Institute of Actuaries of India

Subject ST2 – Life Insurance

September 2017 Examination

INDICATIVE SOLUTION

Solution 1:

i)

- Altering the premium payable
- Making it paid-up
- Altering the sum insured
- Altering the outstanding term
- Option to renew contract without further underwriting

(2)

ii)

In assessing an alteration method, the principles we might judge it against include:

- affordability
- consistency with boundary conditions, eg surrender, paid-up, new policy
- stability
- avoidance of lapse and re-entry
- fairness
- ease of calculation and of explanation to the policyholder.

(3)
[5 marks]

Solution 2:

i)

- Rather than managing ABC Life's insurance risk profile (which is the focus of traditional reinsurance), financial reinsurance focuses on managing ABC Life's capital position.
- The Financial reinsurance arrangement should be a means of improving the accounting or supervisory solvency position of ABC Life.
- The arrangement should not involve a significant transfer of insurance risk from ABC Life to XYZ Re.
- A "loan" arrangement can be made similar to the risk premium reinsurance method, whereby XYZ Re relieves ABC Life of part of its new business financing requirement.
- However, this loan cannot be an ordinary loan, which would need to be shown under ABC Life's liabilities, leading to no improvement in solvency position.
- This "loan" can be presented as a reinsurance commission related to the volume of business reinsured.
- The "repayments" of this loan can be spread over a number of years and are added to the reinsurance premiums.
- Alternatively, this loan could be agreed as a "contingent loan", where assets are increased by the amount of the loan, but liabilities would not have to increase by an equal amount, as future repayments will only materialise should the VIF profit materialise.

Regulatory considerations

- Within realistic reporting basis there is likely to be reduced adoption or at least increased scrutiny of Financial Reinsurance arrangements
- Financial reinsurance is not effective under accounting or supervisory regimes where credit can already be taken for future profits.
- Such an arrangement can also not be made if regulations prescribe a realistic liability to be held in respect of loan repayments, which would negate the aim of Financial reinsurance as explained above.

(7)

ii)

- XYZ Re is providing a contingent loan to ABC Life, where XYZ Re expects to earn back repayments depending on the emergence of future profits (value of in force or "VIF") being generated by the business.
- As the term assurance block is loss-making, XYZ Re expects that the VIF is actually negative, or in other words, the product will not generate future profits which are required for the repayment of the contingent loan.
- If the VIF profit does not occur at all for this block, XYZ Re would simply have made a capital gift to ABC Life for this product, which it would like to avoid.

(2)
[9 marks]

Solution 3:

i)

Description and purpose of MVR

- Market value reduction is an adjustment or reduction generally applicable to the payout on surrenders or withdrawals from an accumulating with-profits contract.
- The adjustment is applied to cover the difference between value of the underlying assets compared to the payout including all bonuses (if the asset values are lower).
- The purpose of the MVR is to protect policyholders who remain in the with-profits fund, as its application means that the withdrawing policyholder gets a fair share of the assets.
- The company will specify as part of the product features on some points at which no MVR will be applied (e.g. on death or after 10 years) to make a product more marketable.

Which products require MVRs and why:

- MVRs are usually applicable for surrenders on accumulating with profits business, and in particular if such a product is "unitised".
- They may also be applicable for maturities, to reduce the cost of capital for the insurance company.
- For unitised accumulating with profits, the initial surrender value would be the bid value of units (similar to unit-linked business). Hence an MVR is required to ensure fairness (and also because for with profits there is discretion to ensure such fairness).
- For conventional with profits business, there is already a bonus mechanism including any discretion or "smoothing" mechanism to ensure fairness across policyholders, thus not requiring further MVRs.
- They are not applicable on non-profits contracts because for such contracts the benefits are usually not discretionary.
- In addition, the surrender value basis for conventional with-profits and also non-profits contracts are already discretionary and not guaranteed in advance, hence there is no further requirement for an MVR to provide protection to policyholders remaining in force.

(6)

ii)

Growing average income for households

Customer needs:

- This would imply that the potential customers of the company have higher savings and appetite for investing their surplus funds.
- The average household might have lower debts since the average income is also growing.
- The biggest need would be to save for retirement and retirement healthcare.

Product suggestions:

- Savings focused products are likely to be popular, especially those designed to maximize the wealth for customers through their investments…
- … or those aiming to ensure sufficient funds or income for retirement.
- There will be less direct need for loan-outstanding protection or income replacement type products.
- … Or the inverse may be potentially true, with higher income leading to a general rise in lifestyle with higher expenses, with increased need for income replacement.
- There will still be some need for pure life protection type products, for outstanding home loans, succession tax, funeral costs children's education, etc
- Those providing future long-term care (protection against long- term sickness or disability) could become affordable given the higher income.

