

EXAMINATIONS

September 2001

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 examiners are mindful that a number of interpretations may be drawn from the syllabus and Core Reading. 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.

The report does not attempt to offer a specimen solution for each question - that is, a solution that a well prepared candidate might have produced in the time allowed. For most questions substantially more detail is given than would normally be necessary to obtain a clear pass. There can also be valid alternatives which would gain equal marks.

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Chairman of the Board of Examiners
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Overall candidates found this paper much more difficult than in previous sittings and the pass mark was reduced accordingly. The two questions that required substantially more wider thought than reproducing bookwork were particularly poorly answered. The lack of ability to develop ideas from a combination of background knowledge, common sense and general reasoning was the most significant factor in the low pass rate.

- 1** The aim of catastrophe reinsurance is to reduce the potential loss to the ceding company due to any non-independence of the risks insured. It also lowers the probability of ruin in most future scenarios that might be tested, and avoids possible deteriorations in the solvency position.

The cover is typically only available on a yearly basis and has to be renegotiated each year.

The reinsuring company will agree to pay out if a “catastrophe”, as defined in the reinsurance contract, occurs. There is no standard definition of a catastrophe but, typically, there needs to be a minimum number of deaths arising from a single incident occurring within a specified time of that incident.

The reinsurance contract will also specify how much the reinsurer will pay. This might be the excess of the total claim amount over the ceding company's catastrophe retention limit. The total claim amount would be net of any amounts reinsured on an original terms or risk premium basis.

The reinsuring company's liability in respect of a single catastrophe would be limited to a maximum amount. Any amount above that would fall back to the ceding company. There is also usually a maximum amount of cover per life.

The cover would usually exclude war risks, epidemics and nuclear risks.

This question was generally answered well. Unsuccessful candidates simply did not cover the features of the contract in adequate depth.

- 2** The model needs to allow for all the cash flows that may arise from premiums, expenses and benefits, including those arising from the need to hold supervisory reserves and an adequate margin of solvency. It also needs to allow for the interaction of assets and liabilities and the potential cash flows from any health or other options.

The model will use parameters to represent demographic, expense and investment experience. Parameters need to be set realistically, and to be self-consistent.

The model should utilise stochastic models or simulation to assess the impact of financial guarantees, and should utilise a suitable time period, in this case probably annual.

There should be sufficient model points to represent the expected new business.

The model should include an objective result (such as NPV of profits or Return on Capital) that is capable of independent verification for reasonableness. It should not be overly complex and therefore will not be too expensive to operate.

The model should be rigorous fully tested and well documented.

This is a relatively common piece of bookwork that should be, and in general was, well known to candidates. The lack of references to the need to establish reserves and solvency margins was disappointing.

- 3** This is a new product for the company and it thus has no experience of its own to use in setting the pricing basis.

The basic structure of the product involves a mismatch between charges and expenses, with charges increasing with duration as fund values increase, and expenses being incurred largely at the start of the contract.

Withdrawal rates may be higher than expected. With a large part of the total charges emerging late in the term of a policy, this would significantly reduce the profitability of the business. This risk would be particularly acute if the company paid initial commission under the product.

Administration costs may be higher than expected. This would reduce the residual charges left to recover sales costs and to provide a profit.

Development costs may be higher than expected, making it more difficult to achieve an acceptable return on the capital invested.

Insufficient new business may be generated to recover the costs incurred when developing the product. This may be due to various reasons, e.g. unrealistic plans or unfamiliarity of the sales force with the product or market.

The average premium size may be lower than expected. With administration costs but not the charges largely independent of premium size, this would reduce the profitability of the business.

More new business than expected will result in the demand on capital being higher than expected, placing a strain on the company's ability to finance the business — or reducing the volume of business that can be written.

The company's investment performance may be poor relative to competitors, reducing the marketability of the product.

Future investment returns may be lower than expected, reducing the size of the fund-based charge.

Competitors may deliberately undercharge their product to buy market share, forcing the company to respond or to accept lower levels of new business.

