# Actuarial Society of India

## EXAMINATIONS

*June 2005*

*CA12 – Liability and Asset liability management*

## Indicative Solution

**Q.1 (a)**

The central part of the actuarial control cycle is based on a simple approach to problem solving:

- Firstly define the problem
- Then design and implement a solution
- Then monitor the effectiveness of the solution and revise it if necessary.

The actuarial control cycle must of course be considered in the context (eg. Legislation, taxation, and economic trends) of the specific economic and commercial environment in which it is being used. In addition the requirements of professionalism must be recognised at all stages of the cycle.

**Q.1 (b)**

(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 needs 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 Medical Examiner's report
- Check some cases (large cases plus a sample of others) with a Medical Examiner's 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 nonsmoker 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.

**Q.2**

Part (a)

The reasons why life insurance companies need capital are to:

- fund the strain from writing new business … [½]
- which may be particularly important in an environment where marketing pressures do not enable sufficient upfront charges to match initial expenses) [½]
- attract new business as financial strength may be significant in determining new business levels (if considered important by individuals and their advisers) [1]
- increase free reserve which will enable the company to invest more freely (in the pursuit of higher expected returns) [½]
- provide the capital required to achieve its strategic aims, *eg* develop a direct sales force, undertake other major new ventures, acquire another company [1]
- provide the capital required to fund overheads and development costs such as computer hardware and software, product development etc [1]
- smooth reported profits [½]
- improve the solvency position of the balance sheet (especially in a time of increasingly stringent supervisory solvency requirements) [1]

cover the general day-to-day risks to which the company is exposed, such as:

- policy guarantees *eg* guaranteed annuity options, guaranteed maturity values [½]
- persistency and expense risks including the effects of inflation [½]
- operational risks [½]
- mortality risks, *ie* claims volatility. [½]

[Maximum 6]

Part (b)

Generally, the main aim of financial reinsurance is to exploit some form of regulatory arbitrage in order to more efficiently manage the capital, solvency or tax position of a life insurance company. [1]

However, all financial reinsurances may be viewed as undesirable by regulators and therefore legislation may change to limit its use, possibly retroactively. [½]

Financial reinsurance is done in the form of a reinsurance contract between the life insurance company and the reinsurer. [½]

Financial reinsurance usually operates either by:

- increasing the assets without a corresponding increase in the liabilities [½]
- reducing the liabilities without a corresponding reduction in the assets. [½]

***Increasing the assets without a corresponding increase in the liabilities***

A straightforward loan from a reinsurer would increase the assets but would not act as a source of capital as the insurance company would usually have to add the amount of the loan to its liabilities in its balance sheet. [1]

There are two main ways to prevent this:

1. Present the loan as a reinsurance commission and the repayments as increases in the reinsurance premiums in future years. [½]

The reinsurer would take into account the expected lapse experience of the portfolio of reinsurance in determining these future payments. [½]

As the insurance company cannot take advance credit for the reinsurance protection it will receive in future years, neither does it have to make any provision for the future premiums that it expects to *pay* for that cover in future years. So, the insurance company does not have to treat these repayments as a liability in its balance sheet. [1]

2. Make use of the future profits contained in a block of new or existing business (an arrangement known as *surplus relief*). [½]

The reinsurer again provides a loan to the insurance company (thereby increasing the assets) but, as the repayment of the loan is contingent upon the stream of future profits being generated by the business, the insurance company does not need to include a provision for repayment in its balance sheet. [1]

The extent to which this is possible will depend on the requirements of the supervisory regime concerned. [½]

***Reducing the liabilities without a corresponding reduction in the assets***

One way in which this could be achieved would be through using assets that are not admissible for supervisory solvency purposes as a reinsurance premium. [1]

The liabilities are then reduced by the amount of reinsurance but the supervisory value of the assets is unchanged (as the reinsurance premium paid had no value for supervisory purposes). [½]

[Total 8]

**Q.3**

Part (a)

Individual

*Advantage*

- the tax system is easy to understand
- can cash in when the income is in lower tax bracket *eg* after retirement or during period of unemployment
- would encourage them to save more for retirement in an environment where life expectancy is increasing, defined benefit pension schemes are getting closed an, with aging population, the government is finding it difficult to provide adequate level of state pension

