new policies issued on equivalent premium rates, assuming future rates of investment return equal to the valuation interest rate assumed.

Taxation — Allow for reduction of interest rate (and expenses) as appropriate in line with current and future expected rate of taxation in the country.

Expenses — Allowance required for expected costs (including commission) of maintaining business including future inflation, likely to be on a run-off rather than a going concern basis and with allowance for transitional expense overrun period.

Resilience — Consider effect of changes in investment conditions (e.g. fall in equity and property values or changes in interest rate) on ability of the company to set up adequate reserves and meet liabilities. Also, allow prudently for any currency mismatch.

Surrenders/Lapses — Ignore unless likely to increase liability, as level of surrenders and effect on the company is uncertain especially if surrender values discretionary.

However, any guaranteed surrender value within say 12 months should be covered by reserve at valuation on assumption of 100% surrenders.

Negative Values — Eliminate

Options — Allow for effect of options exercisable by policyholder

Reinsurance — Offset allowable, subject to assessment of financial strength or adequate security

Calculation — Individual policy by policy, but approximations and generalisations may be allowable if it can be demonstrated satisfactorily that results are at least as high

In addition — the statutory valuation rules are likely to be supplemented by appropriate mandatory professional guidance notes which deal in more detail with certain technical aspects.

Comment: Some easy marks were lost by not considering all of the points effecting the liability calculations but only concentrating on mortality/interest and expenses.

- 9** The values assigned to the parameters should reflect the expected experience of the lives who will buy the contract.

These values should be based on adjusted standard tables where available.

If the company data is adequate the values should take account of past company experience, adjusted for any known factors which are not relevant for the future.

Company experience of a similar class of business may be a suitable substitute.

Any data used will need to be based on a credible data sample and allow for future trends.

Standard tables produced by industry sources such as the Continuous Mortality Investigation Reports in the UK or life reinsurance companies should be considered.

Levels of underwriting will affect the experience so should be considered particularly if it is changing from existing levels.

The sales method should also be considered as different sales methods are usually associated with different social groups who may experience different demographics.

Comment: Fairly well done.