

**Actuarial Society of India**

**Examinations**

**November 2005**

**ST2 – Life Insurance**

**Indicative Solutions**

**Q.1)** New Business Strain

- a) Premium paid at start of contract less initial expenses including commission, not sufficient to cover reserves and solvency margin requirements at that point.

[1]

## b) Design of Contract

- ? Design enables reserves and solvency margin requirements to be kept low.
- ? Lower reserves, lower new business strain.
- ? Slower the increase in reserves over the contract term, the faster any capital is released.

## Frequency of payment of premium

- ? Amount of premium paid at start directly impacts new business strain, other factors being equal.

## Relationship between the pricing and supervisory reserving bases

- ? If a company were to calculate supervisory reserves using its premium basis assumption, and there was no solvency margin requirement, there would be no initial capital strain because premium calculated to pay initial expenses and then be exactly sufficient to meet ongoing expenses and benefits.
- ? If the reserving basis is stronger, then the premium will seem insufficient and capital will be required. Supervisory reserving bases are often stronger than pricing bases.

## Level of initial expenses

- ? Amount of initial expenses directly impacts new business strain, other factors being equal.
- ? If premium charged includes a relevant loading, the reserves may take credit for the present value of these loadings and there is no net effect.
- ? But supervisory reserving basis may not allow this to happen.
- ? Initial expenses may be higher than expected in pricing basis.

**[1/2 mark each point max 5]**

- c) ? It may be that initial expenses and commission are lower for unit linked business
- ? The reserving methodology for wp business is often such that reserves are required to be set up in the first year in excess of those on equivalent unit linked policies
  - ? True that investment guarantees are a significant factor in reserving and there are often no guarantees with investment linked contracts.
  - ? Some investment linked contracts do have investment guarantees and

these must be reserved for when present.

- ? With profit contracts are able to pool risks to a greater extent than investment linked eg across generations of policy and across risk types eg investment losses offset by mortality profits. Therefore less risks, therefore less reserves or solvency requirements.
- ? Investment linked contracts can vary significantly in design especially in the way they recoup initial expenses. Some designs recoup expenses over long periods of time and in these cases initial reserves may be higher.
- ? Investment linked contracts have differing approaches to surrender values. High early surrender values and / or low surrender penalties can increase reserves and therefore strain as in general reserves cannot be less than surrender values.

[1/2 mark each point max 3]

**Q.2)**

**Discretion and Surplus Distribution Systems**

- a) ? Although distributions of surplus are invariably discretionary this is not the same as arbitrary.
- ? The Regulator is likely to expect or require discretionary distributions to be:
  - o Equitable between categories and generations,
  - o Not threaten the company's future business plans, investment strategy or solvency,
  - o Mindful of policyholders' reasonable expectations – created by statements made when selling a policy including benefit illustrations.
- ? There may also be limits on the proportion of surplus that can be distributed to shareholders, typically in the range 10 to 30%.

**General Considerations**

- ? Legal requirements
- ? Market practice on bonus distribution
- ? Competition's products will impact marketability of the product
- ? Systems limitations
- ? Management limitations – particular expertise may be required for some systems.

[1/2 mark each point max 4]

**b) Cash Bonus**

**&  
c)**

- ? May suit policyholders who are asset rich but income deficient.
- ? Compromises build up of long term benefits intended to meet the

policyholder's needs.

#### Premium Reduction

- ? Can reduce all premiums, next premium or reduce the premium paying term
- ? Compromises build up of long term benefits intended to meet the policyholder's needs.
- ? May suit policyholders who are asset rich but income deficient.

#### Benefit Increase

- ? Initial guaranteed sum insured increased by bonuses of three kinds:
  - o Regular reversionary – added throughout the contract term
  - o Special reversionary bonuses – added as a 'one-off' from time to time
  - o Terminal bonus – when the contract reaches maturity and possibly on death or surrender
- ? Regular reversionary bonuses may be simple, compound or super compound
- ? System can be used to defer or delay the distribution of profits and this increases the probability of remaining solvent.
- ? Deferral of distribution can provide greater investment freedom and this could lead to higher bonuses.
- ? Deferral, and use of terminal bonuses, could be relatively unpopular with policyholders as not guaranteed, and so make marketing more difficult.
- ? Augment primary benefits under the contract which presumably tie in with policyholders actual needs.

#### Revalorisation

- ? Surplus is expressed as a percentage of the contract's supervisory reserve.
- ? Benefit and premium are then increased by the same amount.
- ? Profit may be divided into a savings element and an insurance element – the former being profit from investment performance and the latter from all other sources.
- ? Insurance element may be retained by shareholders as reward for the insurance risks they have borne.
- ? Method is simple, transparent and cheap to administer.
- ? Codified method protects policyholders' interests.
- ? Smooth profits if book values are used.
- ? Lack of discretion is a disadvantage to the company.
- ? Tends to discourage equity investment because there is no deferral of profit distribution.
- ? May be unfair not to share insurance profits.
- ? Small additions to guaranteed benefits at early durations.

