

Institute of Actuaries of India

Subject ST2 – Life Insurance

October 2014 Examination

INDICATIVE SOLUTION

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:

i.

- Expertise: Stochastic modeling requires expertise and specialized IT resources which may not be available with the company
- Time and expenses: Deterministic modelling is simpler, and easier to execute, while stochastic modelling can be time and resource intensive. The company may not feel that the benefit of accuracy from stochastic modelling for this product justifies the time and expenses involved.
- Risk Appetite and expectations: The Company may have a high risk appetite and may not be expecting the guarantee to bite given the current levels of interest rates in the market or the design of the product.
- Sales volumes: They may also consider the sales volumes expected from the product when taking this decision.
- Previous modeling: The company may have previously conducted stochastic modeling giving them: (1) either a comfort that the guarantee is unlikely to bite for similar products, or (2) a deterministic 'cost of guarantee' that could be used as a proxy

[2]

ii.

- The company may be performing pricing on a different basis as compared to the prescribed regulatory method. For example:
 - a. The company may be using Net premium method for calculating reserves in pricing while the regulators may have prescribed gross premium valuation.
 - b. The company may be pricing products where there is no margin of adverse deviation assumed to calculate reserves. This may not be as per the regulatory norms.
- While pricing may be conducted based on the company's internal risk appetite, the reserves must be calculated in accordance with the local regulatory regime which may require stochastic modelling for any guarantees and options
- While calculating the reserves the company may not wish to see only a single deterministic scenario, but may wish to understand a range of scenarios to ensure that they are able to meet future liabilities
- The company would wish to ensure consistency with other reserving models being used, and therefore may not be able to use the pricing model

[3]**[5 Marks]**

Solution 2:

(i) Following regulatory restrictions may be imposed which may influence product design directly or indirectly:

- Restriction on the types of contract that a life insurance company can offer
- Restrictions on the premium rates, or charges, that can be used for some types of contract
- Restriction on rating factors that can be used to calculate premiums, for example gender or age
- Requirements relating to the terms and conditions of the contracts offered, for example with regard to how paid-up policy and surrender values are to be calculated
- Restrictions on the channels through which life insurance may be sold or requirements as to the procedures to be followed or the information required to be given as part of the selling process
- Restrictions on the ability to underwrite, for example a prohibition on the use of the results of genetic testing, or prohibition of use of past claims history or medical history
- An indirect constraint on the amount of business that may be written
There may be regulations regarding the minimum level of mathematical reserves that must be held, often combined with minimum solvency capital requirements
These regulations have the effect of limiting the capital available within a company to write new business and effectively placing a min requirement on the finance required to write a contract
- Investment restrictions, such as on:
 - the types of assets that a life insurance company can invest in
 - the amount of any particular type of asset that can be taken into account for the purpose of demonstrating solvency
 - the extent to which mismatching is allowed at all
- Regulations on the policyholder benefits, such as min death benefit, etc., which need to be offered under the life insurance contracts
- Restrictions on the max commission which can be paid to the different distribution channels

[6]

(ii)

- The Chief Marketing officer's (CMO) observations are valid as the expenses are more than the income in the first policy year.
- However this is an acceptable phenomenon in the life insurance industry and this term is called "New Business Strain".
- The primary reason for this is because of high acquisition cost and prudence in calculating supervisory reserves.
- Life Insurance products are long term and policyholders pay premium every year depending on the terms and condition of the policy chosen.
- The subsequent policy years release profits as the maintenance costs are significantly lower.

- Therefore to decide whether the product is expected to yield profits or loss, we should look at the discounted value of future profits and then compare this with the new business strain. Alternatively the NPV may already accommodate for the NB strain.
- This profit of the product is dependent on the assumptions taken for future years and therefore it is necessary that they reflect the reality of the business.

