

EXAMINATION

September 2007

Subject ST2 — Life Insurance Specialist Technical

EXAMINERS' REPORT

Introduction

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

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Chairman of the Board of Examiners

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Comments

Comments on individual questions are given in the solutions that follow.

- 1** The business will need to be split into appropriate model points that represent the in force portfolio. The liabilities and assets would then be projected forward on assumptions that represent expected future experience, although the company will also want to consider the effect of variations from these.

For the assets, stochastic investment models can be incorporated in order to project future investment income and changes in capital values.

The projected supervisory liabilities and assets can be valued at the end of each year. The liabilities need to take into account future bonuses and these should be dynamically linked to reflect actual practice in terms of bonus setting

The excess of asset over liabilities needs to be sufficient to cover comfortably the level of solvency required by the company, which itself may depend on the investment strategy (i.e. the liabilities should be dynamically linked to the investment strategy). What is “comfortable” will depend on any regulatory requirements, the nature of the business, and the level of cover provided by other companies.

The above can be used to produce a statistical distribution of the amounts available each year to cover the level of solvency capital required. From this, the probability of potential future insolvency can be estimated given a particular investment strategy.

The simulations could also be used to determine the level of free assets the company needs in order to support a particular investment strategy and keep the probability of insolvency below an acceptability low figure. If the probability of insolvency is considered too high, then new investment strategies will need to be modelled.

Stronger candidates scored very well on question 1. However a large number of students spent too long describing the investigations behind assumptions used in the model. This was not required by the question. Such candidates scored badly as they tended not to spend long enough describing how the model could be used.

- 2** (i) The factors by which the data could be analysed are as follows:

Duration in force — withdrawals rates are generally higher near the start of the contract, but this will depend on any point guarantees or surrender penalties on the contract.

Target market — the degree of care taken ensuring that a suitable product is sold may depend on the target market. The more suitable the product, the lower the withdrawal experience.

The size of premium and original term of contract would also be considered

The data would also be split by sales channel and advisor. Customer data would also be split by sex and age as experience tends to be worse for females and for younger ages.

The process the company would use is to first split the data into the above homogenous groups. The number of contracts issued in the last financial year is then divided into the corresponding number that survive in force until the first policy anniversary to give a first year persistency rate.

The first year withdrawal rate can be determined as one less the persistency rate. Alternatively look at the number of withdrawals divided by the exposed to risk. Deaths and maturities should be excluded from the investigation (if material). A similar process can be adopted to obtain the second year, third year etc. withdrawal rates.

- (ii) Other investigations the company might do include the following:

The company's profits will be sensitive to policies being made paid-up and to premiums being reduced, as well as to withdrawal rates. An analysis of policies that are made paid-up could be done as a subsidiary part of the withdrawal analysis.

One issue that the company faces is to determine when the policy was made paid-up since the premiums can stop for 12 months before becoming paid-up.

An analysis of premium reductions could also be performed. However this could require data which is not readily available. Also there is the issue that someone may be reducing a premium back to a previous level after a recent increase and so a decision should be made as to whether this really constitutes a reduction. In addition some people may make one off payments, and reverting back to their normal monthly level should not constitute a reduction in the premium

An analysis of premium holidays could also be performed, but again there are difficulties with this. Data as to the duration of the premium holiday would also be required.

Generic problems with the above are that low levels of data could mean results are spurious. These analyses will however be important in understanding the analysis of surplus and its limitations. The results may also help with setting pricing assumptions and reserving assumptions.

The benefits of extending the analysis should be estimated to ensure that they justify the cost.

Part i was mostly well answered. Most candidates were able to describe the methodology in detail, giving good examples of how data would be subdivided.

Most candidates struggled with part ii. Some were able to demonstrate an understanding of the financial impacts of the different decrement types but few showed an understanding of the practical difficulties associated with analysing them.

3 (i) Own sales force:

The sales force are employees of the life insurance company. They are paid either by commission or salary. Most often it is a combination of the two.

Typically, the sales person will initiate the sale by using client lists. Client lists can be purchased, but they may also have been obtained from replies to the press adverts.

A successful sales person will be able to develop a long-standing relationship with their client. Ultimately, the client will approach the sales person for new products, as a trusted source of advice.

The products offered through this channel will depend heavily on the target market, which in turn will depend upon the client lists and the publications where the company adverts are placed. Typically, the market is not particularly financially sophisticated (but this need not be the case). As a result the products offered are typically more simple.

For this channel to be successful, a broad range of products needs to be offered unless the target market is very specific.

Press Advertising:

If the company uses this channel as a sales channel in its own right, then the products have to be very simple.

The publications chosen to carry the adverts will be targeted towards the chosen market so that there is a higher chance of uptake.

