EXAMINATIONS

April 2000

Subject 302 — Life Insurance

EXAMINERS' REPORT

1 (i) The solvency capital provides an additional level of protection to the policyholders over and above that provided by the reserves alone.

The objective is to reduce the likelihood of the insurance companies becoming insolvent in reasonably foreseeable circumstances. In practice the SC provides additional protection by acting as an early warning system, and/or triggering powers of intervention for the regulator.

Note: "Solvency Capital" = Required Minimum Margin in UK terminology; not RMM + mathematical reserve.

(ii) When considering the adequacy of the reserves that have been set up it is important to do this in the context of the solvency requirements and not in isolation.

Similarly when setting the solvency capital requirements it is important to consider the level of reserves already set up.

The balance between the two components can.

However countries where reserves are on a relatively weak basis tend to have a substantial level of solvency margin and vice versa.

This question was answered adequately by most candidates.

2 One must minimise the risk of the model not representing the products

The model being used must be valid, fully tested, rigorous and completely represent the business being modelled.

The parameters being used for demographic, investment, expense and product details must be relevant, accurate and appropriate for the business being modelled.
This includes the fact that these must represent the experience of the company.
The model must be capable of sensitivity testing using different parameter values.

The data being used to represent the expected portfolio of business and the premium/sum assured relationship must be accurate and fair.

The outputs from the model should be capable of independent verification for reasonableness and should be communicable to those whom the advice will be given.

Failure to comply with these basic principles will mean that the model may be inappropriate and misleading as a tool in managing the finances of the business.

In particular an actuarial model would be a tool that would be used to assess both the future profitability and expected solvency position in future years.

An inappropriate model may lead to lower profits or the need for more capital or at worst threaten the solvency position of a life company

On top of the above, a model would be expected to be inexpensive to operate and not overly complex.

This question was answered adequately by most candidates.

3 The most important feature the company will need to consider is the form of the benefit and the circumstances under which it will be paid.

These need to be attractive to the market in which it is intended to operate and the distribution channels open to the company.

A benefit paid as a lump sum will avoid longevity risk, or the cost of care increasing. If benefits are defined as "meeting the costs of care" rather than in cash terms, the company must assess the costs of care to be covered, and test the sensitivity to the level of those costs.

This will reduce overall costs, but may generate a marketing risk in that the benefits may not be enough to cover the eventual cost of care.

Similarly the more conditions that need to be fulfilled before the benefit is paid the lower the cost. This may be good or bad from a marketing point of view.

Good because premiums will be lower; bad because claims may not be paid when some policyholders think they ought to have been.

If the definition of the insured event is loose, the company will incur additional costs in disputing claims and will find it difficult to obtain reinsurance. Answering by means of an example of "loose definition" is OK

Similarly, highly unusual benefit changes might make obtaining reinsurance difficult. The company will require new underwriting abilities and additional underwriting staff. Both for point of sale underwriting and claims admission. And will need to develop new underwriting guidelines and rules.

Although in general the company will not want the structure and level of charges to depart too far from those of competitors, a novel definition of the insured event may differentiate the contract sufficiently in the market so that competitiveness on price is less significant.

In order to make adequate profit, premium rates must be adequate to cover benefits and expenses (including inflation of claims costs and expenses) in most foreseeable circumstances. Profitability conflicts with marketability and competitiveness.

It is also desirable to have a design that minimises sensitivity of profit to changes in experience. The available experience data for this type of contract is still limited, and this company has no data of its own. Assistance may be sought from reinsurers. Overseas experience can be used but one needs to adjust it for the

different risks, benefits and state social benefit schemes, all of which will affect the experience. The expected cost of claims will be affected by the target market and the type of distribution.

Consideration will need to be given to the financing requirement and the solvency margin that needs to be established. A design that reduces these also reduces the overall cost.

The extent to which premium rates and early termination values are guaranteed or reviewable will influence both the overall cost and the market perception of the contract.

The company needs to consider the extent of any cross-subsidies between e.g. large and small contracts.

The marketing advantage of simplicity conflicts with the desire to avoid cross subsidies and associated anti-selection.

It is necessary to ensure that the contract as designed can be administered on the office's systems.

Benefits may need to dovetail with State social benefit schemes.

The plans may need to take account of any government initiatives in this area.

The question indicated that answers should specifically consider benefit design and claims definitions. Most candidates did not give these issues adequate attention.

4 Investment Returns

- There are significant investment risks for the company in offering this product due to the maturity guarantee.
- The policyholder can choose his own investment links, which implies the company has little control over the risk.
- Risks could be reduced by limiting the fund choice.
- The company is exposed to reinvestment risk-current investment returns may be high but as the product is regular premium the future level of investment return is unpredictable.
- Volatile assets such as equities mean the risks of not attaining the necessary return are greatly increased.
- The ability of the policyholder to switch investments from one fund to another may increase the risk that the policyholder may make inappropriate changes in investment.
- Indeed towards the end of the term, if the guarantee is likely to bite, the policyholder may deliberately switch to a more volatile fund to gain possible reward without any downside risk. The cost of the guarantee will depend on the level at which it is set.