[3]

[9 Marks]

Solution 3:

- Writing New Business: The Company may wish to increase the level of new business it writes and wants to free up its risk appetite / capital in order to do so.
- Change in risk appetite: The company's risk appetite might have changed recently causing it take a more cautious approach and reinsure more
- Experience on the business: The Company may have had volatile experience or bad experience in the past. Although, given that the retention is already at a level that is lower than the average sum insured, the reason is more likely to be bad experience than volatile experience, and wishes to reinsure as much of it as possible
- Reinsurance rates: The company may have access to very competitive reinsurance rates, making it more profitable to reinsurance business than to retain it
- Underwriting support: The company may have realized that it needs greater underwriting support either because of the expenses involved in underwriting or because it does not have the necessary expertise, and may feel that reinsuring even more of the business, will mean the reinsurer takes a greater interest in the underwriting, and hence provides greater support
- Regulations: The regulations may have changed recently making a greater proportion of reinsurance either compulsory or more attractive
- Capital requirements: The capital requirements for the reinsurer may be lower than for the insurer, making reinsurance attractive

[5 Marks]

Solution 4:

(i)

- Any specified regulations on unit price calculation need to be adhered to and due consideration should also be given to the industry practice
- Equity principle i.e. the interests of unit-holders not involved in a unit transaction should be unaffected by that transaction should always be ensured
- Basis of valuing the fund on offer or bid basis – if the fund is expanding, the company may use offer basis and if contracting then bid basis
- If the company does not want the basis to change frequently and limit the dealing costs, it might want to maintain a management box. What will be size of the box, etc needs to be decided
- Rounding rules – number of decimal places required in unit price and number of units

- Frequency of unit price calculation – whether daily, weekly, etc.
- Cut-off time – the applicable unit price for a unit transaction will depend on whether the transaction request is received before or after the cut-off time, for example 3pm, 4pm, etc.
- Which pricing system the company needs to buy and maintain for unit-price calculation or whether it wants to outsource the calculation
- What will be the source from where the company will receive updated and current information on the assets held by the unit funds

[5]

(ii)

- The basis used to calculate unit prices will depend on whether the company is a net allocator or redeemer of units. There is a risk that the pricing of units does not reflect a change in the company's position via a change in the pricing basis.
- The systems may hold out of date or inaccurate information e.g. on asset values or accrued income. For some funds, the company may find it difficult to value the underlying assets, which may lead to the assets being mis-priced or out of date market values being used.
- Because errors in the calculation of the price at which units are created or cancelled may occur, for the reasons listed above, there is a risk that policyholders may not be treated equitably and their reasonable expectations may not be met.
- There is also a risk that errors may also be made in the calculation of the price at which units are allocated or de-allocated, leading to policyholder inequity.
- Policyholders may also not be treated equitably if the way in which compensation for errors or inequities of material size is determined is inappropriate. These errors could also give rise to a loss for the company.
- If the company allows surrenders to occur at the price on the preceding day's asset values, anti-selective surrenders may occur if asset values have fallen since that day.
- There is a risk that the company may receive bad publicity relating to any errors that may impact on future new business or persistency rates.

[5]

[10 Marks]

Solution 5:

(i) Reasons for analyzing change in embedded value:

- As a check: A major discrepancy in the analysis compared to previous analyses may indicate a problem with data, models, or other calculations
- Reconcile values for successive years
- Provide management information
- Provide data for use in executive remuneration schemes
- Provide detailed information for publication in the company's accounts or those of any parent company, in particular the value of the new business taken on by the company

[3]

(ii) Lapse:

- If actual lapses are higher than expected, this would mean that there would be fewer policies in future and hence future profit would reduce. The reduction in PVFP is on account of this.
- When a policy lapses or surrenders, there is a surrender charge levied in most policies. The release of these surrender charges will increase the Net Worth.

Mortality:

- If actual mortality is higher than expected, this would also mean that there would be fewer policies in future and hence future profit would reduce. The reduction in PVFP is on account of this. The underlying mortality assumptions have not been changed yet.
- However if the mortality experience is worse it will result in higher claim payments made to the customers. This will reduce the Net Worth.

In this scenario the death benefit is likely to be greater than the loss of present value of the future profits, and hence the magnitude of the impact on net worth would be higher than the impact on present value of future profits. The opposite would be true for the surrender value expected and the present value of future profits on lapsed policies.

[4]**(iii) a.] Mortality:**

- The current year clearly shows higher mortality than expected, and so the mortality assumption may need to be revised upwards
- The company would want to understand the reasons for this bad experience in the last year. For example, have the underwriting practices or claims procedures changed? Or perhaps, the mix of business written by the company may have changed.
- The company may evaluate the experience in further granularity: is the experience bad for a particular product or class of business? In which case, the assumption may change only for that product / class.
- The company may also wish to consider whether the experience it has is credible enough to base assumptions on
- The company may compare its experience against the industry experience over the last year to understand the reasons
- Given that the experience has only been bad for one year, the company may consider waiting to let the experience develop before changing the assumptions