Alternatively, the advertising could promote the services of the sales force.

(ii) (a) Insurance intermediaries:

This would be quite a departure from the existing channels.

Insurance intermediaries compare products across the market place and seek to find the best option for their clients. This will lead to a degree of competition with other life companies that the company is not currently exposed to. Products will, therefore, need to be competitive to meet the desired sales growth.

Also, this market place tends to be at the more sophisticated end of the spectrum. The products that the company currently sells may not suit this market place. However, as this is a very different market, if the company is successful, the opportunity for sales growth is probably greatest.

There may be conflict with the Direct Sales Force leading to lower sales in that channel. So increased sales in this channel may have to be offset against falls in existing channels.

(b) Telephone sales

This might fit well with the existing channels

This could areas of the country that it is uneconomic to cover with sales people. Or it might used where the expected sales might be of lower value and so might not justify a face to face visit. So sales could increased through increased exposure to customers not covered by the Direct Sales Force.

It is not obvious that this will be a lower cost distribution channel than face to face. Whilst telephone sales people will spend more time speaking to more clients, as they do not have to travel, the success rate of those interviews may be less than face to face.

The existence of a call centre gives extra options for the press advertising including:

- Advice on the advertised product, increasing total sales
- Providing alternative products if the advertised product was unsuitable
- Deciding whether a face to face visit is justified.

Again, this will lead to additional sales compared to existing channels.

Answers to question 3 were mixed. Generally candidates described the key features of the channels in part i but many did not give enough detail to score well.

In part ii stronger candidates gave a good range of points regarding how the new channels may compliment the existing as well as describing some of the challenges associated with these channels. Some candidates spent time describing the general features of the new channels, rather than discussing how they might help achieve the aim of increasing sales growth.

- 4 (i) Surrender value = Present value of {Benefits + Claims expenses
+ Renewal expenses – Premiums} – Alteration expense

$$\begin{aligned}\text{Present value of benefits} &= 50,000 * A_{50:15} \text{ at } 6\% \text{ p.a.} \\ &= 50,000 * 0.43181 \\ &= 21,590.5\end{aligned}$$

$$\begin{aligned}\text{Present value of claims expenses} &= 0.5\% \text{ of present value of benefits} \\ &= 0.005 * 21,590.5 = 108.0\end{aligned}$$

$$\text{Expense inflation} = 1.92\% \text{ p.a.}$$

Since $1.0192/1.06 = 1/1.04$, can use annuity factor at 4% p.a. to allow for future inflation of renewal expenses.

Assume renewal expenses are incurred annually in advance, in line with premium payments.

$$\begin{aligned}\text{Present value of renewal expenses} &= 35 * \ddot{a}_{50:15} \text{ at } 4\% \text{ p.a.} \\ &= 35 * 11.253 \\ &= 393.9\end{aligned}$$

$$\begin{aligned}\text{Present value of premiums} &= 1,000 * \ddot{a}_{50:15} \text{ at } 6\% \text{ p.a.} \\ &= 1,000 * 10.038 \\ &= 10,038.0\end{aligned}$$

$$\text{Alteration expense} = £100$$

$$\begin{aligned}\text{So surrender value} &= 21,590.5 + 108.0 + 393.9 - 10,038.0 - 100.0 \\ &= £11,954.4\end{aligned}$$

- (ii) Let the paid-up sum assured be denoted PUSA.

This is then calculated from:

$$\text{Surrender value} = \text{Present value of \{Paid-up benefits + Paid-up claims expenses + Paid-up renewal expenses\}}$$

$$\begin{aligned}\text{Present value of paid-up benefits} &= \text{PUSA} * A_{50:15} \text{ at } 6\% \text{ p.a.} \\ &= \text{PUSA} * 0.43181\end{aligned}$$

$$\text{Present value of paid-up claims expenses} = 0.005 * \text{PUSA} * 0.43181$$

$$\begin{aligned}\text{Present value of paid-up renewal expenses} &= 20 * a''_{50:15} \text{ at } 4\% \text{ p.a.} \\ &= 20 * 11.253 \\ &= 225.1\end{aligned}$$

Surrender value from part (i) = 11,954.4

So:

$$\begin{aligned} 11,954.4 &= \text{PUSA} * 0.43181 * 1.005 + 225.1 \\ \text{PUSA} &= \{11,954.4 - 225.1\} / \{1.005 * 0.43181\} \\ &= \text{£}27,028.0 \end{aligned}$$

- (iii) The change in risk exposure should be considered:

The maturity benefit under this policy is guaranteed whereas the value of equity shares is volatile. This risk is increased if the equities purchased are not well diversified. This means that there is greater downside risk if investing in shares. But there is also greater upside potential.

