

EXAMINATIONS

April 2004

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 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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- 1** (i) Competition is likely to drive companies to price on a cautious best estimate basis, with few margins.

This is unlikely to form an acceptable basis for the statutory reserves, where the need for prudence requires larger margins, although in some countries product prices are controlled, in which very similar bases may be used for pricing and reserving.

However, the relationship depends on the method of regulation used and the level of solvency capital required. In some countries, the reserves are set using a prudent basis, with a relatively low requirement for solvency capital. Here there will be a significant difference between the reserving and pricing bases (and vice versa).

- (ii) As part of the embedded value calculation reserves are calculated and their release projected. Strengthening the mortality assumption for the reserving basis will increase the reserves.

If the embedded value experience assumptions are not changed, this increase in reserve will be released over the lifetime of the policy because there is assumed to be no actual change in experience.

The impact on the embedded value will be simply the cost of tying up this extra reserve over the lifetime of the policy, which will come through as a slight decrease in the embedded value.

If the experience basis is strengthened then a higher level of claims will be assumed in the future.

This results in an increase in the assumed actual outflow from the company (unlike the increase in reserves) and so the negative impact on the embedded value will be much greater in this case.

However the actual profit will depend on the actual experience, so if this changed assumption is not borne out in practice profits will emerge in later years as actual experience will be better than expected.

Part (i) has been asked many times over the years, and was generally well answered. Answers to part (ii) were very variable. Those who understood the difference between changing the reserving assumption and changing the actual experience assumption scored well. Others had few relevant points to make and scored poorly.

2 Mortality Assumption:

Policyholders who take out a policy through the adverts will tend to be of a lower socio-economic group. This will mean that they tend to exhibit heavier mortality which will lead to higher premiums.

There will also be less underwriting for advert policies, since one of the selling features is simple application processes. This may increase the risk of anti-selection and will also lead to heavier mortality and higher premiums.

Withdrawal Assumption:

The fact that advert policyholders are less financially sophisticated will tend to lead to higher lapse rates. Alternatively because the product is bought and not sold, lapse rates may be lower.

The fact that advert policyholders have not received advice and that there is less relationship built up between the company and the policyholders may also lead to higher lapse rates.

Due to the high up front costs, higher lapse rate assumptions at early durations will lead to higher premiums.

Expense Assumptions:

The advert policies will have lower initial expenses due to the reduced underwriting and simplified administrative procedures tending to lead to lower premiums. There will be no initial commission payable for advert cases but this will be offset by the cost of the adverts. The crucial issue is the conversion rate of adverts into proposals. It will be very difficult to estimate this with no experience, so a significant margin may be needed.

Renewal expenses will be similar for both sets of policyholders, although renewal commission will not be paid on advert policies, tending to lead to lower premiums.

Advert policies are likely to be of a different (smaller) size, so will bear a different proportion of fixed costs.

Other Factors:

Advert policies will not compete on price as much as business sold through intermediaries. This will tend to lead to higher premiums for the advert business to generate higher profits.

Because of the limited underwriting, there is also likely to be a smaller range of sums assured. This will affect the extent of cross-subsidies.

Profit per policy may vary by model point. If the mix of business is different for advert business then it will affect the weighted average profit for the portfolio as a whole which might result in changes in premium for particular model points.

The company will incur some development expenses in developing the advert policies and procedures. It will want to recoup these which may lead to higher premiums for the advert policies, depending on the allowance for development expenses in the original business.

Reassurers may quote different rates for the two sales methods, which would need to be reflected in the premium rates.

There were a large number of possible points that could be made to gain marks. The items above are more than even the best prepared candidate could write in the time available. The candidates who did well were those who followed the standard headings in a product pricing question, and considered how the specific situation impacted each of the normal issues considered in product pricing. Candidates with unstructured answers tended to omit more of the issues, and scored less well.

- 3 (i) Smokers have a lower life expectancy than non-smokers. Therefore they would be offered higher annuity instalments for a given purchase price.

The company need to protect itself from non-smokers claiming the smoker rate. So there would be no need to underwrite those who claimed to be non-smokers.

