Institute of Actuaries of India

Subject ST2 – Life Insurance

May 2015 Examinations

INDICATIVE SOLUTIONS

Introduction

The indicative solution has been written by the Examiners with the aim of helping candidates. The solutions given are only indicative. It is realized that there could be other points as valid answers and examiner have given credit for any alternative approach or interpretation which they consider to be reasonable.

Solution 1:

- Underwriting is a way of managing risk.
- Underwriting would provide information on:
    - Whether the risk can be insured under the given product
    - If so, then whether the standard terms can be offered
    - If so, then which categorisation applies, e.g. there might be smoker / non-smoker discounts
    - If the risk cannot be insured on standard terms, then the level of loadings to premium and / or reduction in benefit that would need to apply
- Underwriting would also help contain anti-selection and possibly fraud.
- Financial underwriting would help in ensuring that insurance is being used to replace income, and not as a gamble.
- Products like Term insurance, Health insurance would be underwritten to ensure that the company is not exposed to undue mortality / morbidity risk, and is charging appropriately for the risk being undertaken
- Products such as Annuity / pure endowment would traditionally make profits on early death, and therefore, the underwriting would be purely to ensure correct catergorisation of the policy.
- Products such as Unit Linked products, endowment assurance products, the mortality risk would be high during initial years until reserves are smaller than the death benefit. Therefore the underwriting would be aimed at managing the initial risk.

[5]

Solution 2:

(i)

- The asset share is the accumulation of premiums less deductions associated with the contract,
- …..all accumulated at the actual rate of return earned on investments.
- Thus, the components of asset share are, the accumulation of premiums, less:
    - Expenses incurred and any commissions paid
    - Cost of benefits (in access of asset share) possibly on a smoothed basis. Including, cost of surrender benefit (if anything other than asset share is paid out on surrender)
    - Tax, including any reserves made for future tax liabilities
    - Transfer of profits to shareholders
    - Cost of capital to support the business during the initial years
    - Contribution to free assets
    - Possibly, additional allocation from without profits business, if applicable

[5]

(ii)

- For participating policies, past bonus rates are an important factor at the time of purchase. Therefore the marketing director's suggestion should ideally result in an increase in new business.

- Since the additional cost is being borne by the shareholders, there is no impact on the participating fund.

- However some policyholders may complain of discrimination if this is something which has not been done in the past.

- The increase in new business could result in lower per policy costs which in turn would be able to offset the additional cost of bonus.

- The important thing to understand is how it will impact the PRE.

- There may be an expectation from the policyholders that the shareholders will declare this additional bonus every year.

- The distributors may influence PRE by accounting for the additional bonus in their sales pitch. This may lead to complaints later on if this additional bonus is not declared.

- The company should be careful in not creating a precedent in the market which becomes a norm which will then impact the long term profitability of the company.

- If the company still wishes to go ahead with the proposal, then the bonus should be declared in such a way so that the policyholders don't expect it every year.

- This can be done by either declaring it as a special one off bonus with a sound reason for it.
- The company should bear in mind that the distribution is equitable amongst different sets of policyholders. **[5]**

(iii)

- While calculating benefits paid to policyholders, the supportability is calculated at the portfolio level and therefore when looked ate individual policies, the benefits will be either higher or lower than their individual asset shares.
- This cross subsidy amongst different generation of policyholders can arise for a different number of reasons given below:

  - Asset share during the early years of the policy is usually negative. However the surrender benefit cannot be negative.
  - In fact there may be regulatory pressure to pay some surrender value and therefore the difference between asset share and surrender value will further increase.
  - Companies usually do not pay the entire asset share on surrenders. The margin between the asset share and the surrender value will vary depending on the year of surrender.
  - Policies with large premiums tend to subsidize policies with smaller premiums.
  - The cost of mortality deducted from the asset share is usually calculated using aggregate mortality experience. Therefore there may be some cross subsidy between different ages.
  - The death benefit is usually much higher than the asset share early on in the policy.
- The company may declare a special bonus arising out of undistributed surplus from a different generation of policyholders.
- The company will build some cushion in the asset share to support a terminal bonus which will be calculated towards the maturity of the policy.
- The calculation of terminal bonus will be on an aggregate basis and hence this will lead to some cross subsidy. **[5]**

