

# **EXAMINATIONS**

September 2002

## **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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*As in recent sittings of this subject the most significant weakness was an inability to relate standard bookwork considerations to the particular situation posed in the question. Even successful candidates were generally poor in this area. It suggests that insufficient revision time is given to studying past examination questions and examiners' reports.*

**1** The possible implications are:

There will be less information on which to base the underwriting decision and so it will be more difficult to classify cases correctly into ordinary rates, special terms or decline. Hence it is possible that cases which otherwise might be rated or declined will be accepted. Alternatively a harsher approach might lead to cases that could be acceptable being declined.

It will be necessary to monitor the effects of the change on profitability. In the early years there will only be limited data to do this, as there will be few deaths.

If profitability reduces it may be necessary to increase premium rates and/or the valuation mortality assumption.

There is a risk of anti-selection by those who can avoid disclosing relevant information.

If there is reinsurance cover, this may need to be re-negotiated as the reinsurer may conclude that the anti-selection could materially impact the mortality experience.

The changes may streamline the underwriting process, reducing costs, although there may be a greater need to request additional information, which would lead to additional costs.

Simplifying the application may prove popular in the market, increasing new business, over which overheads can be spread.

*This question was generally well answered, although few mentioned the need to monitor profitability or review the valuation assumption.*

**2** Mortality — fewer health questions are being asked so mortality may be expected to be higher than for other channels. *(Note there is no possibility of seeking additional medical information in this question.)* There is also a potential for anti selection.

The maximum sum assured may be lower than for the intermediary channel where there is an opportunity to obtain further information via a Medical Examiner's Report.

Initial expenses can be expected to be different for a number of reasons:

- No commission will be paid, as no salesman is involved.
- There should be lower new business processing costs — as long as system link is built between the web site and the policy database.

- There are likely to be considerable development costs which will need to be recouped

The profile of the target market may be different. This could affect mortality and persistency. For example:

Internet usage higher amongst younger people, hence average age may be lower — but the target market will affect the age distribution.

Without the existence of face-to-face advice, there may be a tendency for people to underinsure themselves by paying smaller premiums, thus reducing the average case size.

Renewal expenses are also likely to be different because of the internet. For example, there may be facilities for policyholders to make simple administrative changes on-line (e.g. change of address), thus reducing per policy costs.

Persistency may be expected to be different. For example there is no relationship built up between the policyholders and the company.

The uncertainties surrounding the basis elements in the new market indicate that margins should be taken in some or all elements. Alternatively this can be dealt with by increasing the profit requirement. The extent to which this can be done is affected by competition.

The profit criterion may be different. If the company expects to sell large volumes it may be prepared to accept a smaller contribution to overheads and profit.

On the basis of the information given, there is no reason to expect investment returns, tax (if any), or solvency requirements to be any different for this channel.

*Where examples are given above, the marks were available for any well-argued reason why the feature might be different for internet distribution. The question was answered reasonably well, although very few considered the scope to reduce the profit per policy in the hope of getting more policies and maximising overall profit.*

- 3** (i) A prudent basis, rather than a best estimate, should be used. The basis should include appropriate margins for adverse deviations. The size of the margin depends on the importance of the assumption and the extent of data to support it. In general higher margins are appropriate for without profits contracts.

### **Interest Rates**

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

- take into account the currency in which the policy is denominated.
- have regard to the risk adjusted, net of tax 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.

### **Mortality**

Should be chosen prudently having regard to:

- the type of insurance (e.g. assurance or annuity)
- the territory of the person insured
- the company's own experience, adjusted for any changes expected in the future
- mortality improvement in relation to annuity products

### **Expenses**

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

Allowance can be made for recovery of initial expenses by means of a zillmer adjustment

Allowance should be made for inflation.

The net premium method defines the allowance for expenses to be the difference in value of the net and office premiums. The net premium should be restricted so that the difference is not less than the expected expenses determined above, or an explicit additional expense reserve established for any shortfall. For single premium and paid up policies an explicit reserve is always required.

- (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 prudent assumptions. But it is less justifiable for without profits contracts, although it may still be used. It tends to lead to uncompetitive rates.

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.

*Part (i) was a standard piece of bookwork and was answered well. In part (ii), there was no need to comment that different territories have different approaches to get the marks. This part also only required reproduction of text from core reading; those who recalled it did well, others struggled to score many marks.*

**4** Annuity rates should be set so that the company meets its required profit criterion.

This should take into account the cost of the guarantee. The guarantee could be met by giving a lower initial annuity or by introducing a maximum percentage increase in income in any one year.

