

# **Institute of Actuaries of India**

**October 2009 EXAMINATION**

**Subject ST2 — Life Insurance  
Specialist Technical**

**MARKING SCHEDULE**

Sol 1. a)

- The amount of the reserves should be such as to ensure that all liabilities arising out of life insurance contracts can be met by the life insurance company
- The amount of the reserves should be calculated by a suitably prudent actuarial valuation of all future liabilities for all existing policies, including:
  - Guaranteed benefits, including guaranteed surrender values (the amount of the reserves for each policy should be at least as great as any surrender value generated and therefore should not be negative)
  - Bonuses which have already been guaranteed, whether described as vested or allotted
  - Options available to policyholders
  - Non-unit reserves for unit-linked policies
  - Future bonuses for all kinds, taking into account the reasonable expectations of policyholders
  - Expenses, including commissions
  - Taking credit for the premiums which are due to be paid under the terms of the contracts
- A prudent valuation is not a “best estimate” valuation, is neither too much nor too little, but should include an appropriate margin for adverse deviation of the relevant factors
- The valuation should take account of the nature, term and method of valuation of the corresponding assets, depending on the type of policy
- The use of appropriate approximations or generalizations should be allowed
- The rate of interest used in the calculations of the reserves should be chosen prudently, taking into account the currency in which the policy is denominated, and having regard to the yields on the corresponding existing assets and to the yield which it is expected will be obtained on sums to be invested in future
- The elements of the statistical basis, that is the demographic and withdrawal assumptions, and the allowance for expenses used in the calculation of the reserves, should be chosen prudently, having regard to type of insurance, the country where the insured people live, and the administrative costs and commission expected to be incurred
- Where no explicit allowance is made for future bonuses, a rate of interest should be used which is lower than the rate chosen according to the last but one principle, by an appropriate amount
- If a valuation method defines in advance the amount of expenses to be used in the valuation, the amount so defined should not be less than a prudent estimate of the relevant future expenses
- The method of calculation of the reserves from year to year should be such as to recognize profit in an appropriate way over the duration of each policy and should not be subject to discontinuance arising from arbitrary changes to the valuation basis
- Each life insurance company should disclose the methods and bases used in the valuation
- The reserves should not be less than any surrender value payable, whether or not it is guaranteed
- The allowance for expenses should allow for the possibility of the company closing to write new business, if that would increase the reserve

Sol 1. b)

There are 4 checks:

- Firstly, a data reconciliation between “now” and the previous model run
- Grouping data into large blocks (not model points) such as products subdivided by year of entry
  
- Test that
  - Data at previous investigation
  - Plus business come onto the books
  - Less business gone off the books
  - Should equal data at current investigation
- Use this to check items such as policy numbers, premium, sum assured, units by fund (for unit linked business)
- While doing this check it is also useful to check the movement data against appropriate accounts data
- Secondly, check consistency
  - This means checking that the averages by class (eg products by year of year of generation) of important values such as premium and sum assured are sensible
  
  - The ratios of sums assured to premiums are reasonable and consistent with last year
- Thirdly, check for unusual values such as very large sums insured, or ridiculous ages, or total units held of zero
  - Also check for groupings in specific years or specific premium sizes
- Fourthly, look at the valuation analysis of surplus. Any major discrepancies should be investigated as they may indicate data problems.

[20]

Sol 2. a)

Life insurance companies may be taxed in a number of different ways. The most common methods are:

- A tax on the annual profits of the business, where broadly profit means the excess of the change in the value of the assets over the change in the value of the liabilities sometimes this may be based on a specific basis of calculation for the liabilities.
- Tax payable on investment income less some or all of the operating expenses of the company
- In addition, there may be a tax on premium income.

Sol 2. b)

- Within a particular country, different types of life insurance business may be taxed on different methods eg. Pensions business may be taxed differently from other businesses.
  