(iv)

- With-profits business aims to distribute returns from writing the business to with profits policyholders, allowing for shareholders' cost of capital and any other interests.
- Therefore, overall we would expect the asset share for each policy to be distributed as bonuses (allowing for shareholder transfers).
- In order to do this, companies choose representative model points for the business. These are identified such that the number of model points is small enough to be cost effective to monitor their asset shares, and also large enough to be a good representation of the over all business, varying, for example, by class / term / duration of business.
- Certain points on inequity may be deliberately maintained within the choice of model points. For example, model points differing by gender may not be calculated since the local regulations may not allow for benefits to differ by gender.
- The terminal bonus would then be equal to the difference between the asset share and benefits guaranteed to date at the policy maturity date (initial guaranteed plus reversionary bonuses) for each of these model points.
- The results would be smoothed to reduce the impact on the policyholder of investment return fluctuations. This could result in the actual terminal bonus payout differing from what would be mathematically required to set the benefit equal to the asset share. **[5]**

[20 Marks]

Solution 3:

(i)

Cause of concern:

- It would mean that premiums are not adequate to meet the expenses
- The company would not be able to break even
- Strain on capital, leading to difficulty in writing NB
- Regulatory intervention. The regulator might prescribe the maximum expenses that the company can incur
- Might impact the ability to price competitive products.
- The returns of participating policyholders may get diminished if these expenses are booked in the par fund.
- If the company is listed then the share price can get affected. If not then the shareholders will be unwilling to invest more capital unless the reasons of higher expenses are justified.

Investigations :

- analyse expenses by distribution channel / branch / agent to identify any inefficiencies
- Consider conversion ratios of distribution channels / branch / personnel i.e. Number of actual sales / number of sales attempts or quotations to identify inefficiencies
- Understand whether the expense inflation has been higher than assumed
- Compare expenses for other competitors of similar size, age and distribution strategy
- Consider whether the expenses in premiums are unrealistic
- Consider expenses at a product level to understand if any particular nature of expense is high. For example, a waiver of premium rider may be incurring higher claim expenses than anticipated
- Consider whether higher than anticipated lapses or lower new business volumes than anticipated may be leading to lower policy base to distribute the expenses over
- Differences in business mix than anticipated may also contribute to expenses being higher than priced overall, if there had been any cross subsidy while pricing. E.g. Higher proportion of lower ticket size policies, which were being cross-subsidized by large policies for expenses during pricing.

[7]

(ii)

- The infrastructure that would need to be developed in order to provide on lines sales.
- The cost of setting up the new channel, and training the staff. Will this increase expenses? How will these expenses be apportioned?
- The acquisition cost of business sourced through this channel at the moment.