The company also needs to ensure that actual experience reflects that assumed in the pricing basis.

- (ii) The following methods might be used:

- A question on the application form (and nothing else)
- Check every case with a GP report
- Check some cases (large cases plus a sample of others) with a GP report
- Check with the client by telephone in a “policy servicing” call
- Specialist medical tests — particularly for large cases.

- (iii) To review the underwriting process the control cycle would be followed.

The aim is to compare the mortality experience of both the smoker and non-smoker annuitants with the assumptions in the premium basis. It will also be necessary to compare the costs of the underwriting process with those assumed.

Mortality experience will be analysed

- Deaths would be counted
- And the exposed to risk — care needed to ensure they match
- Split into homogenous groups – particularly by smoker status
- Of a sensible size for credibility
- Analyse by amounts as well as lives
- Allow for or estimate late notifications of deaths.

If the mortality experience differs from that in the premium basis, consider whether this is compensated by differences in underwriting costs.

It will be necessary to estimate the effects of changing the level of underwriting on both mortality and expenses. A change in the level of underwriting may be

enough to return the experience to the expected rate, but there may be other reasons why actual and expected experience differ.

If necessary, underwriting standards and/or premium rates can be revised.

This question was generally answered poorly. In parts (i) and (ii), too many candidates answered the generic questions, e.g. "Why are policies underwritten?" rather than the questions asked, even to the extent of suggesting that an HIV test was a suitable indicator of smoking status. In part (iii), very few candidates mentioned using the control cycle, although most had a reasonable idea of the necessary investigations.

- 4** (i) The ceding company reassures some of the sum at risk, i.e. the excess of the benefit over the policy reserve. For term assurance, with high sum assured and low reserves, the sum at risk will remain relatively constant. For endowment assurance the sum at risk reduces as the reserves build up.

The reinsurance may use a constant or a reducing retention level. With a constant retention level the excess sum at risk over a fixed retention limit amount is reassured. With a reducing retention level the retention reduces in line with the total sum at risk.

Risk premium rates may be guaranteed. The premium paid varies with both age and the reassured sum at risk, and may be assessed monthly, quarterly or annually.

Rates tend to be set by reinsurers based on their own investigations of experience allowing for appropriate expense and profit margins

- (ii) The effect of the change will be gradual as reinsurance remains in place for existing business.

The company will be exposed to more volatile claims experience, and hence more volatile profits or even losses. This may lead to higher risk of solvency problems. It will also be more exposed to the risk of not pricing the mortality risk appropriately in its premium rates. Assistance from the reinsurer may cease as there is no new business relationship.

Reserves for new business can no longer be reduced for proportions of business reassured. Solvency margins required may also increase for the same reason. The absence of reinsurance is likely to require greater margins in the reserving basis, or a mortality fluctuation reserve.

Without reinsurance the company will be exposed to higher new business strain.

All these items lead to reduced free assets.

As a mutual there is no source of external capital. This may impact on the company's investment policy or limit the overall new business it can write (including other classes).

Without the reinsurance cover the business may be more profitable over time, on the assumption that the reinsurance terms generated profit for the reinsurer.

Alternatively, if the reinsurer was offering very competitive terms the company's profits might reduce unless it repriced its contracts.

For new business, the company might consider reducing the maximum sum assured or tightening underwriting standards. Both might affect new business volumes.

There may be other types of reinsurance cover available that mitigate some of the above risks.

But the company may need to consider withdrawing from the term assurance market in order to protect its other lines of business.

Part (i) was straightforward bookwork and was well answered. In part (ii) most candidates also scored well. The better candidates remembered to read the question and gained the extra marks for considering the mutual status of the company.

- 5** (i) For all assumptions need to start with the existing assumptions and adjust in the light of experience and new information. The company will only have 24 months experience of this contract, but even this should enable some trends to be identified. The experience from other classes of business will also help identify trends.

The company will know whether sales have been above or below expectations, and thus whether it is looking towards a reduction in rates in order to increase business volumes, or an increase to improve profitability. As the rates were set without the company having any of its own experience, the pricing basis may not reflect actual experience.