### Contribution

- ? Distributable surplus should be distributed among policies in the same proportion as those policies are judged to have contributed to it.
- ? Typically a three factor system involving excess interest, mortality profits and expense profits with the base level in each case being determined in accordance with the valuation basis.
- ? Surplus distributed as cash.
- ? Surplus deferred for terminal distribution tends to be less than for additions to benefits; this is because of greater transparency of cash dividends and pressure to keep annual dividends high.
- ? Extremely equitable.

Dividend often converted to a paid up addition to the benefit instead of being paid out in cash.

[1/2 mark each type identified max 2]

[Up to 1 mark each for comments on cash bonus and premium reduction systems]

[1 mark each for demonstrated knowledge of key feature of Benefit Increase, Contribution Principle and Revalorisation;

½ mark for each other point with maximum of 8]

### Q.3) Embedded and Appraisal Values

- a)
- ? Embedded Value – Value of future profit stream from a company's existing business together with the value of any net assets separately attributable to shareholders.
  - ? Appraisal Value – Sum of embedded value and value to shareholders of the future profits they expect to receive from future new business.

[1/2 mark each]

- b)
- ? Model points chosen to represent in force business
  - ? Check model points eg by using the model points to determine supervisory reserves and then compare this value with published value.
  - ? Determine the basis to be used based on experience investigations
  - ? Determine present value of projected cashflows.
  - ? Cashflows projected on a best estimate basis.
  - ? Projected cashflows allow for reserve and solvency margin requirements.
  - ? Discount using a risk discount rate that allows for the return required by the company and the level of statistical risk attaching to the cashflows ie their variation about their mean.

? In theory a different rate could be used for each stream of cashflows.  
Add to value of net assets

[1/2 mark each max 3]

- c) ? Define what new business is eg how treat premium increases, recurrent single premiums and group contracts
- ? Take new business written in a period – eg one year – and generate model points.
- ? Model at point of sale ie before incurring any initial expenses and before receiving the first premium.
- ? Determine discounted present value of cash flows as described above.
- ? Allows company to check that it has been writing business at target profitability.
- ? Results can be split by product, product class and distribution channel.
- ? Gives valuable information to analysts who will want to estimate the appraisal value of the company

[1/2 mark each max 3]

- d) ? This is an example of an investment guarantee that has become more likely than it was in the past to ‘bite’.
- ? Embedded values determine for products with investment guarantees may not capture the impact on value if the scenario used does not reflect the fact that the guarantee may bite.
- ? This would be the case if a deterministic best estimate investment assumption was used such that it was consistently above the level of investment return at which the guarantee would bite.
- ? The embedded value assessment should consider a range of scenarios that model the range of potential future outcomes so that the effect of the guarantees is captured.
- ? The range of scenarios should ideally be generated stochastically.

[1/2 mark each max 2]

- e) Financial economic approaches seek to set:
- ? Future unknown parameter values in modeling insurance business to as to be consistent with market values where a corresponding market exists.
- ? The results of cash flow projections so as to be consistent with market values where a corresponding market exists.

**The finance director has probably noted that this approach does not appear to have been followed and so the results are potentially inconsistent with a market driven assessment of fair value.**

[1/2 mark each point max 1]

**Q.4) Legal, Regulatory and Guidance.****a) Containing factors:**

- ? Politically stable operating environment.
- ? Legal processes of contract law operate efficiently.
- ? Strong compliance and control culture
- ? Conservative approach to products and marketing

**Factors affecting legal risk:**

- ? PRE principles operating unfavourably.
- ? Unfair contract terms voiding clauses of the contract eg increases to charges.
- ? Contract terms spanning many years – developing legal cultures, interpretations and court judgments.
- ? Increasing consumerism in the country, combined with a litigious culture in the country
- ? Inconsistencies between policy document and representations made by company and agents.

**[1/2 mark each max 4]****b) Purpose:**

- ? Protection of the policyholder.
- ? Fair treatment of policyholders.
- ? Equity between generations.
- ? Governance.
- ? Rules on disclosure.
- ? Protecting the solvency of the company.

**Adverse consequences**

- ? Restricting innovation.
- ? Increased nb costs.
- ? Increased ongoing costs.
- ? Reducing benefits.
- ? Reduced ability to make changes quickly or to change discretionary charges.

**Constraints**

- ? Restrictions on premium rates and charges.
- ? Terms and conditions of contracts eg surrender values and paid-up values.
- ? Restrictions on sales channels.
- ? Information to be given as part of selling process.