- The cost of redundancies that would be necessary within the company as a result of the changes structure, and simultaneously the need to hire experts for the new sales channel.
- The proportion of market share sold through Internet. If this is small, they might not be able to write sufficient business for economies of scale to apply, and therefore per policy costs may actually increase.
- If, on the other hand, this is already a well-established channel, the company would need to analyse the kind of products, processes, commission levels and underwriting operated by their competitors for online distribution channel
- The company may be able to get statistics and financial information about the effectiveness of online sales channel through an industry body.
- Any particular regulations that particularly apply to this channel.
- Whether their reinsurer will support the change in distribution channel, and the resultant change in product design etc.
- Underwriting levels required for their existing products and whether these can be met through Internet.
- The company may be able to save some costs by reducing the underwriting required, and therefore making their products more suited for online sales. However, they would need to consider the impact of this on their expected experience. Also, they would need to consider the levels of reduced underwriting that their reinsurer would be willing to support them with.
- Policyholder reasonable expectations, if other players offer discounts on online products, this may be expected by the customers, and therefore, some of the margins saved through expenses, may need to be used to decrease premiums / charges
- Whether the target market might change in respect of the socio economic group, geographical areas, gender, age, occupation etc might change as a result of moving from the agency distribution channel to online. If so, this might need to be allowed for in the pricing, and also in product development. Some products may need to be modified and refiled.
- Again, the information on differences in demographics and on resultant assumptions might be available through an industry body.
- A different target market may also require a different set of products. For example, the target market accessed through Internet may be more financially aware, and be more prone to comparing products against those of competitors, leading to more sophisticated and highly competitive products needing to be developed by the company.
  This might (i) reduce margins available, and (ii) product development costs
- Also, since this is a new distribution channel, and a new product, the company may need to assume higher margins in their assumptions to allow for the higher uncertainty of experience.
- The impact this will have on the company's reputation. How will the market perceive this move, and what impact would it have on the existing customers? If it leads to a bad

reputation, the company may see higher lapses than anticipated leading to higher expenses being incurred, and per policy costs increasing due to reduced number of policies in force.

- On the other hand, higher than anticipated sales, due to greater popularity of the new channel may lead to more business being written than the company is prepared for, leading to high pressure on resources, delays, and operational risk, including reputational damage.
- The company may need to consider offering products with differential pricing between online channel and the agency channel to allow for the differences in experience, uncertainty, expenses, and competition levels. There might be system costs associated with this, and also this might lead to arbitrage opportunities.
- The impact this will have on the existing business sold through the agency channel. The agents might churn the business by taking it to competitors, leading to higher lapses.
- The company may wish to consider how it's competitors have marketed the same product through two different distribution channels.
- Having considered the various additional costs, it would need to consider whether this actually leads to a reduction in expenses or not. And if it does, then how much business needs to be written in order for the cost of development to be justified. It would also need to consider whether it has the capital available that would be required for the initial development of the online channel.
- The company may be exposed to higher anti-selection risk since face to face interaction with the customer reduces. The company would wish to consider ways of mitigating this risk. For example it could consider ways of automatic validation of details through central data repositories, or greater financial underwriting / stricter exclusion clauses.
  Or else it might consider reducing the maximum sum assured that is available on term assurance.
- The life insurer will consider whether there are any incentives to set up such a sales channel e.g. tax incentives.
- The company would also compare setting up the online sales channel with other alternative options, such as independent intermediaries or direct marketing. **[16]**

[23 Marks]

Solution 4:

(i)

Reasons for monitoring experience are

- Experience will be monitored as part of the control cycle as to:
- develop earned asset shares
- update assumptions as to future experience
- monitor any trends in experience

- monitor actual compared to expected experience and take corrective actions as needed
- provide management information to aid business decisions
- Make more informed decisions about pricing and about the adequacy of reserves.

Experience analysis helps in provide management information by providing

- At a level of detail appropriate to the management concerned in order that, as a result of the information, they can act as necessary.
- Providing reliable information– so information on withdrawal rates, for instance, would need to be based on at least, say, six months of experience to give credible results, and so avoid the risk of management taking decisions based on incorrect data. **[4]**

(ii) The factors that might be affecting withdrawal experience:

- type of contract
- duration in force
- distribution channel used to source business
- Commission paid to distributors
- target market
- frequency of premium
- size of premium
- premium payment method
- original term of contract
- Premium payment term
- Economic stability
- Tax incentives
- Competition
- Court verdicts
- Basis of management remuneration
- Agent turnover ratio **[4]**

(iii) Data would be ideally analyzed by factors as mentioned above.
For each homogeneous group to be analysed, withdrawal rates are determined as follows.