*Disadvantage*

- will have to pay tax at high rate if they wish to withdraw large sum for say house purchase or setting up of business
- as tax relief on contributions is available up to a certain amount and the whole amount of proceeds are taxable, there will be double taxation on the proceeds pertaining to contributions above the limit

Government

*Advantage*

- provide a tax structure which is easy to calculate, easy to collect and easy for all to understand
- would encourage long term savings
- provide level playing field for all providers *eg* banks, unit trusts, life insurers

*Disadvantage*

- will get less revenue during recession because those who are unemployed or underemployed will withdraw without paying tax
- may receive less tax in total with this system than with other systems
- the tax revenue is deferred and is therefore of limited immediate benefit to Government revenue.

[½ marks for each point, maximum 4}

Part (b)

Other practical ways of providing tax concessions on savings are:

Tax relief to individuals on contribution but tax on proceeds less contribution (possibly with some relief for inflation) [1]

Tax relief to individuals on contribution with tax on distributed investment income and capital gains (perhaps with some indexation) at the time of encashment [1]

A tax on contributions received by the provider [½]

A tax on profits, *ie* tax on the excess of value of assets over the value of liabilities [½]

Tax relief on investment in a particular sector *eg* equities [½]

Tax relief only on certain types of products *eg* pension [½]

[Total 4]

**Q.4**

Anti-selection by:

- age
- past driving experience
- location
- vehicle types

Catastrophe risk

Propensity to claim increases as will not worry about next year premium

Increase in moral hazard

Delay in receipt of premiums

Potential for business to be loss making, as small could threaten solvency.

Contract lasts for 3 years so could be tied into loss making rates, also the need to predict inflation for 3 years. Also, new car types could change substantially over time.

Car sales are seasonal - operational problems as small company doing the admin.

If volumes are small will not cover start up costs

Currency risk as manufacturer may sell in many countries

Difficulty in obtaining appropriate reinsurance cover.

Solvency capital considerations as small company and this is a major motor manufacturer, it will substantially increase new business.

Difficulty in setting the fixed price - long discussion as don't know the mix of business are pricing for. Could use manufacturer's details or own judgement or published statistics. Actual experience could be different from assumptions used to derive the fixed price.

Small insurance company will not have much useful historic data especially of writing brand new cars from this manufacturer.

Billing mechanism will need the facility for verification so both parties agree how many cars have been sold

Risk that the manufacturer goes bankrupt and the insurance company does not get paid although the cover is given.

Again there is the risk that the insurer itself becomes insolvent.

UPR variable over the 3 years as the risk varies over the term

If the cover is only for the original purchaser this will exacerbate the variability of UPR/earnings. Could also be an advantage to the insurer if cover, depending on the extent that this has been allowed for in rating the product.

Need to consider the investment strategy in respect of investing receipts for longer than for an annual policy and risks associated with expected returns and security

Introduction of, or increases in rate of, tax or levies imposed by the government based on earned premiums.

**Q.5**

Part (a)

Data:

Scheme rules with details of benefits and eligibility conditions [½]

Normal retirement age [½]

Membership details on the valuation date: Employee number, Name, Sex, Date of birth, Date of joining, current salary [1]

Details of assets held under the scheme [½]

Death, withdrawal, retirement and salary growth experience for the scheme for a sufficiently long period, say 3 to 5 years [1]

Relevant tables or published information for movement rates [½]

[Total 4]

Part (b)

Checks:

Reconcile membership details this valuation with membership details last valuation using membership movement data [1]

Check average age this valuation with average age last valuation [½]

Check whether members lie within a reasonable age range [½]

Salary for a member this valuation should be consistent with salary for the same member last valuation [½]

Date of joining should be consistent with date of birth e.g no member joins service below age 16. [½]

Benefits paid to be consistent with membership movement data [½]

Scheme assets data to be consistent with the income from assets appearing in the scheme accounts [½]

[Total 4]

Part (c)

Analysis of salary increase experience:

There are two increases to investigate: general and promotional/age-related. [½]

These are difficult to distinguish in practice. [½]

Need to use data for members present at both valuation dates ... [½]

... otherwise you will be looking at the experience over two different populations and the answer will be false. [½]

One method is to develop a table which compares, for various age groups, the actual average salary at this valuation and the actual average salary at the last valuation. Any increase is due to both general and promotional increases. [1]

This can be compared with what was expected. [½]

To analyse promotional increases separately you need to identify the global cost of living rises awarded each year over the intervaluation period. [½]

This is most easily done with the company's help. [½]

Alternatively for each age group you could compare the average salary of *all* members at the last valuation with the average salary of all members at the current valuation. This should indicate the general increase in pay excluding promotional increases. [½]

But, this figure can easily be distorted and should be treated only as a rough guide. [½]

National salary inflation indices are also useful indicators. [½]

Once the actual *cost of living* increases over the period have been identified, they can be removed from the figures to isolate the actual *promotional* increases. [½]

… and hence can be compared against expected promotional increases. [½]

[Total 7]

Part (d)

The scheme can retain the whole risk and pay the death benefits from the fund [½]

The decision will depend on expected variance of death claims experience, the amount of surplus assets in the scheme and the sponsoring employer's risk appetite. [½]

The risk can be managed by insuring the death benefits with an insurance company … [½]

… but then the scheme will have to pay for insurer's profit and administrative expenses [½]

An alternative can be to insure the excess of death benefits over actuarial reserve, so that no strain arises on death [½]

Or to insure only the future service benefits [½]

The scheme can just take a catastrophe cover [½]

Another alternative is stop loss cover, although this is rarely available. [½]

[Total 4]

**Q.6**

Part (a)

Need to estimate the future experience of those who will take out this policy … [½]

… which is a problem as the company has no past data. [½]

Is there any industry data for the country? [½]

Is there any national statistics for incidence rate available for the section of the population being targeted? [½]

Do reinsurers have any useful data? – may not be much for the country, so need to look at reinsurers' data relating to other countries, bearing in mind the differences. [1]

For example, look at their relative population mortality and morbidity characteristics, underwriting differences, cultural differences. [½]

Different policy wordings will cause further differences in the experience data compared with the new product. [½]

It will also cause any experience data to be heterogeneous, so even the trends may be misleading. [½]

So overall it will be difficult to get a good fix on the inception rates. [½]

However this will not be too problematic because the unitised nature of the contract will permit reviewable charges. [½]

Once the company has decided on a suitable best estimate of the future experience, a margin will need to be added. This should be reasonably big because of the uncertainty ... [½]

… but not huge because of competitiveness, and the ability to vary rates. [½]

However, competitors are also likely to include margins, if this is a new product for all, they also have the same problems. [½]

[Maximum 6]

Part (b)

The applicant could be declined the rider. This option would only be adopted as a last resort, for the highest risk lives, when all other possible ways of dealing with a case are considered to be too risky for the company. [1]

An extra premium could be charged or a deduction made from the benefit, for all or part of the policy term. This extra premium would be individually assessed for the person in question. This method is appropriate for cases in which the level of extra risk can be assessed with a good degree of confidence, and is not too excessive. [1]

An exclusion clause could be imposed on the policy, *ie* such that hospitalization arising due to pre-existing conditions or due to a particular illness would not lead to payment of benefits under the contract. For some types of pre-existing conditions there might be a limit to the number of days for which payment is made. There may also be difficulties due to possible bad publicity in cases where the company does not pay out and potential legal contests if there is uncertainty about a diagnosis and so about whether or not a claim is valid. [1]

The decision may be deferred to a later date, if it is felt that the current prognosis of future health is too uncertain to make a decision at the present time, but may become clearer at some future date. This could arise, for example, if the applicant has recently undergone some serious medical treatment. [1]

[Total 4]

**Q.7 (a)**

The actuary is often required to make fairly long-term assumptions for each parameter in the assumption set. The values assigned to these parameters should reflect the expected future experience of the lives that will take out the contract being priced.