- This can mean that it is lower cost for the consumer if certain forms of benefits can be offered as one type of business rather than another
- The taxation treatment of life insurance business may make life insurance more or less attractive as a savings medium in that contracts offered by other savings institutions may be subject to a different fiscal regime
- Tax concessions available to an individual may make the sale of certain types of contracts easier

- The tax treatment in the hands of the policyholders of policy proceeds can distort buying habits
- Taxation of life insurance products can provide opportunities to life insurance companies. On the hand, the ability to avail of favourable taxation treatment may force constraints on product design.
- The presence of tax losses and their treatment may make is beneficial to the company to sell certain products with a particular design

[7]

Sol 3. a)

The possible justifications are:

- The company may have made a loss on early withdrawals when the asset share would have been negative, often substantially so. So the company feels justified in recouping some of these withdrawal losses by making profits from later withdrawals
- There will be a significant selective withdrawal effect. The retained asset share can then go towards meeting the increased costs due to the higher average mortality of the remaining insured lives
- Assets shares can never be very large on level term contracts, and payment of very small surrender values would not justify the cost of administering them
- Term assurance asset shares will tend to be quite volatile (fluctuating with claims experience each year), making any fair scale of surrender values equally volatile. This could seriously upset policyholders
- Even at later durations asset shares are not always positive eg where the policy is loss-making.
- The policy contract does not provide for any benefit on early termination
- In setting premium rates, the profits on termination will probably have helped to keep the premium rates down.

Sol 3. b)

- Policyholders from different companies with identical investment, expense and mortality experience, and distributing the same proportion of surplus, will receive broadly the same eventual benefits irrespective of slight variations in the premium level.
- This is because the bonus distribution will tend to release to policyholders the excess of eg investment profit over and above the guaranteed level implicit in the rates, so that a lower sum assured will be associated with bonus rates, all else being equal
- However, different companies will have different bonus philosophies, in particular the degree of smoothing of bonus rates between cohorts and from year-to-year, and the extent of terminal bonuses.
- However, the guaranteed benefits will be different, especially early on
- Some companies have stronger estates (built up over time) and hence they may be able to take more investment risk, which could result in better returns. Whilst others may build a margin into the rates to help create the estate.

- Some companies may have better scale or better expense management, which will mean more chance of favourable expense experience, which may result in better bonuses. Whilst others may need to charge more to cover their expense inefficiency.
- Some companies may rely heavily on cross-subsidization between large and small premiums,
- Some companies are mutual and other proprietary. All other things being equal the proprietary companies will produce lower returns as a result of the payments to shareholders (although this may be, at least in part, offset by the greater investment freedom and lower expenses mentioned above.
- A with-profits policyholder simply wants to save a certain amount per month, rather than have a particular sum insured. At parity of investment, mortality and expense experience, a given sum of premiums should lead to the same final benefit
- However, there are two ways in which the premium rate, ie the level of guaranteed sum assured relative to the premium, can have an effect on the final maturity payout.
  - With a higher sum assured, the death benefit at early durations will be higher. Hence the asset share will grow less quickly, as more is paid out on death, which means that the maturity amount should be lower. This actually leads to an inverse relation between the maturity proceeds and the guaranteed sum assured – the higher the guaranteed sum assured the lower the maturity benefits are likely to be.
  - A policy having a higher level of initial guarantee implies that the reserves near the start of the contract will be higher. This gives the company less investment freedom, a lower expected return from the assets, and hence a lower expected maturity value.

[14]

Sol 4. a)

Factors affecting withdrawal experience

- Duration in force – usually most important factor
- Sales method / channel / agent / market segment – important
- Commission /clawback terms
- Policy size
- Age
- Sex
- Term
- Premium payment method
- Premium payment frequency
- Competitiveness of premium rates/ product design – both at inception and subsequently
- Market conditions (investment?)
- Economic factors (unemployment, interest rates, inflation)
- As it is a small portfolio it will be subject to more volatility than a larger portfolio
- Impact of legislation/regulation /fiscal changes
- Change in strength/reputation of the company

## Sol 4. b)

- Insufficient data to analyze all relevant factors in detail – too few records in each cell of the analysis. The company has only a small portfolio hence the data may quite possibly be immature
- The data should be sufficiently large for grouping
- Focus should be on important factors such as duration in force, sales methods etc, which significantly impact the experience
- It may be possible to look at the experience on other similar products too, if these exist
- compare with withdrawal data from other sources if available– e.g. reinsurer / industry stats and pay particular attention to the relative difference between industry experience for a factor (say, Premium Payment mode, where we only have enough data for one mode (say))– but we should note any sources of difference.
- Important to test sensitivity of any assumption e.g. commission etc.
- Data could be corrupt
- Overcome this by proper data checking (and possible excluding certain tranches of business)
- System may not have stored some data accurately (e.g. channel)
- There may have been changes in product terms or changes in business source.
- Overcome this by comparing tranche (before and after the change)
- The distribution channel and target market for the new product may be different to the current channels and target market, making the current analysis unreliable as a predictor.
- Isolate impact of one-off events where possible eg reduction in premium rates by a competitor