- ? Underwriting restrictions.
- ? Indirect constraints on volumes via reserving and solvency margins.
- ? Investment types.
- ? Asset admissibility.
- ? Mismatching.
- ? Asset related constraints on valuing liabilities.
- ? Regulatory differences between institutions offering similar financial products eg savings products.
- ? Restriction on products.
- ? Shareholder transfer restrictions.
- ? Use of projections / Max projection rates.
- ? Use of reinsurance.
- ? Payment of bonuses.

**[1/2 mark each max 10]**

**Q.5) Immediate Annuities**

- a)**
- ? Ensure that the premium/consideration amount will be sufficient to cover the benefits provided, expenses, and provide a margin for profits.
  - ? Annuity benefits offered need to be attractive to the market in which the contracts will be sold.
  - ? Consider the type of benefits to be sold eg level, escalating, joint life, indexed.
  - ? Consider whether will offer impaired life annuities and underwriting requirements.
  - ? Is the longevity risk acceptable – what industry data is available.
  - ? Consider reinsurance availability, requirements and opportunities to support innovation.
  - ? To be competitive may need to invest in riskier assets than government securities so need to consider credit risk.
  - ? Capital strain is likely to be a problem as although the single premium is paid at the outset, there are often reserving strains and solvency margin requirements.
  - ? Risk of investment guarantee should be acceptable to the company as the interest rate will reflect the market at the time the policy is sold. but only if matching assets are available.
  - ? Risk that sufficiently long term assets may not be available in the market for matching purposes.
  - ? Sensitivity of the contract's profitability depends on expenses



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including expense inflation.

**[1/2 mark for each point , max 5 ]**

- b)**
- ? Decide on suitable assumptions for each parameter to assess the cost of the liability assumed.
  - ? Key part of the process is the determination of what future experience is expected.
  - ? Company does not have its own experience of annuitants' mortality.
  - ? Mortality rate assumptions will be based on a standard published annuitant mortality with suitable adjustments considering the expected future experience.
  - ? Considerations should be given to expected future improvements in the longevity.
  - ? Investment return is an important assumption as sizeable reserves are built up as single lump sum is paid as consideration amount.
  - ? Investment yield on the day invested is the starting point for the interest rate assumption.
  - ? Extent of any reinvestment risk is to be considered depending on the degree of matching.
  - ? Given the investment strategy consider the default risk on non-government fixed interest securities.
  - ? Suitable assumption should be made for taxation, if any, of investment income.
  - ? Parameter value for expenses should reflect the expected expenses to be incurred in processing and subsequently administering the contract.
  - ? Values will be determined after analyzing the company's recent expenses with suitable adjustments for annuity business.
  - ? Parameter value for commission will reflect that normally paid in the market.
  - ? Initial commission and other acquisition expenses are to be included in setting the annuity rates.
  - ? Suitable provision for expected future inflation is necessary for loading for administration cost which can be on per policy basis.
  - ? No allowance is made for withdrawals as surrender values are not likely to be paid.
  - ? Margins may be built through risk discount rate in the assumptions.
  - ? Check resultant rates against competition

**[1/2 mark for each point, max 7]**

- Q.6 a)**
- ? Explicit allowance for all guaranteed benefits.
  - ? Explicit allowance for expenses.
  - ? Explicit allowance for bonuses, both existing and possibly future
  - ? Explicit allowance for all other benefits eg surrender values where relevant.
  - ? Future premiums valued are the actual premiums payable.
  - ? Negative reserves usually have to be eliminated at individual policy level.
  - ? Asset valuation and liability valuation should be consistent.
  - ? Any options/guarantees are to be provided for.
  - ? Different expectations of smoothing of bonus rates play a part.

**[ ½ mark for each point, maximum 4]**

- b)**
- ? Key part is the determination of what future experience is expected.
  - ? Second aspect is what other factors need consideration.
  - ? Investigate the historical experience and exclude exceptional items.
  - ? Make best estimates of the parameters taking into account future trends.
  - ? Allow for conditions will be like in the future period.
  - ? Allow margins for other factors like credibility of the data.
  - ? Adjust the best estimate to include a margin for prudence.
  - ? Assumptions should have regard to legislation.
  - ? Assumptions should have regard to accounting principles governing the preparation of the accounts if this is necessary to comply with regulation or to ensure internal consistency.
  - ? The basis should be consistent with the basis used for previous valuation and any deviation must be justifiable.

**[1/2 mark for each point , max 4]**

- c)**
- ? Any proposed bonus distribution should be in accord with policyholders' reasonable expectations.
  - ? Bonus distribution should be equitable between different categories and generations of policyholders.
  - ? Bonus distribution may need to take into account business plans, investment strategy, future investment expectations and solvency of the company.
  - ? Take into account smoothing rules
  - ? Balance between RB and TB.
  - ? Maintenance / distribution of estate.
  - ? Sustainable.