Expenses

- The company is vulnerable to higher expenses (due to high inflation), but the ability to pass these costs onto the policyholders will be limited by both competition **and** policyholders' reasonable expectations.
- High inflation may be associated with high investment returns. Increased fund management charges may offset increased expenses. The converse point is also acceptable (low inflation and investment returns means lower than expected management charges).
- The guarantees imply that high expenses are a risk and inflation over 10 years will be very difficult to predict.

Mortality

- The death benefits are set at outset, the charging structure of a unit linked contract is likely to mean that increases in mortality cannot easily be passed on to the policyholders.
- If excess mortality or expenses costs are passed to the policyholder it may simply mean the maturity guarantee is more likely to bite hence exposing the company to the risk.
- The sum at risk is likely to be low so the mortality risk is likely to be small.

Withdrawals

- Higher than expected withdrawals are likely to be a risk to the company.
- They mean profits are likely not to be as high as expected hence increasing the effect on the company if the guarantee bites.
- Withdrawals are likely to be selective.
- If they are low when investment returns are poor the company has a higher exposure to the guarantee.
- If they are high when returns are good, the management charges the company can expect to receive will be reduced.

Volume of new business

- If this is a market leading product the company is at risk of writing 'too much' business and over stretching its resources. A different mix of business from expected (e.g. different average policy size) may be a risk to profitability.
- Particular problems may exist with capital.
- There is a risk that a competitor may introduce an even more attractive product and hence volumes sold may be significantly less than predicted and hence the fixed launch costs may be relatively high causing losses.

Capital risks

- The company may not have sufficient assets to meet the valuation strains caused by the product's guarantee, particularly if investment conditions or regulatory requirements change.

Question 4 was generally answered poorly. Many answers only quoted standard bookwork, without applying it to the situation given in the question (i.e. the maturity guarantee).

5 (i) The fundamental principle is that dividends are paid to individual policies in proportion to the policies' contribution to surplus.

The dividends may be built up by calculating the profits arising from mortality, interest or expense (or "loading") surplus.

The dividends are often paid as cash but may be:

- left on deposit with the insurance company;
- used to increase benefits by "paid up additions"; or
- used to decrease future premiums.

Other approaches exist for determining the amount of the contribution. One in particular is to compare the statutory reserve with the earned asset share. If the latter exceeds the former, the company will return a proportion to the policyholder.

This proportion is determined so as to avoid the statutory reserve ever exceeding the earned asset share. This implies using an artificial earned asset share that limits the problem of new business strain.

Using this approach, the theoretical dividend can be determined for specimen contracts in relatively homogeneous groups. From these figures, a simple practical scale to apply to all contracts can be determined. If the company has shareholders, part of the surplus identified may be paid to them.

A terminal dividend may be given, which effectively returns to the policyholder at maturity part of the difference between the true earned asset share at that point and the sum assured.

(ii) It is difficult to identify exactly what the investment, mortality and expense surpluses are for individual policies. In practice the calculations may be carried out for homogeneous groups of policies.

The process can lead to small amounts of cash being paid. For some policies the surplus may be negative.

Some element of smoothing in the experience may be required to prevent the dividends from becoming too volatile.

The calculations are complex, being different for virtually every policy or homogeneous group .

This can make it difficult to explain to policyholders how the amount was derived.

Also historical information need to be kept on premium bases, which need to be adjusted for policy changes.

(iii) Dividend = $(V0 + P)(i'' - i) + (q - q'')(S - V1) + [E(1+i) - E''(1 + i'')]$

Where

V0 = value of contract at beginning of year on valuation basis
V1 = value of contract at end of year on valuation basis

P = gross premium

i'' = actual rate of interest

i = valuation basis rate of interest

q'' = actual rate mortality experienced

q = valuation basis rate of mortality

S = sum assured

E'' = actual expenses experiences under the contract

E = expenses experienced under the contract according to the valuation basis

This question was answered adequately by most candidates.

6 (i) *Note: The question says "reasons" for underwriting and the solution says "purposes". There is a subtle difference here – candidates who have answered literally "why is this application being underwritten?" can get credit if their answers are valid.)*

The main purpose of underwriting a client's application is to establish the risk classification of the client. In particular to establish if the client is

- Uninsurable
- Acceptable on normal terms
- Subject to special terms

Adequate risk classification will help prevent the risk to the company that a client selects against it (i.e. counteract anti-selection).