Growing elderly population (60+ years)
Customer needs:

- Significant proportion of this elderly population would be moving from employment into retirement, requiring steady retirement income.
- The elderly are likely to have less outstanding debt, and likely to have saved for their retirement.
- Retired customers will likely be more risk averse…
- …they will also need to plan for retirement healthcare.

Product suggestions:

- Products offering regular income in exchange of a lump sum (e.g. annuities).
- ..particularly as they provide protection against longevity risk
- In case of income drawdown funds where customer can withdraw at his choice products offering a choice to invest in stable bond funds, or traditional savings products (including with profits business) may be suitable.
- Long Term Healthcare products would be suitable…

(6)
[12 marks]

Solution 4:

i)

The main factors for the company to consider when determining the bonus method are the following:

- Equity and smoothing,
- Flexibility (i.e. discretion),
- Simplicity,
- Investment freedom.

Equity and smoothing

- The contributions method is probably the most equitable, splitting the profit across all sources (investment, mortality, expense).
- Revalorisation is equitable for investment profits with some smoothing.
- Addition to benefits method has more discretion and is only broadly equitable.

Flexibility

- The maximum flexibility is under the addition to benefits method, with scope to apply smoothing at discretion to ensure fairness across cohorts of policyholders.
- The contribution method is moderately flexible.
- Revalorisation is least flexible, being based on a set formula.

Simplicity

- Revalorisation and addition to benefits are both relatively simple to apply.
- However it is more difficult to explain the addition to benefits to policyholders (as the company has discretion which is not very transparent).

- The contribution method is probably the most complex of the three methods.

Investment freedom

- The addition to benefits method provides the most discretion, especially if there is a terminal bonus applicable where the company can defer the distribution of profits significantly.

- Revalorisation probably provides the least freedom, while contribution provides some investment freedom through terminal dividends.

(8)

ii)

Justification for with profits business:

- Asset shares are useful to determine the "supportable" bonus rates, i.e. the amount of bonus that the company is able to pay on with profits contracts.
- There are several other considerations for bonus setting (i.e. PRE, competition, company principles, etc). However, asset shares are an important part of the process to determine the company's ability to pay bonuses, which is essential in the management of with profits business.

Other than with-profits business:

- In theory, asset shares can be calculated for all products (including non-profits and unit linked business).
- However, for unit-linked products, the size of the unit account in conjunction with any guarantees is the main determinant for the benefits to be paid out.
- So if these underlying factors are already calculated, then there is no further need to derive asset shares for unit-linked products (though it can be argued that "unit account values" are proxy asset shares).
- For conventional non-profits contracts the benefit is usually the fixed guaranteed sum assured (unless the specific contract has alternative benefits). So, for these contracts we do not need to calculate asset shares.
- The only use of the asset share for such contracts would be to monitor the profit or loss once a contract has been terminated (the profit / loss is the difference between the asset share and the final payout to the policyholders).
- Hence, an argument could be made to calculate asset shares to monitor profitability for other contracts, if this is practically feasible.

(4)

iii)

- The table provided by the junior actuary seems incorrect for a number of reasons.
- For a regular premium policy, we expect significant initial expenses, caused by the cost of acquiring the business, which typically would lead to negative asset shares in year 1. This does not seem to be the case in the presented table.
- The asset share would then increase (depending on the profit pattern) as renewal premiums are receives and the accumulated assets share with investment earnings is expected to exceed any asset share deductions.
- We expect that the investment income will result in a growing asset share, which also does not seem to be the case.
- As the policyholder ages, we expect the cost of life cover to increase year by year, with a slight reduction in the asset share, but likely not as large as observed in the table.
- At maturity, we would expect the asset share to exceed the guaranteed sum insured (INR 1,00,00,000), assuming that the policy is profitable, and this is not the case.
- In fact, based on the above points, the asset share pattern looks like the opposite of what we expect from year 1 to 6. The asset share projections might be consistent if the durations are correctly assigned

To validate the exact numbers, more information would be required (e.g. initial expenses, actual investment returns, amount of premiums, etc).

(5)
[17 marks]

Solution 5:

i)

Formula method vs Cashflow method

- Formula method will give a smooth progression of reserve
- Formula method ignores withdrawals, whereas the cashflow method is able to allow for all cashflows
- Formula method is not appropriate for Unit linked business…
- … since it would be difficult to express the expected future cashflows in form of a formula

- Formula method, where a formula can be created, might be easier to use than the cashflow method
- Cashflow method can identify whether net cashflows at any period are positive or negative….