[3]

b.] Lapses:

- The experience over the last year seems to be consistently worse than the previous year
- The expected assumptions used do not seem to be in line with the experience this year, as well as last year
- The company may consider more accurately reflecting the *shape* and *magnitude* of the lapse experience in the assumptions
- The company may wish to understand the reasons for the bad lapse experience in the last year. For example, could this be caused by economic conditions, or by launch of a more attractive product in the market?
- The company would want to analyze results in a greater level of granularity to understand the experience better and to formulate assumptions that might more closely reflect the experience , preferably by:
 - a. Different products or product class
 - b. Different distribution channel
 - c. Size and frequency of premium payment
 - d. Original term of contract
- The company may also wish to understand the reasons for the high lapses in the initial years. Could these be due to mis-selling?
- The company may wish to understand the high lapses in the fourth policy year. Could this be due to design of their product? If so, then the lapse assumption may need to be changed only for the products impacted.

[5]**(iv)**

- Reserves do not reduce profit but delay the release of profit.
- Therefore the impact of the reduction in the prudence of the reserve will depend on the methodology used to calculate EV.
- If the company uses MCEV basis then the impact will be minimum.
- If the company uses TEV method, then the impact will depend on the difference between the earned rate and the risk discount rate. The greater the difference, the larger the impact.
- The company will also have to take into account the way the regulators view the reduction in prudence in reserves.
- If the company is using the prudence in line with the regulations, then there is very little that can be done.
- If the prudence is removed and the experience turns out to be very bad, then explaining to the shareholders would create a problem.
- Also since the reduction in EV is due to adverse experience, it may be reasonable to expect the same trend in future unless the company acts on it.
- The removal of prudence will only avoid a drop in EV one time, so this does not solve the problem but just postpones the inevitable.

- The reduction in EV may be trying to show a trend and it would be better if the company identifies that and fixes the problem.
- It may be the case that the company has already identified the problem and is confident that the measures taken will reverse the reduction in the next reporting.
- The company can look at other ways to avoid reporting the drop in EV, for example:
 - i. Removing any conservatism in the modeling approach
 - ii. Negotiating with reinsurers to reduce reinsurance rates if it can be justified.

[6]

[21 Marks]

Solution 6:

(i)

- The premium rates may have become uncompetitive due to other companies:
 - accepting lower profit margins or selling at a loss to gain market share
 - may have negotiated more favourable terms with reinsurers
 - having lower expenses
 - having better critical illness claims' experience which is reflected in their pricing
 - increasing the number of critical illnesses covered under their policies, or made their critical illness definitions more attractive
 - reducing the number of critical illnesses covered under their policies, making the product cheaper (this would be beneficial if the cost of the diseases excluded exceeded the perceived value of the benefit of having them covered)
 - Reinsurer may have increased the rates for the company causing an increase in the actual premium rates
- Initial commission paid to agents and brokers may be lower compared to other products, and in case of brokers lower than other companies
- The company may have gained a bad reputation over whether or not it would pay a critical illness claim
- There may have been servicing delays over collection of premiums which would not have been popular with policyholders so may have impacted on new business volumes, or delays over claim payments
- There may have been delays over the payment of commission to brokers which would have made them less likely to place future new business with the company
- The company may have developed a reputation for unpopular underwriting decisions, i.e. rating people when other companies don't, or the sum assured at which medicals are requested may be lower than other companies
- The proposal forms may be difficult to follow and time consuming to complete
- There may be concerns about the financial strength of the company and hence the potential inability to pay future claims
- Other companies may have introduced attractive options such as guaranteed insurability on certain events or reviewable rates

- The company may have been concentrating on the marketing of other product lines, or other companies may give more sales support to brokers
- The company may have received bad publicity about some other area of business which would impact on term assurance new business volumes
- There may have been a general reduction in new business volumes throughout the marketplace. For example, this might be caused by a recession, etc.
- New sales regulations may have made the product more difficult to sell, or other forms of critical illness may have become more popular (e.g. unit-linked)
- There might have been a deliberate decision by the company to restrict new business, to reduce new business strain or limit exposure to CI experience
- There might have been adverse changes to the tax treatment of the policyholders

[10]

(ii)

Proposition 1:

- With reviewable premiums the company would not be exposed to the risk that future experience was worse than expected
- For guaranteed rates it will either have priced for the guarantee directly or used prudent critical illness assumptions when setting the premiums
- It would therefore be able to charge lower premiums for reviewable rates
- However, potential policyholders may not like the potential for future increases in premiums. Whether or not the availability of reviewable rates would improve new business volumes would depend on whether the reduction in premiums appeared more attractive than the value placed on having guaranteed rates.
- If other companies offer reviewable rates then these rates may be more accepted in the marketplace.
- If no other companies offered the product, then the company would need to undertake some market research to determine whether there might be a demand.
- The company would also need to consider whether the business sold on reviewable rates would simply replace that which it would have otherwise sold on guaranteed rates.
- If so, then it would not be worth developing the new option unless greater profit could be made on reviewable rates.
- The company would need to consider whether it had the systems capability to actually change the premiums in light of bad experience
- This proposal is likely to involve development costs which have to be justified by potential increases in business volumes. The reviews themselves will also lead to an increase in expenses
- It also needs to consider potential bad publicity from future increases in premiums and be sure that it would actually carry out these increases in practice (if required). If it would not, then the rates are not really reviewable.

- It would need to make sure that marketing material and policy conditions clearly sets out the potential for increases in premium and what would cause these so that policyholders' expectations were framed appropriately.
- The company needs to decide on how frequently it will carry out reviews.
- Also, in order to sell, it may need to guarantee a period at the start of the policy during which it would not change the premiums
- It would need to consider whether it would also reduce premiums in light of good experience, set this out clearly, and be prepared to do it in practice.
- It needs to make sure that it monitors experience appropriately in order to identify changes in experience as soon as possible. Even then, there will still be a time lag between identifying bad experience and actually changing premiums.
- If significant increases are required in the future then some policies will lapse which otherwise would not have. Thus, persistency experience would tend to be worse.
- Also, the policies which lapsed would tend to be those in better health so the claims' experience of the remaining policies would worsen further, requiring further increase in premium.
- There might also be a lapse and re-entry issue for existing policyholders on guaranteed rates if they perceive the new reviewable rates as being better value.
- Reviewable rates may be less capital intensive i.e. lower margins in reserves and SM.

[8]

Proposition 2:

- If attractive to potential policyholders, then this could increase sales since maintenance of real cover will help meet policyholder needs
- The increase is at the policyholder's discretion. The PH is more likely to increase their premium if they are in bad health. This anti-selection risk is likely to lead to poorer experience.
- The risk could be reduced by making policyholders choose at outset whether they want an automatic increase each year.
- Or the company could offer a larger one-off increase in the event of lifestyle changing events such as parenthood or marriage.
- If inflation is high then the financial impact of anti-selection would be greater. So the company could limit the increase to the lower of inflation and x%.
- The company would have to allow for the potentially worse experience when setting the premium rates.
- In theory, the cost of critical illness cover will increase with age so if the sum assured increases in line with inflation then, all other things being equal, the percentage of increase in premium should increase by more than the percentage increase in sum assured.
- To allow for the fact that the premiums increase at the same rate, the premium at outset would have to be higher than for a policy without this option.
- To do this, the company would have to make an assumption about how many increases will be effected by each PH. This will be difficult to predict making it more likely that actual experience will differ from that assumed.

- If the assumption is too prudent then the policies will not sell but a best estimate assumption brings a relatively high probability of losses due to more increases being effected than expected.
- The company would also need to assume a rate of price inflation (consistent with other financial assumptions) when setting the premium.
- Expenses will also be incurred at each indexation which would need to be allowed for in the premiums.
- The company might introduce a minimum % increase to ensure that expenses are covered.
- The company will want to adapt its systems to ensure that the process for taking out an increase is as automated as possible.
- The indexation option may afford the company an opportunity to communicate with the customer and possibly cross-sell.
- The company will need to decide what to do for policies which were originally rated.
- The company may choose to provide the option of indexation only to standard lives.
- Anti-selection issue may mean that underwriting needs to be tighter which may deter sales.
- The options will have to be reserved for appropriately ; this may increase NB strain

[7]

[25 Marks]

Solution 7:**(i) a.]**

- The additions can take the form of “reversionary bonuses”, which usually are given on a regular basis throughout the lifetime of a contract.
- There are 3 different types of reversionary bonus which can be used: simple, compound or super-compound.
- Simple, compound or super-compound represent an increasing deferral of surplus.
- Once declared they become guaranteed and cannot be taken away.
- A company may declare part or all of a reversionary bonus as a one-off “special”, i.e. in addition to any regular reversionary bonus that it is giving.
- The additions can also take the form of a “terminal bonus” which is determined when the insured events occurs.
- In theory this gives a lot of flexibility to change bonus.
- In practice this does not happen, but even so a company will not guarantee to maintain the bonus at any particular level.

b.]