Mortality/Morbidity

Projected mortality improvements can be factored in to any new rates.

Mortality, and more particularly morbidity, experience depends on the socio-economic group of the insured. Consequently it is important to determine whether the market in which the product is sold is the same as that anticipated in the pricing basis.

Critical Illness rates are likely to be derived from reinsurers'/industry sources. Need to take any revised rates from reinsurers into account.

Even the limited data would indicate whether the underwriting process was effective. If not either the costs of underwriting or the mortality assumption would need to change.

Expenses/Commission

In the short time since launch, it is unlikely that there will be significant changes in expense assumptions if these were originally set appropriately. There will be very little data on claims expenses.

Commission rates will need to reflect current rates being paid. There is a need to take into account current and expected future rates of inflation (both for prices and earnings)

Withdrawals

Consider any changes in lapse rates on all the company's business through this target market to assess if future assumed lapse rates are still appropriate. If the actual market is different from the original target then there may be a big difference in persistency rates.

Other

The average policy size may be different from assumed. The company will also have a better idea of the total volume of business that is achievable. Both of these will affect the loadings for overhead expenses.

The mix of business and any cross-subsidies between sizes and ages should be investigated. It may be that these work against the market actually buying the policy.

The allowance for tax in the pricing basis should be compared with the company's current and expected future tax position.

Actions of competitors may necessitate a redesign of contract features, for example critical illness definitions.

The company may have changed its risk discount rate, profit criterion, or the extent of corporate cost that this product needs to support.

Investment return is not included as the reserves are not material

- (ii) Need to develop a profit test model — start by using that developed when product was priced initially.

Choose model points to represent the future business — use the original model points and compare them with a split of existing business. Adjust model points where appropriate.

Determine a basis for future experience, possibly by modifying the original basis in the light of subsequent experience. Now some experience has been gained, it may be possible to reduce contingency margins in the original basis.

For each model point project cash flows using this basis, allowing for reserve and solvency margin requirements.

Decide on a discount rate based on return required by company and level of risk attaching to cash flow, and discount each cash flow. The net cash flows for each model point will then be scaled up for expected new business.

Compare aggregate profitability with company profit requirement.

Check sensitivity of profitability by varying model points and parameters.

Assess profitability of new rates against profitability of current rates.

Performance on part (i) was very mixed. Candidates who realised that the current premium rates had been set a relatively short time ago and concentrated on the factors to be considered in a review, as required by the question, scored well. The majority of candidates, who reproduced a bookwork answer to a general premium rating question, missed most of the points and scored poorly. Part (ii) was mainly bookwork, and was answered adequately.

- 6** (i) A life insurance company might want to investigate its solvency position using stochastic modelling to get a more accurate a picture of its financial position by, for example assessing the probability of ruin. In particular it allows the actuary to assess the company's ability to withstand future changes in both the external economic environment and the company's own experience.

It allows the actuary to place a value on options and guarantees that only become onerous as a result of particular events in the financial markets at some point in the future.

It allows the effects of management actions and the interrelationships between variables to be quantified.

It allows the company to determine the particular risks that expose it to insolvency and thus make informed decisions in advance of such events occurring, to help prevent future insolvency.

Depending on the company's business it might be appropriate to model basis elements other than investment returns stochastically. For example, a company writing protection business would be more interested in modelling mortality stochastically, than it would investment items.

Accurate determination of the solvency position will allow the company to determine whether its current level of capital is adequate, and if not, to plan how it might raise capital. If the company doesn't believe future capital will be found,

then it can take other actions, such as limiting the amount of new business written, so that the solvency position is maintained.

The company may be required, under the regulatory regime in which the company operates, or by professional guidance, to use stochastic modelling.

- (ii) The company will need to build models to project the future cash flows of the company from both the assets and the liabilities. The models will need to replicate the conditions that existed at the valuation date, and the model points will need to replicate the portfolio.

The criterion (for example probability of ruin within a given period) against which solvency will be tested is needed.