- …..which might be necessary if reserves are to be calculated on a prudent basis
- Using formula approach, it is difficult to factor in assumptions that are expected to vary over time….
- … for example any mortality improvement, or an appropriate yield curve
- It is easier to model reinsurance…
- … and tax, particularly if they have complex structures, using cashflow method than formula method

(4)

ii)

- Negative reserves are a credit for future expected profits taken in advance
- Since the solvency capital is a percentage only of the reserve…
- …it would further reduce the solvency capital requirement
- This would increase free surplus
- Enabling greater investment freedom, and thus potential of greater returns for the shareholder

- …or ability to write greater new business
- …since this is a new company, it might help reach break-even sooner
- Reserves are likely to be negative at the beginning of the policy…
- …holding negative reserves would help reduce the new business strain
- The risk is that the expected profits do not emerge in future
- For example, if the surrender penalty is not equal to the present value of the future expected profits, and the withdrawal rates are higher than those assumed while calculating the negative reserves

(4)

iii)

- The proposed change will strengthen the statutory reserves, all else being equal
- Since the purpose of the required solvency margin is to provide a cushion…
- …such that the reserves and the required solvency capital together are sufficient to meet all liabilities
- With the strengthening the statutory basis for reserving, the regulator might consider relaxing the solvency requirements….

- … since a lower cushion is now required.
- Thus the percentage is likely to reduce.

(3)

iv)

Experience will be monitored so as:

- to develop earned asset shares;
- to update assumptions as to future experience, thereby feeding back into the control cycle;
- to monitor any trends in experience;
- to monitor actual compared to expected experience and take corrective actions as needed
- to provide management information to aid business decisions; and,
- to make more informed decisions about pricing and about the adequacy of reserves.

(3)

v)

- consistent data would need to be maintained for both the products but separate for each product
- For each life insured, the following accurate information would be required to be maintained:
    - Product
    - Product type
    - Duration in force
    - Sales method used and target market
    - Frequency of premium
    - Size of premium
    - Premium payment method
    - Original term of the contract
    - Sex and age
    - Smoker / non-smoker status
    - Medical / non-medical status

(5)

vi)

- Big data could help recognize patterns and behaviours of consumers
- The patterns and behaviours could be used to identify high – risk (e.g. being able to identify high risk hobbies / pass times / occupations)
- …and low-risk lives (e.g. gym membership, regular health check-up etc)
- the ability to analyse and utilize this information could provide an edge while pricing the term insurance product in future
- … particularly since term insurance is very price sensitive
- it could also help target better lives, thereby improving the experience on the term insurance product
- it would provide risk classification opportunity, allowing more accurate rating for each customer
- by going a step further, it might help identify behavior that alters the risk categorization
- giving an opportunity to possibly intervene, by either influencing customer behavior
- .. or altering the risk classification for the product (if allowed by regulations)

(5)

[24 marks]

Solution 6:

i)

- The prime objective in building an actuarial model is to enable the actuary advising a life insurance company to give that company appropriate advice so that it can be run in a sound financial way.

- As a model is a small representation of the real thing, model results can generally be produced more quickly and cheaply than testing something on the whole block of business.

- Models will therefore be used to assist in the day-to- day work of the company and to provide checks and controls on its business.
- Actuaries can build models for various purposes, say, projecting the profitability of the company, using actuarial expertise or judgement for any complex areas.

(2)

ii)

- Since this is a unit linked product, the assets backing the unit fund should be invested in the assets representing the unit fund…
- …. based on the risk profile chosen by the policyholder
- …to ensure that surrender and maturity liabilities are matched exactly
- The descriptions of the funds will indicate the broad asset classes permitted and the proportions in which each of the three funds will invest
- The non-unit reserves are likely to be much smaller than the unit reserves
- Assets backing the non-unit fund would be used to cover expenses and any benefit payout to the extent that it exceeds the unit fund value (such as the mortality benefit).
- The investment strategy would need to take into account the future expected cashflows from the deductions from the fund.
- Since the timing of death benefit to be paid through the non-unit fund is unknown, the assets are likely to require having low volatility and high liquidity, at least initially
- Thus, fixed income securities are likely to form a large part of these.
- as duration increases, the unit fund is likely to exceed the sum assured
- however, since the sum assured is 15 times the annual premium, this may never happen for short term policies of period less than around 15 years
- on the other hand, this would be a factor to consider for the longer term policies
- reducing the need for liquidity in the non-unit fund
- Some proportion may be invested in equities to generate higher growth…
- …. and to match future expense liabilities which would be impacted by inflation
- …if, and to the extent, permitted by regulations
- Assets backing the required solvency margin should be invested in line with the assets backing the corresponding reserves
- Free assets would probably be invested in equities to maximize growth