## Sol 4. c)

- Withdrawing policies may have different future mortality experience from those that don't.
- There is a risk that healthier lives withdraw leaving the insurer with less healthy lives. This is more likely if rates in the market have reduced.
- This means that reserves could then be underestimated and the future mortality experience could deteriorate
- Can anticipate the potential risk but the impact is difficult to estimate and there remains a risk that one underestimates the effect.

## Sol 4. d)

## Impact on profitability

- A lapse at early durations will result in a financial loss to the insurer since initial expenses are not recouped
- Lapse at later duration could increase the profitability since there is a release of reserves held in respect of these policies and these contracts typically do not pay Surrender Values.
- If more policies withdraw then the insurer is exposed to risk of loss arising from the effect of selective withdrawals.

- Higher lapses than expected result in lower volumes of in-force business, and this may result in under-recovery of maintenance expenses.

Sol 4. e)

Impact of aggressive competitor

- Current book is not large, so the total impact won't be that big.
- 20% cheaper may not translate to 20% cheaper for existing clients, who are now older, and looking for a shorter term. Where you hold a large positive reserve, the client is unlikely to find the new terms attractive.
- The reputation of the competitor may impact on his success in attracting your clients
- On a term assurance policy, a saving of up to 20% may not be sufficient to persuade all healthy clients to move, as the premiums are usually very small relative to the client's means.
- The loss for recently written business is likely to be largest, because initial expenses won't be recovered, except possibly for any clawback on commission.
- The take up is likely to be largest at early durations because addresses are unlikely to have changed and the client is aware of the policy
- The declaration of health may discourage clients of yours who are now in worse health from moving – so you will feel the effect of selective withdrawal

[23]

Sol 5.

### **Immediate annuities**

#### *Longevity risk*

- Risk is that that policyholders experience better mortality than is assumed in the premium basis.
- There is a risk of self selection by lives that expect to live longer than the mean life expectancy
- Select a suitable (annuitants) mortality table with a prudent allowance for future mortality improvements
- Adopt a strategy which means that you get a share of poorer lives and/or adapt a pricing/underwriting strategy which prices impaired and other lives separately

#### *Interest rate risk*

- Single premium product – so minimal risk if pricing interest rate is closely matched.
- Prices are adjusted regularly against the market to available yields on bonds of appropriate duration
- For younger lives where long term matching investments may not be available, a margin is included for reinvestment risk

#### *Expense risk*

- Risk is that maintenance / payment expenses exceed pricing assumptions
- because of higher than anticipated expense inflation
- Initial expenses can be met immediately from the single premium, so no risk that they are not recovered.

*Other risks*

- failure to price the product competitively or failure to offer attractive features may result in lower take-up and hence higher per policy expenses
- being a new product with very different features there is a risk that the processes and systems do not work as planned
- fraud risk is higher because it is not practical to investigate every annuity payment. However, the financial impact is likely to be small

**Group deferred annuities***Mortality / longevity risk*

- Mortality risk in deferment depends on the benefits on death before retirement
- if premiums returned with ~actual interest earned, then no mortality risk
- if pricing allows for higher or lower death benefits, there is an implied mortality guarantee.
- A margin in the mortality table (appropriate to the nature of the death benefit) can be taken.
- Annuity rates at retirement may or may not be guaranteed. If they are, there is significant longevity risk, which demands a prudent allowance for future mortality improvement.
- May need specific underwriting because individual member data may not be available so need to consider type of group being insured

*Interest rate risk*

- Risk is that asset proceeds cannot be reinvested at the yield assumed in pricing during the deferred period since capital value at retirement is usually guaranteed
- While the yield assumed on the initial invested amount can be at market rates, a lower yield assumption for reinvestment should be used to price