The company would need to determine which variables it wants to project stochastically, and which will be projected deterministically. The accuracy versus time and cost of running the model is a relevant consideration.

A distribution function for the stochastic variables would then have to be determined. This allows the mean expected value of the variable and its variance to be specified. This will usually be done by looking at the past behaviour of the variable as a starting point.

Need to decide on what management action would be in certain scenarios. For example, when and how investment mix and bonuses would change under different economic conditions.

Although surpluses from new business are not involved in assessing current solvency, the impact of new business on expense costs, etc needs to be modelled

From this, the company will generate the future expected returns for a large number of scenarios — maybe 1000 scenarios.

The company will specify the behaviour of other variables in the model, dependent on the stochastically modelled variable. These relationships all need to be specified so that for a given return on investments each year, the asset and liability cash flows in that year can be projected as accurately as possible, and the required statutory reserves and solvency capital can be determined for each projection period.

The cash flows will be projected using the investment returns from the 1000 scenarios and allowing for the dynamic linking between all of the variables. The value of both assets and liabilities can be calculated at each future point in time, and the solvency position assessed for each different scenario.

The model can be tested against deterministic calculations performed on a small number of model points. Different models or parameter sets can also be sensitivity tested.

A reserve for the liabilities can then be established that meets the established success criterion.

Most candidates found this the most difficult question on the paper, possibly because the concepts have not been examined in a full question before. Many had difficulty in distinguishing between the reasons for using stochastic modelling (tested in part (i)), and the process (tested in part (ii)).

- 7** (i) The most significant risk is that the life insurance company underestimates the mortality risk when determining the price of the product, and the amount paid in claims is greater than that expected in the pricing process.

In assessing the mortality risk for a group term assurance contract, the following main elements will be taken into account:

- The base mortality experienced by employed insured lives.
- The geographical location of the employees being covered.
- The occupation of the employees.
- The salaries, ages, sex and retirement age of the workforce.

The geographical location and occupation of the employees will be used to adjust (up or down) the base mortality assumption for the weighted (by salary) average age and sex.

The past experience of the scheme will be important if it is large enough to be credible. This will also be used to adjust the base mortality assumption. Employers are likely to have records of deaths in service, even if the risk has not previously been insured.

However particularly for large employers where a scheme is not in place for all employees, inaccurate data from employers gives rise to risks. Particularly with no past experience data, determining these adjustments is likely to involve an element of subjective judgement. This introduces a risk.

The factors used to assess the premium rate, in particular the age/sex structure and the type of occupation, may change while the policy is in force, invalidating the premium rate. To protect against this the rate should only be guaranteed for a limited period, perhaps one year. Alternatively the rate could be reviewable on a significant change in the size of the scheme.

There is much lower anti selection risk in the group term assurance market than in the individual term assurance market. This is because the choice to purchase insurance is not made by the individual employees and the lives covered are fit enough to work. The risk can be mitigated by making the scheme compulsory for those actively at work on the commencement date

There is also an anti-selection risk if the salary multiple varies between groups of employees, particularly for small schemes. This should not be permitted.

To reduce the risk of underwriting losses through underestimating mortality, the company can reinsure a significant proportion of the business, so that the reinsurer takes on most of the mortality risk. The reinsurer will provide the life insurance company with assistance in setting the base mortality assumption and in determining the appropriate adjustments for the occupation and geographical location of the employees.

It will also assist the life insurance company in setting appropriate free cover levels for the scheme (below which individual lives are not medically underwritten). If free cover limits are set too high, not enough employees will be medically underwritten and the insurer may suffer from worse than anticipated mortality overall. If the free cover levels are set too low then too many employees will be medically underwritten, which will be costly. If the limits are out of line with the market, business may be placed elsewhere.

Reinsuring the business has the disadvantage of passing profits on to the reinsurer but will provide the life insurance company with some comfort that they are not exposed too heavily to the mortality risk in the early days of writing this business.

To help assess the mortality risk the company can make use of publicly available data, e.g. industry statistics etc, and compare the proposed mortality rates to that data.