Given the difference with the company's current product, greater problems than expected may be experienced developing new administration systems or training staff in the new product.

Future legislative change may undermine the product.

The company might have a miss-selling risk, particularly as it operates through its own sales force.

Most candidates generated the standard risks described in the core reading. Unsuccessful candidates did not, in general, explain why the risk existed or identify which were the principal risks. Mortality, for example, is not a significant risk.

- 4 The company's current surrender values are unlikely to be competitive, particularly at long durations. The precise position will depend on how much of the overall return under a policy is paid as terminal bonus and on the details of the prospective basis currently being used. There will also be a discontinuity at maturity, due to the addition of terminal bonus at that point.

Hence, a change is desirable, particularly to ensure equity between policyholders.

The company is likely to want any change to move the surrender value closer to the asset share underlying a policy, although some deduction from the asset share may be justified to protect the interests of continuing policyholders.

Adding terminal bonus should achieve this aim close to maturity, and will also eliminate the discontinuity between maturity and surrender values.

However, adding the normal scale of terminal bonus will not necessarily produce a surrender value close to asset share at shorter durations. The terminal bonus that brings the sum assured and bonus up to asset share at maturity will not necessarily bring a prospective surrender value up to asset share midway through the term. Indeed, adding full terminal bonus may produce surrender values at some durations that exceed asset share.

The surrender value under the proposed basis should therefore be compared with the asset share for a range of specimen policies, giving an adequate coverage of the in force business. This may indicate that the terminal bonus scale should be adjusted, for example by making a percentage reduction to the scale for maturities. An alternative would be to have a completely separate terminal bonus scale for surrenders, although this may be more complex administratively depending on the capability of the current administration systems.

The proposed surrender values should also be compared with those payable by other companies and with auction and TEP values. This may indicate that surrender values have to be set above asset share at short durations for competitive reasons.

The implications of the change on other benefits should also be investigated. For example, the company may be subsidising maturity values by recycling surrender profits. Following the proposed change, the scope for this will reduce or disappear.

The implications of the change for PRE should be considered.

The company should also check that the new approach should in general be stable but also be capable of accommodating future changes in experience.

Any change might require new business quotations to be altered.

The question did not indicate that only the additions to benefits method was to be considered. Candidates were not penalised for discussing other methods of surplus distribution. There were a lot of issues that required application of the principles surrounding surrender values and with profits business in general. Only the best candidates were able to move beyond the standard "principles of early termination values" question that is frequently asked.

5 (i) The reserves should ensure that all the liabilities arising from the existing policies can be met. These include:

- Guaranteed benefits, including any declared bonuses that are guaranteed and any guaranteed surrender values.
- Any options available to the policyholder.
- All future bonuses, taking into account the reasonable expectations of policyholders.
- Expenses.

Credit can be taken for future premiums.

The valuation should be prudent, including appropriate margins for adverse experience.

It should take account of the nature, term and method of valuation of the corresponding assets.

Suitable approximations are normally permitted.

The rate of interest used should take account of the currency in which the liability is denominated and the yield expected to be earned in the future.

The demographic, withdrawal and expense assumptions should have regard to the type of insurance, the territory of the persons insured and the costs expected to be incurred.

Where no explicit allowance is made for future bonuses, the valuation rate of interest should be appropriately reduced.

The method of valuation should recognise profits appropriately and should avoid discontinuities from arbitrary changes of basis.

The method and basis should be disclosed.

- (ii) The guaranteed sum assured and declared bonuses are valued directly. For with profits contracts, allowance is made for future bonuses through a reduction to the valuation rate of interest.

The method takes credit for future premiums by valuing the net premium.

For regular premium policies the margin between the office and net premium allows for future expenses implicitly. If this is not adequate an additional reserve needs to be held. An expense reserve is always required for single premium and paid-up policies.