If the policyholder decides to surrender the policy and invest the proceeds into equities then he loses the whole guarantee. If he decides to make the policy paid-up and invest future premiums into equities then he retains part of the guarantee.

The policyholder therefore needs to take into account his attitude to risk.

The change in protection cover should be considered:

This policy is not just a savings policy, it is also a protection policy: the death benefit is considerably higher than the surrender value. If the policyholder decides to surrender the policy then he loses this extra death benefit cover. If he makes the policy paid-up then it reduces significantly.

Depending on his personal circumstances, this protection might be important.

Other issue to consider:

It will be necessary to consider the tax implications of the surrender and investment in equities.

Stronger candidates scored well on question 4 getting full marks on parts i and ii. However a number of candidates did not use the correct formulae and consequently lost marks.

Many candidates made a good attempt at part iii showing a good understanding of the product by highlighting differences in return potential and impacts from losing the protection element of the contract.

- 5** (i) A cashflow approach would normally be preferable to a formula approach because:

It enables a company to measure the expected return than the providers of capital will receive.

The sensitivity of profit to variations in experience can be investigated so as to determine appropriate margins for the parameter values.

Reserves and solvency requirements can be explicitly allowed for.

The cashflows can be used to assess the financing requirements for new business by incorporating these cashflows into the in force model to see the impact of the financing requirements on the company as a whole.

It allows more easily for lapses and surrenders.

The anti-selection effect of the option can more easily be allowed for.

It is easier to incorporate assumptions that vary over time, including stochastic assumptions.

The risk discount rate can take account of the term structure of interest rates, although this may not be significant for this contract due to the low reserves.

Tax can be allowed for more appropriately.

- (ii) Firstly, determine a set of model points which represent the expected new business based on the profile of the existing business allowing for any expected changes in the profile.

For each model point project the cashflows allowing for projected solvency and reserving requirements. Use best estimate assumptions for mortality, withdrawals, expenses, investment returns and tax

Calculate the cost at the end of the projection period of the cost of the option. Could use either North American or Conventional Method

Need to make assumptions regarding mortality at the end of current term, and also take-up rates. If assume higher take up rate, then mortality may revert to average mortality over time. But if assume lower take up, then should have higher mortality assumption for renewal option as it is likely that those with lower life expectancy will take it up.

It is likely that the charge for the option will be a % of premium — the company needs to assess this against competitors and consider whether it is marketable. The cost will also need to be assessed against standard term assurance rates

The company should discount the cashflows at a risk discount rate that reflects the return required by the company and the level of statistical risk attached to the cashflows (i.e. the variation around the mean as represented by the cashflows themselves).

The premiums can be set so that the company achieves its required profit target.

The premiums need to be considered for marketability. This may lead to reconsideration of the design of the product (e.g. the removal of option or the addition of features to differentiate this product from its competitors). The distribution channel which may either permit lower expenses to be used, or higher premiums to be charged without it affecting the marketability may also be reconsidered

The company may also reconsider its profit requirement and ultimately whether to proceed with marketing the product.

The net cashflows from these model points, scaled up for the expected new business can be incorporated into a model of the whole company. It may be possible that the required level of profit can be reached in aggregate without each individual model point being profitable in its own right. However if this is the case the company may be exposed to the risk of a change in the mix of business.

The actuary will also consider the amount and timing of cashflows to assess the impact on capital of writing the contract. This may lead to a redesign of the product to reduce the capital requirements.

Once acceptable premiums have been determined for the model points, premiums for all variations can be determined.

- (iii) A stochastic method allows a probability distribution to be assigned to one or more of the unknown future parameters.

A positive liability can be calculated where a deterministic approach might otherwise produce a zero liability.

Future parameters can be assumed to vary together as a dynamic set, in this case a general worsening of mortality could imply higher take up rates.

There are no embedded derivatives to consider in this contract. Stochastic projections might be useful to determine the full range of possible mortality rates that might occur at the date of conversion, but it is unlikely these would give greatly differing results than scenario testing.

So the options on this contract can be valued using deterministic assumptions for the expected take up rate and the increased mortality assumptions due to the anti-selection effect.

(iv) **Market/Competition:**

The company would need to look at products offered by competitors.

It should consider whether competitors are offering similar options in which case it may need to enter market anyway to maintain market share — if not it may decide to enter the market to differentiate

It should consider whether consumers are looking for and purchasing these options.

Market research should indicate whether there is a demand for the option.

Contract Details:

It needs to clearly define option in literature (e.g. only available at fixed point).

The option should be available for sum assured no larger than current sum assured

Admin Process:

It may need to make underwriting stricter at outset of policy.

It needs to ensure company can administer the option and systems are changed in order to identify the new option.