- The number of contracts issued in the company's last financial year is divided into the corresponding number that survive in-force until the first policy anniversary to give a first year persistency rate.
- The first year withdrawal rate can be determined as one less the persistency rate.
- Deaths and maturities should be excluded from the calculation, if they are material.
- A similar procedure can be adopted to obtain the second year, third year, etc withdrawal rates, by looking at the number surviving from the number of contracts, in each group, that have their first, second, etc., policy anniversary in the last financial year.

A reasonable volume of stable consistent data in sufficient size will be required, to allow credible analysis down to the level of broad product groups split by relevant risk factors. Hence not all of the factors above mentioned may be may not be analysed to avoid cells with few policies in the analysis.

- Groups where there is little difference (for instance the difference in withdrawal rates for policies of duration twelve years compared with those of duration thirteen years), and intuitively a difference would not be expected, could be combined.
- For some groups the differences emerging might seem to be statistical quirks stemming from small cell sizes (eg withdrawal rates for eighty-six year old policyholders).

Based on these considerations, the data may be regrouped and withdrawal rates may be recalculated for broader groups.

Further data groupings may require further consolidation depending on the level of management involved. For instance senior management would probably want results split by broad product class, not by every product. **[5]**

(iv)

- To prevent mis-selling, the regulators may impose restrictions in three main areas:
  - Design of the product
  - Remuneration of distributors

- Method of sale of product

Product Design:

- The regulators may want to simplify product design so that it becomes easier for the customer to understand. Too many options in a single product may be discouraged in a single product.
- The definitions of critical illness may be standardized to make it easier for customers to compare across companies.
- The regulators may force the insurance companies to offer high surrender values in the initial years as well.
- The regulators may impose a long cooling-off period (say 45 days) for the company so that the policyholders can return their policies if they have discovered that they have been mis-sold.

Remuneration of distributors:

- The company may have to put a cap on the first year commission they can pay. They would have to spread it over the term of the policy to ensure persistency is good.
- The regulators may ask the company to disclose the commission paid to distributors to its customers. The customers may be able to take a more informed decision.
- The company may have to introduce a claw back of commission if the policy lapses. This will financially impact the distributors who will in turn ensure that the policy is sold in the right manner.

Method of Sale:

- The company may have to increase the training requirements for an agent/ distributor to be licensed to sell products.
- The company may be forced to look at its minimum criterion of appointment of agents.
- The company may be barred from selling through certain distribution channels which have very poor persistency.
- May have to introduce a pre-issuance verification call for all its customers to check whether the sale is genuine.

- A customized benefit illustration may have to be shown to each prospective customer. The customers may be required to sign the illustration if he is interested in buying the policy.

- The company may also be forced to compulsorily do a financial need analysis for all its prospective customers.

[10]
[23 Marks]

Solution 5:

(i)

- The basic nature of the product, term assurance remains same. The main risk arises from mortality.

- There will be a significant anti-selection risk as large sums assured can be obtained for relatively small premiums. The risk is that those who take out the policy are the ones who "expect" to have heavier than average mortality. Without underwriting, the insurance company would suffer earlier claims, on average, resulting in lower profits.

- In addition, there will be a mortality risk from selective withdrawals. The policyholders most likely to withdraw from the contract are those in good health, leaving the insurance company with a sub-standard group of lives.

- There is a financial risk from withdrawals at times where the asset share is negative. When the asset share is negative on withdrawal, the company will lose money even if it pays the policyholder nothing.

- There will be an expense risk in that the actual marginal costs of administering the contract need to be met. The expense risk can be substantial, particularly if the policy term is long, as the premiums are often relatively small and may well be of fixed amount throughout the term of the policy. The fixed pay-out structure will extend the policy term beyond the premium payment period, hence expenses of managing the fixed pay outs may turn out be significant.