The sensitivity of the cost of guarantee and profitability should be tested — possibly stochastically.

There will be a balance between profitability and volumes sold — the company should aim to maximise total contribution to overheads and profit.

There will be a need for reinsurance because the company has no experience of its own and will be relying on market data for pricing. Availability of reinsurance for the risk of the guarantee biting is also relevant

Analysis of the target market is necessary to ensure that it is adequate.

There is also a balance between the level of the guarantee and the cost. The more sophisticated investors in the target market may prefer a lower level of downside guarantee in exchange for greater upside potential.

Use of a well-known equity index may improve marketability.

The asset backing needs to be determined. This could be a portfolio designed to replicate the index or a derivative strategy. Taxation and costs are relevant issues

Risks include longevity, investment mis-matching and expenses. All need to be acceptable to the company. In particular longevity may be affected by selection; policyholders with better average mortality may be more likely to take out this product.

The product design and annuity rates should be compared with those offered by competitors (if any).

In general linked annuities have a lower capital requirement than fixed income annuities, but this is not the case here because of investment guarantee. If capital resources are scarce, the company will wish to minimise the level of guarantee offered, or new business volumes restricted.

Consideration needs to be given to expense cross-subsidies between different sizes of policies and whether a policy fee approach should be used.

There is a marketing risk that the contract terms will not be made clear to prospective policyholders. Training of sales and administration staff will be necessary.

The contract, and particularly the impact of the guarantee, needs to be administered on the company's systems.

The product design and terms need to be consistent with other annuity products offered by the company.

*Candidates tended to concentrate on the unusual feature of the contract – the downside guarantee. Many of the marks available for the standard considerations such as expense risk and mortality risk were missed. Marks were available for a wide range of points, and most candidates earned a good number of them.*

**5** (i) The main sources of data are as follows:

The company's own data  
The company's reinsurers  
Industry compiled data if available  
Any national statistics  
Statistics from other countries if there is no sufficient information in the home country.

If the company's own data is sufficient then this would be the best source of data.

To determine the basis the experience and the exposed to risk data needs to be divided into cells by the key risk factors. The number of cells depends on the volume of data available.

If the period of any mortality investigation were quite long to get sufficient data, then care would need to be taken to ensure that the data remains homogeneous. We are told that the mix of business has been relatively constant over many years, but there may have been changes in underwriting standards, target market or other relevant factors.

If the data were not sufficient to develop a company specific mortality table, then the company data would be used to develop adjustments to any industry or national mortality tables. The former is preferable.

In all of the above the advice of the company's reinsurers would be sought.

(ii) There are three categories of people:

A — non-smokers including those who gave up more than 3 years ago ( $q_n$ )  
B — those that gave up between three and one year ago ( $q_3$ )  
C — smokers including those that gave up less than a year ago ( $q_s$ )

One might expect the relative mortality of these groups to be  $q_s > q_3 > q_n$

The existing definition means that "non-smoker" only contain group A and "smoker" contains B and C. The proposed definition means that "non-smoker" contains groups A and B, whilst "smoker" contains C only.

Non-smoker mortality moves from  $q_n$  to a weighted average of  $q_n$  and  $q_3$ , so

using the above mortality relationship the new non-smoker mortality would be expected to worsen.

Smoker mortality moves from a weighted average of  $q_3$  and  $q_s$  to  $q_s$ . So, using the above mortality relationship, the new smoker mortality would also be expected to worsen.

This would mean, all else being equal, that the new non-smoker rates would worsen and so would not be attractive to category A people because they could get better rates elsewhere.

However, they would be attractive to category B people in the market. This would mean the relative weights between A and B would move more towards B than simply analysing the existing policyholder mix. Some existing policyholders in category B, currently on smoker terms, might lapse and re-enter on non-smoker terms.

Again, all else being equal, smoker terms would be less attractive to category C people as better rates could be gained elsewhere in the market.

These effects will change the relative mix of smokers and non-smokers, which would have to be considered, particularly if there were cross-subsidies between the categories.

As both smoker and non-smoker rates worsen, the pricing approach of a five-year age differential may still be suitable.

To develop a pricing basis for this change, it will be necessary to re-perform the mortality investigation, re-defining the smoker, non-smoker population. An adjustment would need to be made for the fact that the company will get a greater market share for the category B people.

- (iii) This product will be sold mainly to women and so will have a very different mix to the existing product, and the male dominated data of the existing product will be largely irrelevant.

The question is whether the company has sufficient female data to form a basis. Even if there is sufficient data, it may well be that the profile of the store's database is fundamentally different to that of the life company's.