(7)

iii)

- Before initiating the modelling process, the company should have an initial proposed investment strategy for the non-unit assets, and expected portfolios for the linked assets that fit with the fund descriptions and other representations made to policyholders.
- Using a model to project the business in force, a model investment portfolio can be built up based on the company's proposed investment strategy.
- The liabilities and the assets would then be projected forward on assumptions that represent expected future experience.
- The company may want to consider the effect of variations or multiple scenarios with different assumed experience.
- In-fact one of the most important considerations will be how the proposed investment strategy fares in the light of significant market movements downwards.
- For the assets, stochastic investment models can be incorporated in order to project future investment income and changes in capital values.
- Inflation rate models are used to project future expenses on the liabilities side.

- The parameters should be consistent – for the assets we will need consistency between inflation, interest rates and market (capital) values.
- The valuation interest rates used in the liability model should be consistent with the economic assumptions.
- The projected liabilities and assets can then be valued at the end of each projection year on the company's supervisory basis, to test the solvency position at the end of each year.
- Various investment strategies can be tested in this way, until one strategy leads to the desired result in terms of the resulting solvency position and is within the company's risk appetite.

- Using a stochastic investment model and simulation techniques, the above can be extended to produce a statistical distribution of the amounts available each year to cover the level of solvency capital required.
- Stochastic methods can also help determine the probability of potential future insolvency for a particular investment strategy.
- We also need to identify some measure of success apart from solvency (most likely the profitability, by say looking at the VIF) which we can use to compare investment strategies.

- Finally, the investment strategy selected would be based on the target profitability and solvency ratio (and perhaps other metrics selected by management).
    - This would need to be balanced with the variability acceptable to management under the selected investment strategy, which can be observed better through stochastic modelling.

(9)

iv)

Charge for guarantee

- The company needs to determine how it will charge for the maturity guarantee.
- It is likely to do this by amending an element of the existing charging basis rather than inventing something new
- Most likely would be an increase in the amc

Profitability

- The company would want to ensure that the guarantee is costed correctly so that the product remains as profitable as before
- However, this may be constrained by the wish to make the product more marketable

Marketability

- Addition of the guarantee should make the product more marketable
- Provided the cost of the guarantee is lower than those offered by competitors
- And also, provided, the cost is lower than the value assigned to the guarantee by the customer

Competitiveness

- The company would want to check what level of guarantees are offered by competitors
- ..and at what cost (½ mark already allotted to this above.)

Financing requirement

- The addition of a guarantee is likely to increase the reserve requirement
- This may be offset by the increase in premium, so the net impact needs to be considered

Risk Characteristics

- The addition of a guarantee increases the risk faced by the company even if it is costed correctly

- The company would face additional model and parameter risk as well

Sensitivity of profit

- The addition of the guarantee is likely to make its profit much more sensitive to variations in the growth rate of the fund

Administrative system

- The cost of changing the administrative system to apply this guarantee needs to be considered

Regulatory requirements

- The company needs to consider whether the revised product also satisfies the regulatory environment…(no points for stating this much)
- …for example whether the charges after allowing for the additional charges are still within the capped charges (if any) .. or any other valid example

(10)

v)

- The company would need to use a stochastic model to project forward the value of its unit linked fund…
- …under various scenarios and compare this to the guaranteed amount.
- Additional liability would be created as a result of the guarantee equal to the shortfall of the fund compared to the guaranteed amount…
- …in scenarios where the growth rate of the fund is lower than 3% p.a…
- …after adjusting for any charges that apply.
- The assumptions underlying the model would need to reflect the planned investments in the fund category chosen by the policyholder
- Either a separate costing would need to be done for each of the three categories: low, medium or high risk,..
- …or, an assumption regarding the proportion (by value) of investors choosing each would need to be made as part of the projection exercise
- The present value of the liability can be determined by discounting the simulated cost at a suitable rate.
- An appropriately large number of simulations, say 5,000 to 10,000 would be required…
- …to generate a probability distribution of the present value of the guarantee.
- The cost of the guarantee, may therefore be the expected value of this distribution.

(5)

[33 marks]