*Expense risk*

- Risk is as for Immediate Annuity but potentially greater because term of contract may be longer

*General*

- All these risks could be mitigated by the use of with-profits contract design - life office does not guarantee all benefits.
- Mitigate by stress testing assumptions about new business volumes
- Mitigate by carefully testing systems and processes before launch

**[10]**

Sol 6. a)

The Financial and economic assumptions will be:

- Expected return on assets underlying units
- Expected asset mix to derive Unit growth rate
- Interest on non-unit and negative non-unit reserves
- Inflation of expenses and administration charges
- Risk discount rate
- Tax rates

## Sol 6. b)

*Principles in setting assumptions*

- You would want a stable basis that is slightly prudent but not overly conservative, as the results will be published. It is not a best-estimate.
- The uncertainty that is likely to apply to many of the parameters here would be allowed for through a suitable choice of risk discount rate, and so large margins in the individual assumptions would not be appropriate

*Mortality*

- The company will have very little data and these data will not be credible
- Experience and judgement would be needed based on standard tables adjusted in line with recent experience (from industry data)
- Also adjusted for the company's target market and degree of underwriting
- Also take account of any data available from reinsurers
- This will not be so critical if the company can vary its charges or has significant reinsurance cover, otherwise it should allow for any deterioration of experience expected (eg due to AIDS), or for improvement in mortality (especially for the annuity business)

*Withdrawals*

- These would be difficult to estimate since the company has only 3 years of data, and the last year may not be reliable (still chance that premiums will be paid)
- These data could be used as a starting point (depending on how much data there are), bearing in mind that withdrawal rates would tend to fall in the first few years after the sale (i.e. duration effect)
- Based on experience and judgment, advice might be sought from reinsurers, consultants or employees with relevant experience.
- Care will be needed in using any information because withdrawal rates vary considerably over time and for different target markets and sales channels
- Need to consider separately full and partial withdrawals and Paid-ups/premium holidays

*Expenses*

- It is a fairly new company but will have some expense analysis to refer to. This could be used to determine the items of expense (salaries, property etc)
- There will be a few problems because of the start-up, namely:
  - i. Company might base its expense loadings on a steady state situation, and will not yet be at that stage
  - ii. Adjustments might be necessary for the exceptional costs of start-up
- Could set up a specific reserve for expected overrun until critical mass is achieved

[14]

Sol 7.

- 1) Assets may not be appropriate for the Liabilities
  - Not an issue for the unit linked (as long as mandate is followed)
  - Risk of not having suitable nature (fixed payments at the end)
  - Risk of default on corporate bonds.
  - Risk of not having the same term (tenor/tenure)
  - Risk of having to reinvest interest payments in future
- 2) Mortality higher than priced for
  - Issue for the unit linked and non-Par
  - Risk of deteriorating trend in mortality (unlikely)
  - Risk of inadequate/ineffective underwriting
  - Risk that major factors were not properly allowed for (gender, habits)
  - Risk of not reaching the desired target market
  - Magnitude of risk depends on the type of death benefit given (initial size and subsequent run-off)
  - Catastrophe risk – especially if there is geographical concentration
  - Epidemics
- 3) Concentration of business
  - Relying on just 2 products (both of which are investment type products)
  - Change in tax dispensation may make products unattractive, and could even result in wide spread surrenders
- 4) Expense control
  - Unable to change expense charges
  - Risk that volume of business will not grow as expected
  - Risk that inflation (and particularly salary inflation) may be higher than expected
  - Risk that new regulatory requirements may increase costs
- 5) Operational Risk
  - Insufficient testing of systems may mean errors in payments and cost of correcting this.
  - Errors by staff (poor training, poor controls or poor process) may result in, for example, wrong unit price being loaded for UL, wrong bond being purchases, or wrong benefit being paid
    - Risk of fraud (where benefits are too small to be investigated)
    - Risk of external event eg flood/fire affecting systems/ability to operate
    - Risk of legislation/fiscal/regulatory changes
- 6) Reputational risk
  - Risk that errors damage the brand with either public or regulator
  - Risk that poor selling practices damage image with clients
- 7) Capital Management
  - Risk that business mix or volume is such that capital is used up.

[12]

**Total Marks [100]**

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