An analysis of the store's database may give useful information as to the socio-economic groupings that may be compared with that of the life company's.

*Most candidates answered part (i) well, although a surprising number failed to provide a list when the question required one. The performance on part (ii) was mixed with many candidates failing to grasp the point of the question. Those who understood the principle usually failed to carry the argument through to discuss the implications on the actions of the different groups, and the knock on effect on pricing. Few gained many marks for part (iii).*

- 6** (i) Supervisory requirements usually only require that a company demonstrates solvency at a particular point in time. This will not 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.

To do this the actuary needs to project the solvency position into the future, normally using a range of different future scenarios. This will enable the actuary to advise the company of the suitability or otherwise of any proposed course of action, or of maintaining the status quo.

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 sales people to pay.

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, diseconomies of scale will arise. 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.

*Marks were available for any sensible well-argued second order effect (e.g. redundancy costs if terminations were compulsory, or the salespeople who left may have written more profitable lines of business), but not for saying that those who left were the better producers (the question states that average production is unchanged)*

- (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.

*There is particular scope for valid points to be made in the “wrong” part of the answer to this question. These were given credit as if they had been written in the intended place.*

*The standard of answer to this question was extremely poor; even the best candidates failed to gain many marks. Part (i) was generally answered adequately. Thereafter the thrust of the question hinged on the profit profile of a life insurance contract (a topic from the 100 series), and it was disappointing that so few candidates even mentioned the phrase “new business strain”. Even fewer realised that positive cash flows to repay the strain continue to emerge from the existing business despite the change in new business levels.*

*In part (iv) many candidates suggested making the policy cheaper – this is a very high-risk strategy as expenses are already under pressure from reduced volumes.*

- 7 (i) The first stage is to determine the standard mortality assumptions, split between male and female.

There will be no existing company experience and so it will be necessary to base the assumption on industry standard experience. Industry aggregate data will contain lives in ill health, so this will need to be allowed for.

Reinsurer's advice could assist with both healthy and ill health mortality.

Rates will need to be adjusted to reflect any difference in the target market.

An assumption will be needed about the rates of future mortality improvement. This can be based on recent rates of mortality improvement adjusted to reflect any expected change in future. Developments in medical science will be an important issue for ill-health annuities.

For both data analysis and product design a clear definition of ill health will be vital. Close liaison with the underwriters will be required.

The volume of industry experience on the mortality of impaired lives is limited so it may be necessary to use the population data.

Impairments could be assessed by a rule-based (point scoring) system or by each life being individually underwritten.

- (ii) The first stage in pricing the product will be to determine the initial assumptions about future experience. As well as mortality these include investment return, inflation and expenses.

The product will then be profit tested to determine appropriate premium rates, which deliver an acceptable profit to the company.

It is also necessary to ensure that the premium rates are competitive in the market place.

The need to adopt a professional approach involves ensuring equity between existing and new business, and impaired and healthy lives.

It is necessary to discuss the mortality basis with the underwriter to ensure that the underwriting decisions are consistent with the pricing basis

Judgement will need to be applied as to the margin for prudence in the reserving basis that will be used.

The assumed reserving basis will also feed in to the profit testing of the product.

After launch the experience will be monitored regularly to determine how it compares with the assumptions made at launch.

It may take time for significant volumes of data to build up, particularly if mortality experience is being monitored by type of illness, except for impairments with a very short life expectancy.

The smaller the volume of business, the greater the likely volatility of the experience, particularly if a large number of different groupings of illnesses are being used for determining the ill health enhancements.

The investment return achieved and the expense experience would also be monitored.

If the experience differs markedly from the initial assumptions then revised assumptions may be determined. Using these, the product would be profit tested once more which may lead to a change in premium rates and/or a change in reserving basis.

The experience should be discussed with the underwriters as it may indicate inconsistencies between the approaches taken by the underwriters and that assumed in the pricing assumptions. This might result in a change in underwriting standards or in premium rates.

The experience may also lead to a change in the rating basis used for determining the ill health enhancements.

Changes to the premium rates offered by competitors will also be monitored to ensure that the rates did not become uncompetitive. This may also lead to a change in the premium rates.

Monitoring the ill health enhancements offered by competitors may be difficult as the approach taken to grouping illnesses may vary significantly between companies.

The company may find that it cannot offer premium rates which are both competitive and profitable, in which case it may withdraw from the marketplace, just offer impaired or healthy life annuities, or seek a different target market.