Underwriting enables the company to ensure mortality experienced is no worse than mortality assumed. Reinsurance terms available will be better than for non-underwritten business.

To accept as many proposals at ordinary rates as is consistent with the mortality rates assumed.

To enable a life insurance company to calculate the special terms a proposal should be offered if not acceptable at ordinary rates.

To ensure equitable treatment of all potential policyholders; both those acceptable at ordinary rates and those not.

The company will expect to justify the cost of underwriting by reference to the cost of claims saved.

Financial underwriting can help avoid over-insurance.

(ii) Typically medical evidence can be obtained from the following sources:

- Questions on the application or proposal form completed by the applicant or a declaration of good health.
- Reports from medical doctors that the applicant has consulted
- A medical examination and report carried out on the applicant
- Specialist medical tests (such as AIDS/HIV test)
- Applicant's answers to further questions asked by the company
- Previous applications to the insurer or to other insurers.

(iii) The options available to a company if the underwriting process finds a client to have a higher level of risk than assumed by the company are as follows:

- Charge an additional premium for the additional risk.
- It may charge an additional premium for a limited period of time if the risk is of that nature.
- Reduce the level of life cover available for the premium payable, or impose a debt which could reduce over time
- Impose an exclusion clause, which excludes payment of the benefits that arise from a specific cause
- It could decline the application. There may be legal or regulatory constraints on declining an application or imposing special terms.
- It could defer the applications (usually only used where the illness may be of a temporary nature)
- It could offer an alternative contract where the mortality risk is lower or a shorter term contract may be offered.
- It could ignore the extra risk and offer the contract on normal terms.

- If a reinsurance company is prepared to accept the client on normal terms then the company may reinsure the proposal. (**Note** this is not a way of accepting substandard life risks on normal terms. It may however be useful in a situation where the direct office has very little experience or exposure to a particular risk.)

This question was answered adequately by most candidates.

7 (i) For each policy withdrawing during a period (usually a year)

- identifier
- policy type
- sales method and target market
- entry date
- premium size
- premium payment method
- original term
- salesperson
- age
- sex
- premium frequency
- type of exit (PUP, surrender, lapse)
- date of exit

It is important to be clear what the rate is expressed as a percentage of.

The easiest is to express lapses as a percentage of the in force at the start of the period. In this case the opening portfolio needs to be analysed using the same criteria as those listed above. A suitable period of investigation should be chosen, typically 3 to 5 years.

Alternatively lapses can be expressed as a percentage of the original number of contracts sold. In this case each year's sales for all past years needs to be broken down into the above categories.

In either case deaths and maturities would be excluded from the exposed to risk.

Only the largest companies are likely to have sufficient data to perform a meaningful analysis using all the possible cells listed above.

The problem is splitting the data into homogenous groups while keeping the size of the cells credible.

The most important levels at which to carry out the analysis are:

- sales method (usually an adequate indicator of target market)
- type of exit (PUP, surrender, lapse)
- duration in force (lapses are usually heavier at early durations)
- type of contract (pension, protection, savings, etc)

This would probably give adequate data for most practical purposes. A more detailed analysis could cover

- original term of policy
- premium payment method
- premium size and frequency

(ii) Withdrawal rates are particularly affected by the economic situation at the time of withdrawal.

Increased unemployment is likely to lead to higher withdrawals. There might be a significant increase in withdrawals in a particular calendar year, but thereafter the policies which survived might be less likely to lapse.

The perceived competitive position of the products is relevant. Products which appear to be giving poor value are likely to see higher lapses as policyholders "take the money and run". The converse point is also acceptable (policies may lapse when the fund value is "high enough" to achieve the policyholder's financial target).

Exactly the same considerations apply when each cohort is affected. Economic and competitive conditions can affect the type of person effecting a policy and hence the future propensity to lapse.

The lapse rate experienced in the tenth year of a policy is necessarily based on a contract issued ten years or more ago.

Extrapolation to a contract issued today may not be valid. Only short duration rates can be used with any degree of confidence.

Changes in the sales process could affect the lapse rates, for example the introduction of a requirement for salespeople to have an academic qualification.
Changes in the surrender basis could have affected the withdrawal rates. As also could new product launches which can lead to "churning". Legal or tax changes may make it less attractive for policyholders to retain the policy.

(iii) The persistency rate for individual salespeople can be made part of the remuneration package.

Persistency rates are needed in product pricing. The design of a product is tested to ensure it is robust with changes in experience, including persistency.

Where discontinuance terms are available, persistency rates at different durations are needed to ensure that overall the desired return is achieved from discontinuing policyholders i.e. surrender values may be reviewed in the light of lapse rates.

The results of the analysis of experience are fed back into the control cycle.