## *Mortality assumption*

If the company has adequate data, the adjustment would be derived by analyzing the company's own experience for the type of contract concerned. Alternatively, the experience of a similar class of business could be used as a substitute.

The data would relate to an appropriate period of years, such that the volume of data is adequate, but excessive heterogeneity due to trends over time is not introduced.

The analysis would divide the data into relevant homogeneous groups, subject to adequate levels of data being retained within each cell.

If the company has insufficient data to produce reliable results or has no appropriate data at all, industry sources, such as CMI Reports or life reinsurance companies would be used instead.

If the adjusted rates are to apply to a class of lives which is expected to have a different experience from that to which the analysed data relates, then further adjustments may need to be made. This situation could arise due to a change in target market, distribution channel, or the basis of underwriting and accepting lives.

[2]

## *Withdrawal assumptions*

The withdrawal assumptions should reflect the expected future experience in respect of the contracts that will be taken out.

They will be based on an analysis of the company's recent experience. Ideally, this should relate to the contract being priced, but if no experience exists or the available data is inadequate, then the experience under any similar contracts would be analysed.

If the company does not itself have adequate data, there may be industry wide experience that it could use.

The results of such an analyses should be assessed to see if they have been affected by special factors such as an adverse economic situation in the country.

The market segment effecting the contract is a key influence on the withdrawal rates. If the contract is targeted at a different market from that in the experience data, an appropriate adjustment will need to be made.

[2]

## *Investment return*

The values assigned to the parameters for investment return will be affected by:

- The significance of the assumption for the profitability of the contract, which will depend on the level of reserves built up.
- The intended investment mix for the contract, the current return on the investments within that mix and where appropriate the likely future return.

Likely to be a relatively less important assumption for a term assurance.

[2]

## *Expenses*

The parameter value for expenses should reflect the expected expenses to be incurred in processing and subsequently administering the business to be written.

These values will be determined after analyzing the company's recent experience for the type of business concerned. The result of this analysis will be a division of the expenses by function and possibly by whether the level of expense is expected to be proportional to the level of premium or benefit, or can be expressed as an amount per contract.

If the company has insufficient recent experience to provide meaningful results, or suitable recent experience is not available, the parameter values may be based on a similar type of business and, if this is not available or not reliable, on any industry data or data from a life reinsurance company.

An area of risk with expenses relates to how to incorporate into the premiums r charging structure the expenses that do not vary by size of contract.

The company will set the parameter values for commission and is likely to take account of the rates of commission normally paid in the market in which the company intends selling the product.

[2]

Inflation of expenses:
The following may be considered when setting the value of the assumption for the inflation of expenses:

- Current rates of inflation, both for prices and earnings
- Expected future rates if inflation
- The differential between the return on government fixed-interest securities and on government index-linked securities, where such exist
- Recent actual experience of the office or the industry as a whole.

[1]

## *Reinsurance*

An assumption will also be needed for the cost of any reinsurance that may be purchased in respect of this contract. This will involve projecting expected future terms on which other parties will write reinsurance.

[1]

## *Margins*

The assumptions will be estimates of the expected values for the parameters. Where a cashflow model is being used to price product, the risk to the provider from adverse future experience could be allowed for by:

- Adjusting the risk element of the risk discount rate
- Using a stochastic discount rate
- Assessing what margins to apply to the expected values.

## *Profit margins*

In pricing a product a profit requirement will need to be incorporated, as it is reasonable to suppose that the owners of the provider decide where to invest by comparing the returns offered by different projects, relative to the risks that are run.

[2]

## *Risk discount rates*

It represents the risk-free rate of returns that the providers of capital demand plus an amount to allow for the risk that the profits may not emerge as expected from the project.

The following features that can make a product design riskier, viewed as an investment:

- Lack of historical data
- Policyholders options, such as conversion options
- Overhead costs.

It is not easy to assess these risks, and it is even harder to say what effect they should have on the risk discount rate.

[2]

## *Profit criterion*

Among the profit criteria that could be used are:

- Net present value
- Internal rate of return
- Discounted payback period

[1]

**Q.7 (b)**

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 online (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.

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