*Part (i) was answered well by most candidates. In part (ii) tried to fit what would be done in practice into a reproduction of the core reading on the control cycle, usually unsuccessfully. Many candidates simply said "feed back the results" and missed many of the specific practicalities that arise with this situation.*

**8 (i) General**

The company will have no brand or reputation in this particular market segment.

The company may experience lower levels of new business of its current whole life contracts.

This type of contract will require considerable capital, and so the company's solvency position is vulnerable to writing significant volumes of new business. In this case there is also a risk that the admin systems won't be able to administer the business efficiently or correctly if they are not developed appropriately.

**Mortality/Morbidity rates**

The company will have no directly relevant data of its own for the purposes of calculating its mortality/morbidity experience for use in setting rates so there is more risk that the assumption will be wrong.

There is a risk that the emerging experience is worse than that assumed in the pricing basis due to the current experience or the future trends in experience being different from those assumed. The future trends are a particular risk for CI business where claims will be affected by future changes in medical treatments or diagnostic techniques that are very difficult to predict.

The company is unlikely to have significant free assets to absorb large volatility in claims costs, because unit-linked business is not capital intensive.

If the premiums are guaranteed for the term of the contract, any adjustments required as a result of emerging experience may only be made in respect of new business.

Anti-selection is a particular risk with CI policies so there is a need to design the proposal form carefully; again there is no past experience.

Badly worded claims definitions in policy document may lead to accepting claims that not allowed for in pricing assumptions; or bad publicity from turning down contentious claims, leading to reduced new business or higher lapses.

If society becomes more litigious, this may lead to more CI claims than anticipated.

A new disease may emerge which is not covered but which is significant for policyholders and where there is significant public pressure to admit claims.

There is an underwriting risk in that lives may not be charged a premium appropriate to their level of risk due to a lack of experience in underwriting this business. There is also a risk that the approach taken by the underwriters

is not consistent with that assumed in the pricing assumptions. This is particularly true as there is no own data for experience assumptions, which would reflect the underwriting approach.

### **Expenses**

It is possible that the administration of this product may introduce some new functions (e.g. underwriting), so that per policy costs may be higher than for its existing product lines. The company will have no experience of its own on the likely cost of these. Conversely, there may be some current functions that would not be needed for the new product (e.g. unit pricing) that would reduce per policy processing costs.

There will therefore be considerable uncertainty as to the level of per policy expense that should be loaded into the premium rate calculations.

There will be some system development and staff training costs, which will only be recouped if sufficient volumes of business are sold.

Given it is a new product, future new business volumes will be uncertain making the expense per policy uncertain even if total expenses can be estimated accurately. If the pricing basis involves cross-subsidies, there is a business mix risk, as well.

There is a risk that inadequate allowance will be made for expense inflation.

### **Withdrawals**

If company's rates are undercut, then there may be early lapses that cause a financial loss to the company since high initial expenses will not have been recouped. There is also a possibility of selective withdrawals, leaving a portfolio in less than expected good health.

(ii)

### **General**

The company should undertake sufficient market research to establish that there is demand for this product, and that it would be regarded as a credible product provider.

The company should model the capital it requires for a variety of different new business assumptions if it is able to get additional capital from a parent

Alternatively, it could consider reinsurance finance

### **Mortality/morbidity rates**

It is likely that the company will want to reinsure a considerable proportion of the risk so that the reinsurer's rates will form a starting point for the company.

Alternatively, it may use industry standard tables (if any exist) as a starting point.

It can reduce its exposure to claims volatility by appropriate reinsurance, or by imposing stricter underwriting requirements (both at commencement and on claim).

Limit the critical illnesses covered to the standard definitions used by other companies.

### **Expenses**

There is little alternative but to attempt to analyse expenses by function as far as possible and attempt to identify which of these functions, and hence costs would be incurred in administering the new product classes.

Estimates for any new functions using whatever market salary data may be available, as salary costs are likely to form the majority of the company's expenses.

Out-sourcing administration may be considered on a fee per plan basis, which reduces the risk to the company that per policy expense estimates are wrong

The company could consider a packaged administration system as an alternative to in-house development to reduce the risk of costs exceeding estimates.

### **Withdrawals**

The company may try to mitigate the extent of any loss on early termination by lengthening commission earnings periods. This may not be possible depending on market norms.

Alternatively, the contracts may be designed to include attractive options that are perceived as adding value to reduce the threat of early exit. E.g. an option to increase cover on specified events with no further underwriting

The company may simultaneously review its charges on its current business to remove or reduce any incentive to lapse

*This question was answered well with most candidates picking up many of the points available.*