This enables

- surplus to be analysed

- comparisons to be made with industry experience and differences investigated
- past trends to be observed and understood
- projections to be made for the future
- unprofitable contracts or market/channels to be identified
- pricing assumptions to be updated
- contracts to be recosted
- assumptions set for the reserving basis
- assumptions set for embedded value calculations
- management information to be produced

Part (i) was generally answered well, although many answers ignored the need to collect exposed-to-risk data.

Part (ii) was answered adequately by most candidates.

Part (iii) required candidates to recognise how the analysis of any experience item fits into the control cycle. Many answers made no reference to this.

8

(i) The features that could be offered under the contract include:

- A guarantee minimum payment period for the annuity of typically five or ten years or capital protection i.e. total paid out is at least the purchase price.
- The annuity to increase each year, either at a fixed rate or in line with a published index such as the RPI, or to be unit-linked.
- On the policyholder's death, the continuation of the annuity at the same or at a lower level to a surviving spouse or dependent.
- A step in the annuity payment so that it integrates with any pension payable by the State.
- Choice of payment frequency and in advance/in arrear.

(ii) One of the principal risks faced by the life insurance company is longevity – annuitants surviving longer than anticipated when the contracts were priced.

This may be because the base mortality rates are over-estimated. More likely, because insufficient allowance is made for future mortality improvements.

The company will have to make an assumption regarding the investment return it will earn in the future on the premium paid to purchase the annuity. The actual return earned may fall below this level.

Such a scenario could arise because the company invests in assets where the return is not guaranteed. Alternatively, the term of the assets may not match that of the liabilities, leaving the company exposed to a reinvestment or early encashment risk.

Similarly, actual expense levels may exceed those assumed in the pricing basis. This could arise either because current expense levels are underestimated, or because inflation is higher than expected.

The expense loading in the premium basis is expressed as a percentage of the annuity. However, actual expenses are likely to be a fixed amount per policy.

Hence, the company will need to make an assumption regarding the average size of annuity. This may exceed that actually experienced, resulting in a loss even if actual unit costs are as expected. If withdrawals are permitted, there will be a risk of anti-selection (unhealthy lives more likely to withdraw).

The company will need to produce an adequate return on the costs incurred developing the product. This will depend on the profit margin in the premium basis and the volume of business sold.

Competitive pressures may force down the profit margin, particularly as annuities are sold largely on price. Alternatively, new business volumes may fall below the levels projected. Also there may be an operational risk if the systems cannot cope with all the product's features. If the company sells a high volume of business, it may run short of capital.

(iii) The following actions are available to the company to limit the impact of each of the risks identified above.

Longevity

The company has some control over its target market. For example, it could set an appropriate minimum or maximum annuity level or operate only in certain geographical locations.

It could also choose to market annuities to certain types of impaired lives.

The company could obtain some protection through reinsurance, by, for example, the use of stop loss cover.

Ultimately however, the company has to adopt a suitably prudent pricing basis, which allows adequately for future mortality improvements.

Investment

The investment risk can in theory be eliminated by holding Government fixed interest securities with a mean term equal to that of the liabilities or index-linked securities if the annuity payments are index-linked.

However, whilst the risk can be significantly reduced through holding appropriate assets, it is unlikely in practice to be possible to eliminate it completely.

For example, the term of the liabilities may be too long, although the company could write shorter term without profit business as well in order to reduce the discounted mean term of the whole business.

Also, the need to offer competitive annuity rates may necessitate accepting some investment risk in the expectation of earning a higher return. For example, by holding corporate rather then Government fixed interest securities. Derivatives could be used to improve matching.

The ability of the company to do this will depend on the size of its free assets.

Withdrawals

If withdrawals are permitted, the company could underwrite annuitants who seek to withdraw.

Expenses

The company could replace the expense loading with a policy fee. This would produce a closer match between charges and costs.

The policy fee could increase in line with the RPI to offer protection against rising inflation.

However, the nature of the product makes it unlikely that the company will have complete freedom over the charges it can levy. Hence, cost control through a strict budgetary process will be important.

Marketing

The company could choose to market a less price-sensitive product.

For example, a with profit or unit-linked annuity may allow greater scope to alter charges to reflect changes in experience.

Similarly, a niche product, such as an impaired lives annuity, may permit the inclusion of a higher profit margin.

The choice of distribution outlet is also important. Marketing through a direct sales force should be less price-sensitive than through independent advisers. However, this option may not be available to the company.

The company could market other products alongside the annuities. This would reduce the proportion of its new business represented by the product, making profits less dependent on fluctuations in volume.

Realistic sales forecasts are important, as is a strict control over development and marketing costs.

Parts (i) and (ii) were generally answered well, although the risk arising from the mismatched administration charge was ignored in some answers.

Parts (iii) produced generally good answers in respect of the longevity and investment risks, but few candidates dealt adequately with the expense and marketing risks.