(ii) Catastrophe Risk

The insurer is exposed to the risk of a catastrophe at one of the employers' premises, which would lead to many claims from a single event. An example would be an explosion at a factory which killed a large number of employees.

The insurer can minimise its exposure to this kind of risk by putting in place adequate catastrophe cover. This would lead to the catastrophe reinsurer meeting the costs of claims in excess of a certain amount, when a single event leads to more than a pre-defined number of claims in a 24 hour period.

However, following the 9/11 tragedy it has become increasingly difficult for insurers to place catastrophe cover at an acceptable cost. Hence insurers are making more use of exclusion clauses to limit their liability in the event of a catastrophe.

Competition Risk

As with individual term assurance business, group term assurance business tends to be price competitive. Hence it is essential for the insurer to price the product competitively if it is to sell the required volumes of business.

Although persistency of individual members is not an issue, persistency of the whole scheme is, particularly where schemes are annually renewable. Ways of mitigating this risk might be to charge a reduced premium for subsequent years of cover after the first, or to incorporate a profit share. But if the first year's premium is the deciding factor, this may not be effective.

Product differentiation can be achieved by having a first-class service for administration and rate quotations (especially in the insurance intermediary market), and by competitive free cover limits.

If the insurer offers uncompetitive rates, it will not achieve the volume of sales required to cover the fixed costs of developing the product (including the development of systems on which the product will be administered). In addition, the insurer will lose credibility in the market if its product is priced out of line with its competitors.

To reduce the risk of having an uncompetitive product the insurer must take care not to overestimate the mortality risk. Clearly this conflicts with the desire not to underestimate mortality as described above.

Expense/Cost of capital risk

There is a risk that the company does not adequately allow for the expenses of writing this business in determining the pricing assumptions to be used. As a lot of the administrative functions are scheme based, the average size of scheme, in terms of numbers of employees will be important to spread overhead expenses correctly in the premium rating.

Writing group term assurance may be quite capital intensive if the local regulatory requirements require the insurer to hold solvency capital that is defined as a percentage of the sum at risk (since the sums at risk for group term assurance are very large). The cost of capital must be taken into account in the pricing basis. Reinsurance can reduce the cost of capital, but introduces a risk of reinsurer default.

The insurer can project the likely size of sum insured for a given volume of premium written, using assumptions regarding the average salary of the lives that will be covered. This will allow the insurer to project the capital required to support the writing of this business.

The insurer can minimise the risk of getting the expense assumption wrong by analysing the expenses that are incurred in launching this product. Accurately estimating the expense assumption will be heavily dependent on estimating the volume of business that will be written, since this will determine the base over which fixed costs are recouped.

Similarly estimating the cost of capital also requires estimation of business volumes. Here too much business increases the risk.

There is a risk that the contract cannot be easily administered on the company's systems.

There were two errors of interpretation in this question. A number of candidates assumed that the employer could select a different salary multiple for each employee when the scheme was set up. This freedom gives rise to the possibility of selection and appropriate credit was

given to candidates who made this assumption and argued logically from it. A smaller number of candidates assumed that the company published a single rate, which was available to all schemes, of whatever size and age/salary structure. The examiners felt that this assumption would obviously lead to so much selection that it must be clear that no company would adopt the approach in practice. No credit was given to candidates who did make this assumption. The question clearly states "for each scheme" rather than "for all schemes".

A large number of candidates covered catastrophe risks in part (i) rather than part (ii) as intended by the examiners. Full credit was given to candidates who did this.

There were a large number of points that could be made in answer to the question, and most candidates scored reasonably well. As usual the better candidates were generally those who adopted a structured approach to their answers. A large proportion of candidates spent much time discussing individuals withdrawing from the scheme, an event that is not relevant as the employer is purchasing the benefit for them.

8 (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 to meet (b) depends on the extent of the company's free assets.

Alternatively this 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) In theory the asset should be denominated in the same currency as the liabilities so as to reduce currency risk. In practice some overseas assets may be held so as to diversify risk and reduce exposure to asset performance in a single country; the extent of this depends on policyholder expectations and practice of other companies, and the extent of the company's free assets.