- Additional interest rate risk- The fixed pay-outs are at the terms defined at the beginning of the policy. This might pose a significant risk that the available asset yield to fund the fixed pay-outs is lesser than the defined terms, especially at the later years of the policy.

[3]

(ii)

- The comparison is on the conversion rates is valid. Both provide an option to take an annuity at a pre-defined rate.

- Both the designs provide an option to select against the company if interest rates are higher than the one used to price the annuity rates.

- However the impact of selection is lower in the term product than the annuity product as we would expect very few deaths and very few people eligible to exercise the option.

- The impact is also lower as the tenure of monthly payout is limited to a maximum of fifteen years. For a lifetime annuity product, the annuity is payable till the policyholder is alive.

- The risk can be mitigated in the term insurance product by adequately reinsuring. While calculating the sum at risk, the company can calculate the present value of the fixed payments at a conservative interest rate. Though the reinsurance premium will be slightly higher, the interest rate risk will be mitigated.

- There is very little scope to hedge against the investment risk in an annuity product through reinsurance. The only way is through investment derivatives which may not be available.

[4]
[7 Marks]

Solution 6:

(i)

Factors to be considered in product design:

Profitability - In addition to ensuring the base annuity premiums to be profitable, the additional deductions and the lump sum charged for additional CI benefit should cover the respective costs, and add to the base annuity plan profitability.

- Ideally profits should be emerging from all the components, investment income, mortality surplus, CI cost savings and cost savings.

Marketability- The benefits offered need to be attractive to the market in which the contract will be sold. The additional benefits and the additional CI annuity should be appealing to the customers; detailed survey might have been made.

- The additional features need to be understood, restrictions on amount and extend of health checkups and medical second opinion may not be well understood, as well as the exclusions in the CI annuity benefit.

- This aspect is very sensitive to the distribution channel, need to ensure that the distribution channel explain the benefits, especially if they are new to health benefit selling.

- If intending to market the same product through more than one channel, the company will need to decide whether to apply the same pricing to all channels, or to price differently for different channels (dual pricing).

<u>Competitiveness</u> – Base annuity purchase prices need to competitive as well as the level charges and the one time deduction towards CI benefits should not reduce the annuity pay-outs significantly compared to base annuity pay-outs.

- The prime influence on competitiveness will be the level of the expense charges on annuity contract maintenance and the managing the regular health check-up. The interest, risk and expense components of the premium basis must all be set at a feasible level.

<u>Financing requirement-</u> The product design needs to minimize the capital requirements unless there are substantial capital resources are available.

- Model office techniques to project the financial situation with and without the new product under sensible sales assumptions to assess the company's ability to finance the product, and whether the return on capital is adequate.
- It might be difficult to reduce the valuation reserves, given that capital markets are not deep and liquid enough, and derivatives are not allowed. This is likely to have significant impact on valuation interest rates leading to initial reserve strain.
- Lack of experience on annuity products may further necessitate conservative assumptions in the valuations.

<u>Risk characteristics</u> - Consideration will need to be given to the acceptability of the level of risk associated with a proposed contract design. The level of risk that may be acceptable will depend upon the company's ability or willingness either to absorb risk internally or to reinsure or hedge it.

- Mortality will be an issue to lesser extent as Company doesn't have any experience yet in the annuity products.
- Value added services and CI benefit might be source of additional risk and need careful consideration on incidence assumptions and availability of reinsurance or otherwise risk transfer tools.

<u>Onerousness of any guarantees</u>: The investment guarantee in annuities in terms of annuity pay-outs may pose a significant guarantee risk, as the company may not be able to reduce the financial impact due to shortage of suitable investments.

<u>Sensitivity of profit</u>: Profits anticipated may be subject to significant variations due to

- Shortage of suitable investment as mentioned above
- Lack of experience in annuity products

- Experience in respect of additional value added services and CI payouts may turn out very different than expected.

Extent of cross-subsidies - A company needs to decide on the extent of any cross-subsidies between its product lines.