Reflect policyholders contribution (asset share).

**[1/2 mark for each point, maximum 3]**

**Q.7**

**Investment Policy and Capital Management**

- a)
- ? Choice of investment strategy is important for commercial success and security to policyholders and shareholders.
  - ? Guaranteed benefits have to be met.
  - ? Select investments appropriate to the term, nature and currency of liabilities.
  - ? Getting the right balance between high returns and volatility / risk.
  - ? Balance returns and security.
  - ? Able to meet its supervisory reserving requirements if market conditions were to change suddenly.
  - ? Ensure that policyholders' reasonable expectations are met.
  - ? Including following the investment strategy described in the marketing material.
  - ? The higher the level of free assets the riskier the investment strategy that can be adopted
  - ? Views of the company at any time as the relative performance of the asset classes concerned will clearly influence the strategy.
  - ? Different approached for par business, linked business and non-profit.
  - ? Take into account competition.
  - ? Take into account extent of guarantees.
  - ? Look at projected cash flows for company on different scenarios.

**[1/2 mark for each point , maximum 6]**

- b)
- ? Liabilities span a long period of years.
  - ? Necessary to ensure that the company is solvent at all points of time.
  - ? Project revenue account and balance sheet forward for a sufficient period of years.
  - ? Ensure on going solvency allowing for management actions.
  - ? Solvency at a point of time can be measured by comparing the value of the liabilities with the value of the assets.
  - ? Project forward the business given the new business plans of the company.
  - ? Full model office with realistic representation of the liability portfolio is required for this purpose.
  - ? Solvency based on supervisory values will provide a strong basis.
  - ? Capital management will be based on the management's assessment of the potential liabilities of the company over future years with eg a

99.5% probability, which may well be different to supervisory standards.

- ? It is important to assess the ability of the company to withstand future changes in both the external economic environment and particular experience of the company.
- ? Adequacy of internal capital should therefore be assessed by including new business.
- ? It may mean that stochastic models will be required.
- ? The models will take into account potential management and policyholder actions in differing scenarios.
- ? Recommend raising the amount of capital to the required level in sufficient time.

[ ½ mark for each point, maximum 6]

**Q.8 a)**

- ? Reinsurance arrangements need to be reviewed whether they are adequate or give away too much profit.
- ? A key aspect is the reinsurance premiums payable for the risks borne and hence how much profit is being given away.
- ? On the other hand one would take into account the extent of the profit commission payable by the reinsurer.
- ? There may be a need for financing which may be obtained from the reinsurer.
- ? Retention limit is to be set at such a level that probability of insolvency is below a specified level given the model of business and expected claim costs.
- ? The type of business being written and the source of business may be important as they will have an impact on the volatility of the claims experience.
- ? Cost of financing an appropriate mortality fluctuation reserve with the cost of obtaining has to be balanced.
- ? Reinsurance against claim payment fluctuations is particularly important for small companies.
- ? Purpose is to balance the risk from adverse claim experience against the profit that may arise from the contracts the company reinsures.
- ? There may be other non-financial benefits from the relationship with the reinsurer such as advice, training or underwriting systems.
- ? The need for this will be more important if products are being written for which the company does not have any experience.
- ? One would also consider the extent of any catastrophe cover required or given.
- ? The less free capital the company has the more important the reinsurance arrangements.

[ 1/2 mark for each point, maximum 6]

- b)
- ? Protect the life insurance company from anti-selection from seriously impaired cases.
  - ? Enable a company to identify cases that can be accepted at standard rates of premium.
  - ? Identify lives with sub standard health and identify suitable approach and special terms to be offered.
  - ? Ensure that all risks are treated fairly.
  - ? Ensure that actual mortality experience does not depart too much from that assumed in the premium basis.
  - ? Help to reduce the risk from over insurance.

[1/2 mark for each point, total 3]

- c)
- ? Medical examinations incur expense.
  - ? Extent to which medical examination is used depends on extent of loss to the company if it mis-estimates the state of health of the applicant.
  - ? Questions on the proposal form completed by the applicant will provide details of the applicant's medical history.
  - ? However, the applicants details will not always be accurate and these can be checked through the ME.
  - ? An alternative is to get a medical attendant report at lower levels of cover.
  - ? A great proportion of high risk applicants can be identified from the information obtained from the applicant in the proposal form.
  - ? If the answers suggest a non- standard risk, suitable medical evidence including full medical examination can be resorted to.
  - ? It needs to have regard to the limits of competitors otherwise there may be anti-selection if the company's limits are higher.
  - ? To the extent that higher limits reduce costs and potentially improve new business levels, there is an offset to the worsening of claims experience.
  - ? Need to consider the views/requirements of reinsurers.

[1/2 mark for each point, max 4]

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