Some assets would normally be held in cash or near cash to meet immediate outgo, particularly as there is no stream of regular premium income.

That part of the benefit in the form of basic sum assured and existing declared bonuses is guaranteed in nature. The appropriate assets to back this are therefore fixed interest type investments. The higher the basic sum assured for a given premium, the greater the proportion of fixed interest type investments that should be held. Conversely methods that defer distribution of surplus need a lower proportion of fixed interest investments.

Since the term of the liabilities is 10 years, the fixed interest investment should also have this term.

The part of the benefits distributed as future bonus is not guaranteed. The company will want, as far as possible, to maximise this part of the benefit as it will improve the returns to policyholders. This means investing in assets that will produce the highest expected return. To do this, a significant proportion of assets should therefore be held in equity type investments.

This will be consistent with the expectation of policyholders who take out a with profits policy who will expect the proceeds to maintain their value in real terms. However, the company can only invest in equities to the extent that it is consistent with its financial resources and attitude to risk.

Assets with the highest returns, such as equities, will also have the highest variance of return.

Policyholders will expect the bonus rates to be smoother than returns earned on equities. The impact of this smoothing will reduce the free assets when equity returns are low and increase them when equity returns are high. The company therefore needs significant free assets in order to smooth the bonus rates.

The low level of free assets will limit the extent to which the company can invest in equities unless shareholders are willing to inject significant capital into the company.

Another issue is that, until a significant block of existing business has built up, the company is very exposed to the level of equity markets at the end of the ten years. This will again limit the extent to which it can invest in equities.

The company will need to consider whether it has the investment expertise to invest in all possible asset categories. As long as it has managed linked funds that invest in all asset categories then this should not pose a problem.

The company will need to reflect policyholder expectations when setting investment strategy. Since there is no past practice for the company, this will be based on policyholder literature and the actions of other companies in the market. The company has the opportunity to frame expectations appropriately by careful drafting of literature targeted at the appropriate market.

The company should consider the different tax treatment of different asset classes.

The assets held should be sufficiently diversified so as to minimise the risk of over-exposure to any one counterparty.

Regulatory rules may limit the types of amounts of assets of certain types that can be held.

The company may want to minimise over-exposure to any particular asset type by holding some property as well as equities and by holding equities across a range of different sectors.

Features of certain assets may affect the supervisory valuation basis for the liabilities. Thus efficient asset choices can affect free reserves and hence investment freedom.

- (iii) Policyholder expectations are influenced by the general practice in the insurance market, as well as by specific statements made in marketing literature.

The company will need to consider whether to match competitors' asset structures or to differentiate, and make a point of the differentiation by careful explanation in literature.

Usually with profits policies offered by companies operating the additions to benefits method have a significant proportion of equity investments. Also, policyholders who take out a with profits policy will expect the benefits to smooth out the peaks and troughs in market levels.

But with low free assets the company will not be able to achieve either of these objectives. This will need to be clearly set out in policyholder literature so as to set appropriate policyholder expectations.

The effect on sales depends on the financial sophistication of the target market and any intermediaries involved in the sales process. It may be that the technicalities do not affect sales volumes. Rather sales could be driven by a good past performance record on existing unit-linked business, on the grounds that, although not a guide to the future, it gives an indication of the quality of the company's investment management.

A lower equity proportion is likely to result in lower long term returns which may have an adverse impact on sales.

Less smoothing is also likely to have an adverse impact on sales.

So it is difficult to see how the policies can appear competitive without a significant capital injection.

Part (i) was a frequently asked piece of bookwork, and was well answered. Full marks were available for either of the two definitions; it was not (and is never) necessary to write both. Part (ii) was generally well answered, with many candidates scoring highly. Performance on part (iii) was very mixed. Candidates who understood the impact of free assets on investment choices, and then moved to the consequent effects on new business volumes gained a number of points. Others preformed much less well. Candidates who mentioned relevant competitive issues in their answer to part (ii) were given credit for them in this part.