- Cross subsidy between investment profit and expense profit, considering the expenses involved in the new line of annuity business and value added health services for relatively senior policyholders.

Administration systems - The system requirements for the new line of annuity business and the additional benefits may limit the benefits to be provided.

- Managing the annuity payouts, annual medical checkups and second opinion and establishing the CI conditions to be within the exclusions could require significant system enhancements.

Regulatory requirements **-** ***A***ny regulatory requirements, *eg* minimum surrender pay-outs, treating customers fairly need to be considered.

[12]

(ii)

a. Morbidity Assumptions for CI Benefits

The assumption should reflect the expected future experience of the lives who will take out the contract being priced.

This would depend upon

- the target market for the contract –dependent on the distribution channel
- the underwriting controls applied (or not applied)
- The expected change in the experience since the time of the last historical investigation to the point in time at which the assumption will on average apply.

It is likely that company may not have experience in respect of CI incidence rates in respect of annuitants, even though it has regular CI business.

Most likely the target group of similar business is likely to be different, younger and possibly clubbed with savings contracts.

These values will be based on an adjustment to mortality rates from a standard table.

Industry sources might be useful if no standard table exists for the target group of contracts.

Another potentially useful source of data might be population mortality statistics.

If the business amount expected is significant, reinsurers may be able provide some reference rates.

However, it will often be the case that the regulatory authorities will constrain, perhaps severely, the choice of basis in a pricing context.

The class of lives concerned is almost always going to have a different experience from that underlying the data, just due to the influence of time.

Consideration should be paid to the expected changes in rates over time. This is a particular issue for annuities where increased longevity is a risk.

If there is uncertainty in the rates is material, the premium rates may be made reviewable at certain intervals.

[4]

b. Investment Returns

The assumption is very significant for the profitability of the contract, due to guaranteed returns in terms of the annuity rates.

This is further accentuated by lack of deep and liquid bond markets and the restriction on derivative instruments.

Hence this assumption is set more cautiously, reflected in the investment return assumption.

The extent of any reinvestment risk and the extent to which this can be reduced by a suitable choice of assets – this might be likely if the capital market doesn’t have liquid zero coupon bonds to match the expected annuity pay outs.

The overall best estimate investment assumption will reflect the expected balance between the expected future (due to coupon reinvestments, if zero coupon bonds are not sufficient) and current investment yields.

The assumption will depend upon intended investment mix for the contract, as affected by the above, the current return on the investments within that mix and, if appropriate, the likely future return.

The intended investment mix for the contract should be derived from looking at the level of free assets available to the company to support writing the business, as higher free assets would reduce the extent of need for matching the assets and liabilities.

If a market-consistent approach is used in estimating profitability either deterministically or stochastically, then the expected investment return can be set as the risk-free rate.

Appropriate tax treatment needs to be allowed for.

[3]

c. Expenses and commission

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

Following marginal expenses are reflected.

- Initial acquisition (eg initial commission and related sales costs)
- Initial medical underwriting (likely to be not significant for annuities, but
- Initial administration
- Renewal administration
- Renewal reward to sales channel (ie renewal commission, or similar)
- Investment expenses
- Claim/ maturity administration (relevant for CI benefit).

The expense loadings should also contain some contribution to the company's fixed overheads.

As the company has no annuity business any industry data or data from a life reinsurance company will be looked as starting point.

More commonly, the expected expenses would be derived from the construction of a suitable expense model. These results would be tested for reasonableness by comparison with industry averages.

Commission will be set by the company and are likely to take account of the rates of commission normally paid in the market in which the company intends selling the product.

These commission assumptions should take into account any intended extra payments made to salesmen, brokers etc on achievement of certain high production targets.

An inflation assumption is made to loadings in respect of renewal administration expenses.
These will be affected primarily by earnings (rather than price) inflation. **[3]**

[22 Marks]

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