For with profits contracts, the difference between the office and net premium also includes a margin for future bonuses. Terminal bonus is not reserved for explicitly. However the method is used with a book value of assets, so that investment appreciation is taken to an investment reserve and not brought into the comparison between assets and liabilities when surplus is determined.

The mortality, interest and expense bases used in the valuation are set prudently, by reference to current and expected future experience.

The method produces a smooth emergence of profits, if used in conjunction with assets taken at book value.

The method and basis are simple to describe for disclosure purposes.

Part (i) was very well answered. In part (ii) most candidates failed to point out that terminal bonus is not reserved for and the implications that flow from this.

- 6 (i)** Implementation of a claims management process should, in the short term, lead to an increase in claim termination rates since some of the claims currently on the books are likely to be terminated as a result of the intervention by health professionals.

The treatments given should lead to some claimants returning to work sooner than they otherwise would have done.

The process should also lead to a reduction in claim inception rates — since some of the claims notified to the insurer during the deferred period, which in the past would have been admitted, will no longer incept as a result of the early

intervention by health professionals.

In the longer term claim inception rates should remain lower than the rates experienced prior to the introduction of the claims management process, as a lower proportion of the claims notified will reach inception.

In addition, the company may find that once policyholders and intermediaries become aware of the claims management process, borderline claimants may be discouraged from claiming — so the actual number of claims notified may decrease.

Termination rates may stabilise, since the type of claim, which led to a reduction in claim termination rates in the short term, will no longer incept.

The claims management process should weed out some claims at an earlier stage and so more claims that do incept should be “genuine” claims.

It is possible that the termination rates of the remaining claims will be less than the aggregate portfolio prior to the process being introduced because the population of claimants remaining is entirely different. It is equally possible that the termination rates will be greater because of the new procedures.

- (ii) Experience should be measured prior to the introduction of the claims management process.

Claims inception and termination rates should be expressed, for example, as a % of a standard table.

Claims experience should then be monitored following the introduction of the process and again expressed as a % of a standard table, for ease of comparison with the rates experienced prior to the introduction of the process.

A standard table for measuring sickness that is suitable for the territory of business may not exist. If this is the case then a numerical comparison of the (capitalised) claims costs with earned premiums could be used instead or reinsurers' rates could be used for comparison

Experience analysis should be carried out, splitting the **claims** and **exposure** data by:

- age
- sex
- definition of disability
- duration in force at claim inception
- duration since claim inception
- benefit details (e.g. benefit amount and deferred period)
- territory
- distribution channel
- medical/non-medical
- smoker status
- occupation

As the claims need to be compared with the corresponding exposure, care needs to be taken to code the claims according to when they incepted rather than the later point at which they were admitted, with a provision for IBNR in the most recent year.

A balance will need to be struck between wanting to split the claims into as many homogenous groups as possible and having sufficient data in each of the cells for the results to be credible. This may lead to the grouping of the data, For example, into age bands, grouping of similar occupations and so on. In practice it is unlikely that sufficient data will exist to analyse by type of sickness.

If there is sufficient data analyse individual years separately or in small groups to establish any trends.

This analysis measures experience prior to the implementation of changed procedures. To set the initial new pricing assumptions it needs to be modified to allow for past trends observed, and then further modified to anticipate the effects of the change in procedures.

After the change, the results of further analyses would need to be modified to allow for the one-off effects of the change in procedures (e.g. instant termination of a number of claims). The initial new assumptions could then be revised or corrected.

Allowance for the changed costs of claims management, both internally and in additional medical costs needs to be made.

Part (i) was very poorly answered. Few candidates showed any ability to think through the scenario and show any application of their knowledge. In particular the existence of a deferred period in this type of contract was almost universally ignored. Part (ii) reverted to a frequently asked type of question, and was answered adequately.

7 (i) The principles of investment can be stated as:

(a) A company should select investments that are appropriate to the nature term and currency of the liabilities.

(b) The investments should also be selected so as to maximise the overall return on the assets, including both income and capital.