- The profit to be given to a particular contract is expressed as a percentage of that contract’s supervisory reserve.
- The benefit under the contract and the premium payable by the policyholder are then increased by the same percentage.
- Where this method is used, the profit of the company is typically divided into a “savings” profit and an “insurance” profit.

- The “savings” profit represents the profit from the assets and can be distributed, in whole or in part by this method.
- The “insurance” profit is that arising from actual experience being better than expected for all sources of profit other than the return on the assets and typically retained by the company for distribution to shareholders.

c.]

- The dividend given to a particular contract may be calculated using a formula which takes into account that contract’s contribution to surplus from different sources - typically interest, mortality and expenses.
- The proportion of the total surplus which is distributed will vary from year to year, in order to obtain a more stable (i.e, smoothed) progression of dividends over time.
- Some profit may also be retained for shareholders, held against future adverse contingencies and/or held for future distribution as a terminal dividend.
- The dividend can be paid in cash or converted into an addition to the benefits.
- A terminal dividend may also be given.

[9]

(ii) a]

- The company will retain a high free asset ratio if the terminal bonus is not included in the calculation of the statutory reserves.
- This allows it investment freedom and therefore the prospect of higher returns.
- Also, it would mean greater capital to finance further new business.
- If the economic changes are reversed in future, the company can reduce terminal bonuses accordingly.
- Surrender values may not fully reflect Terminal Bonuses, in which case they may not increase in line with asset values.
- A high level of surrender surplus may arise, which might be inconsistent with the company’s interpretation of equity between policyholders.
- PHs may be dissatisfied with the surrender terms and their expectations may not be met.
- The company’s competitiveness might be reduced in terms of its reversionary bonus rates, levels of guaranteed benefit, and surrender values.
- However, its total payout including terminal bonus should still be competitive.
- And at least no unreasonable policyholder expectations are created.
- The company’s shareholders will not receive as much short-term benefit from the exceptional surplus.

[4]

b]

- The principles of smoothing for with profit business normally mean that any significant change in bonus rates may need to be made gradually over a number of years.
- The company will retain a high free asset ratio for some years, until the exceptional surplus has all been distributed.
- This will confer the same advantages as in (i) but only while it lasts.
- If the economic changes are reversed in the near future, the company can return to the previous levels of bonus.
- The company's profits will be increased due to higher shareholder transfers.
- In a lower interest economy, sustainable bonuses are lower, not higher.
- The company might therefore be going against the market trend.
- This might give it a competitive advantage, but it might also cause a problem of credibility.
- Policyholders and shareholders may come to expect that the higher bonuses and profits will continue indefinitely.
- They may be dissatisfied with the fall in bonus rates, when the exceptional surplus has all been distributed.

[4]**c]**

- By identifying the bonus as special, the company would avoid unrealistic expectations being generated.
- Maturity values and surrender values would both benefit immediately from the revaluation of assets.
- Shareholders would be entitled to a substantial one-off surplus.
- This could support a special dividend, or could be used to invest in new activities.
- The company bears the risk of the economic changes being reversed, which would probably force it to declare reduced normal bonuses for several years.
- The benefits of a high free asset ratio will not be achieved. However, the free asset ratio may not be any lower than had the economic circumstances not changed.

[3]**iii)**

- Not declaring bonuses will mean that this surplus is available for other purpose, however the extent the company can use this for any other objective will depend on the following factors:
 - Communication to policyholders in the past regarding the allocation methodology of any such surplus.
 - Competitive practice
 - Past practice of the company with respect to such surplus
 - Regulatory restrictions of use of such surplus.
- The use of this surplus to write new business will ultimately benefit the policyholders if the new business is written on profitable terms.

- However the company will have to ensure equity towards the generation of policyholders who contributed to the surplus and the generation of policyholders who benefit from it.
- The company can explore other uses of this capital which may benefit the right generation of policyholders like greater investment freedom which should translate to higher bonuses.
- The company can also use this surplus to show a higher solvency ratio, if that is what the investors are looking for. This in turn should increase the share price. However if the investors feel that this is not the best use of capital then it could work otherwise.

[5]

[25 Marks]