The extra costs involved in potential extra underwriting, extra training of staff and extra marketing literature need to be taken into account.

Other:

It needs to make a decision on whether option is profit neutral or profit making

It needs to consider whether it wishes to take on the extra risk, Will the extra volume and profit justify this increase in risk?

It should consider the impacts on capital requirements.

If this business is reinsured, then the views of the reinsurer will be relevant.

Part i was mostly well answered with stronger candidates scoring full marks.

Part ii differentiated candidates significantly. Stronger candidates gave good detail of the approach in particular including discussion of how the design and price may be iterated to meet all financial and competitive requirements. Only a few candidates gave any detail on how the option value might be calculated.

Part iii was generally not well answered. Most candidates highlighted what a stochastic model could do but failed to demonstrate understanding of how to apply it to the contract being asked about.

Most candidates answered part iv well giving a good range of practical and competitive considerations.

- 6**
- (i)
1. The reserves should be sufficient to meet all liabilities arising.
 2. The reserves should be calculated using a suitably prudent actuarial approach, and should include neither too little nor too much prudence.
 3. The reserves should cover liabilities for guaranteed benefits.
 4. For unit-linked policies, non-unit reserves should be held.
 5. The reserves should include an allowance for future bonuses consistent with policyholders' reasonable expectations.
 6. The reserves should cover future expenses.
 7. The valuation should take account of the nature, term and method of valuation of the corresponding assets.
 8. The use of approximations or generalisations should be allowed.
 9. The method of calculation should be such as to recognise profit in an appropriate way over the duration of each policy.
 10. The method should not be subject to discontinuities from arbitrary changes.
 11. Methods and bases should be disclosed.
- (ii) The approach is consistent with the principles to the following extent:
1. The reserves by definition are sufficient to meet the death benefit. They also meet the surrender benefit.

However, they may be insufficient to meet the maturity benefit — see later re bonus.

The approach is therefore not consistent with this principle.
 2. There are no assumptions required so prudence within the elements of the basis is not relevant.

However, holding an amount equal to the death benefit could be considered to be unnecessarily prudent.

The reserve does not take into account the fact that only a relatively small proportion of the policyholders would be expected to die. The approach effectively assumes that all policyholders die immediately, and that the guaranteed minimum death benefit is paid to everyone.

The high degree of prudence is particularly the case early on in the policy whilst the value of allocated units is less than the original premium. And also during periods when investment markets are low and the value of units falls to below the original premium.

Further, as noted in 1, the reserve may be imprudent to the extent that it may not cover the maturity benefit.

The approach is therefore not consistent with this principle.

3. The minimum death benefit is a guarantee, and the reserve meets this amount.

The payment at maturity of a minimum of the value of units is also a guarantee, and the reserve meets this amount.

The approach is therefore consistent with this principle.

4. If the unit fund is lower than the original premium then the excess is held as a non-unit reserve. However, no non-unit reserves are held to cover any excess of expenses over the annual fund management charge.

The approach is therefore partially consistent with this principle.

5. The reserves do not make allowance for the maturity bonus.

Since the potential for bonus will have been communicated to policyholders at sale and on average a bonus has been paid over the last few years, policyholders will have formed an expectation of it.

The reserves should make an allowance for accrued entitlement to bonus, perhaps allowing for the proportion of policyholders expected to stay to maturity. Otherwise, the company will have to recognise a loss at the maturity date.

The approach is therefore not consistent with this principle.

6. No allowance is made for future expenses.

The approach is therefore not consistent with this principle.

7. The valuation takes account of the value of the units, and hence the value of the underlying assets.

The approach is therefore consistent with this principle.

8. The method can be considered to be an approximation.

The approach is therefore consistent with this principle.

9. Under this method, significant profits could emerge on surrenders. Particularly when unit values are low.

Significant losses could also arise on maturing policies due to the bonus.

Overall, the approach could therefore be considered to be inconsistent with this principle.

10. Provided the method remains unchanged from year to year, there will not be discontinuities due to arbitrary changes and the approach would be consistent with this principle.

11. The method is very straightforward and there is no basis to disclose.

The approach can therefore very easily be consistent with this principle.

Part i of question 6 was mostly well answered with many candidates identifying the majority of the requirements although some wasted time giving standard requirements that were not relevant to this particular product.

A number of candidates struggled in part ii. Many were able to pick up marks from simple observations of principles clearly adhered to. Few however were able to show understanding of the level of prudence from different aspects of the reserving basis and thus lost marks.

In addition some candidates suffered from using a general discussion to answering part ii. Candidates who used the technique of systematically discussing each of the principles from part i tended to score more heavily.

END OF EXAMINERS' REPORT