The extent to which (a) may be departed from in order to meet (b) depends, *inter alia*, on the extent of the company's free assets.

Alternatively they can be expressed as:

The company should invest so as to maximise the overall return on the assets, subject to the risks taken being within the financial resources available to it.

(ii) The regulatory framework may influence the investment decisions in a number of ways:

- It may be illegal to invest in certain types of asset.
- Although legal, some types of asset may not be able to be taken into account for solvency purposes.
- Or they may only be taken into account to a limited extent.
- To prevent over-exposure to single counterparties, particular securities may only be able to be taken into account to a limited extent.
- It may be compulsory to hold a certain proportion of the liabilities in certain types of asset, e.g. government securities or cash.
- It may be a requirement to match liabilities with assets denominated in the same currency.
- Restrictions on liability valuation interest assumptions may be related to features of the associated assets. The need or desire to minimise the value of liabilities (and therefore maximise the free reserves) may thus influence the asset choices.
- Tax regime may treat some types of asset more favourably than others.
- There may be a regulatory requirement to establish mismatching reserves. The use of risky assets with a potential for high investment returns is likely to require higher mismatching reserves.

(iii) The main features of the liabilities are:

- The annuity payments are guaranteed in monetary terms and are likely to extend many years into the future.
- With a large enough portfolio to eliminate mortality fluctuations, it is possible to construct a reasonably credible model of the overall cash flows.
- Expenses are likely to increase, probably somewhere between price inflation and earnings inflation.

The starting point would be to determine a portfolio of guaranteed fixed interest securities with cash flows that match the expected liability cash flows. This may well be impossible, particularly if there are a number of young lives or a large number of joint life last survivor annuities in the liabilities. It may not be possible to find assets of long enough duration.

In this case the portfolio that is best immunised against changes in interest rates might be chosen. Immunisation means that the changes in value of assets and liabilities move together as closely as possible for small changes in interest rates.

Government stocks give absolute guarantees and are readily marketable.

However, stocks issued by regional authorities and guaranteed by a group of governments (e.g. the World Bank, the European Investment Bank) are just as secure but less marketable. They give a higher yield because of this, and may well be used. The theory used implies that they will be held to maturity so marketability shouldn't be a problem.

Stocks issued in a different currency to the liabilities do however introduce a currency mismatch.

Corporate debt gives a still higher yield, but carries a risk of default as well as poorer marketability. If the office has adequate free assets to cover the risk, corporate debt of high quality companies might be used to secure the extra yield, although the extra risk should be allowed for.

Future expenses are likely to be matched by assets increasing in real terms. Both equities and index-linked gilts provide this feature.

- (iv) (a) A portfolio of index-linked securities might theoretically be able to be found to match the annuity outgo. Providing that the assets can all be held to maturity, the position is exactly as for fixed annuities.

The range of non-government index-linked securities in most countries is much smaller than government stocks, so there is less opportunity to achieve an increased yield at increased risk.

If the model requires the assets to be sold prior to maturity the immunisation theory breaks down, because market values of index-linked stocks do not move in line with the index, but reflect the market view of future inflation.

There may not be any sizeable market in any form of index-linked stocks, so some other type of 'real' asset would have to be used and any mismatching risk allowed for.

- (b) Equity-linked annuity instalments suggest that investment should be in the stocks comprising the index.

Equities have no maturity date and so may have to be sold eventually, though in practice with a growing portfolio this need not be the case.

It may be impractical for the company to invest in the index directly because of the number of holdings necessary. A tracker fund could be used, but would incur additional charges. Another option would be to replicate the index performance by means of a derivative strategy. This also has adverse cost implications.

Parts (i) and (ii) were well answered, part (iii) adequately and part (iv) poorly. Few candidates were that index-linked stocks only provide an index return if held to maturity.

- 8 (i) In the pricing process, assumptions will have been made for the portfolio in aggregate about:

- Average case size
- Persistency
- Per policy expenses.

If you "reward" favourable experience in one part of the portfolio by enhancing terms, then by implication you should worsen terms where experience has been worse than assumed unless the new arrangements actually alter the above features.

As total profit is the product of profit per unit and sales volume, increased sales at the expense of lower unit profit could increase company's overall profits.

Unless there are surrender penalties, the only source of revenue is the annual management charge, which is directly related to the size of the fund.

The better that persistency is, the more revenue should accrue to the company over time and hence, all other things being equal, profit per unit should be higher.

Acquisition expenses will comprise commission, sales related costs, new business processing costs and contributions to fixed overheads and profit. The first two are likely to vary in proportion to the premium, and so average case size will have no effect on them.

New business and renewal processing costs are likely to be largely fixed per policy. For a higher than average case size, this implies lower expenses as percentage of premium, and higher profit per case.

Additional sales of business with better persistency and higher average case size will lead to different averages from those assumed in the pricing basis and the changed averages will result in higher average profit per case.

Increasing commission to some of the business will increase average per policy expenses. This will bring the average profit per case down again, but as long as the total profit for the company increases, after allowing for the increased sales, the result is acceptable.

If other intermediaries discover this deal, they may try to negotiate similar terms. If you refuse, they may place their business elsewhere, reducing overall new business levels. Ultimately, pressure may build across the whole market for higher commission.

Improvements in persistency might be secured by offering renewal commission terms, rather than enhanced initial commission.

As a minimum, the revised terms should ensure that the business covers its marginal costs, and makes a positive contribution to overheads and profit. It is thus worthwhile writing the business. However, you cannot price ALL your business in this way, or you will fail to cover all your expenses, and ultimately solvency will be threatened.

The proposal deserves investigation and sounds reasonable, as long as projected sales volumes justify the effort involved.

- (ii) The investigations will form part of the financial control cycle of the company. In particular they will assist in the analysis of the movement in both embedded value and statutory surplus. Both analyses will be carried out for the business in aggregate, and for the business of the intermediary concerned.

Persistency investigations:

Individual policy data by intermediary should be available, as systems are required to ensure that correct commission is paid.

If there is a regulatory requirement to monitor the persistency of intermediaries some data suitable for a basic analysis may be available, but otherwise this is unlikely.

There may already be information available for the class in aggregate as a result of other work done e.g. for regulatory purposes, or for setting embedded value assumptions.

The sorts of statistics which would be useful is a simple count of contracts and premium issued in a period, and then how many are still live after 12, 24 and 36 months.

Exits from other causes (deaths) are likely to be relatively few and may be ignored without invalidating the analysis.

Partial withdrawals reduce fund size and hence the annual management charge income, but they do not reduce the number of policies to be managed. Thus the charges and expenses show different rates of reduction. It is thus necessary to allow for the rate of reduction in funds through partial withdrawals.

Expense investigations:

It is necessary to verify that the intermediary's average case size is higher than the portfolio average.

Per policy acquisition expenses need to be calculated. These then need to be restated as a percentage of average case size both for this intermediary and the business in aggregate.

The staff that administer the business may be separately identified which makes the analysis more straightforward. Otherwise, some form of time sheet analysis will be required to allocate new business admin staff salary costs to this product line.

Expenses need to be split into initial, renewal and claim. Non-salary costs such as rental and computer costs for the division will be allocated in proportion to the salary costs. Any one-off costs would be amortised. If they are eliminated, care should be taken to ensure that they are covered elsewhere.

The total costs can then be divided by the number of new business applications processed, which will give a marginal per policy acquisition expense.

A contribution to the overheads of the business can then be added.

A per policy maintenance expense will be required for profit testing purposes. This can be obtained from existing expense analyses, as there is no reason to suppose that the sales director's proposal will have any effect on the maintenance costs.

This question was extremely poorly answered. Many candidates seemed to think that whenever the "sales director" appears in an exam question, his ideas must be ridiculous and require demolishing. In part (i), few candidates thought through the consequences of total profit being the product of unit profit and number of units, which was the crux of the solution.