

Institute of Actuaries of India

Subject SP2 – Life Insurance Principles

November 2019 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) The main reasons to undertake an analysis of surplus are:
- Show the financial effect of divergence between the valuation assumptions and the actual experience, exposing which assumptions are more financially significant
 - Show the financial effect of writing new business
 - Provide a check on valuation data and process, if carried out independently
 - Identify non- recurring components of surplus, thus enabling appropriate decisions to be made about the distribution of surplus to with-profits policyholders
 - Give management information on trends in the experience of the company
 - Comply with regulatory requirements [3]
- ii) The main reasons to undertake an analysis of embedded value profit are
- Validate the assumptions, calculations and data used
 - Reconcile the value for successive years
 - Provide management information
 - Provide data for use in executive remuneration schemes
 - Provide detailed information for publication in company's accounts or those of any parent company, in particular the value of new business taken upon by the company [2]
- iii) Higher than expected lapses would impact both Present Value of Future Profits as well as the Net assets of the company.
 An increase in lapse rates leads to reduction in the PVFP as lesser no of policies now contribute to the future profits.
 However, at the same time, reserves are not required to be held by the company. Thus, the embedded value increases due to an increase in Net Assets.
 Since early on in the policy term, reserves are low and most of the profit is yet to be earned in the future, the loss of profit in the future is expected to be higher than the immediate gain from release of reserves. Thus, the EV should fall.
 On the other hand, if the release of reserves is more than the loss in future profits the EV can increase as well.
 If the experience during the year, results in the EV assumptions being modified we would see an additional impact on PVFP.
 If as a result of higher lapses, if the EV projection basis is modified to allow for higher lapses, the EV is expected to fall due to a fall in PVFP. This happens as the loss of future profits is higher than the expected gain on release of early reserves as mentioned before.
 Also, a higher lapse assumption may force the insurer to revise the mortality basis (selection affect) and expense basis (higher per policy costs) upwards. This would further reduce the PVFP and thus the EV.
 Based on the higher lapse experience, the insurer may further decide to change the reserving basis in its PVFP calculations.
 If the reserving basis is modified to allow for the impact of higher lapses, it would result in higher reserves, lower net assets, higher PVFP but possibly lower EV.

This would happen as the increase in PVFP would be lower than the reduction in net assets under traditional embedded value approach as the risk discount rate is expected to be higher than the assumed projected investment return.

[10]

[15 Marks]

Solution 2:

i)

There are three types of bonuses under the addition to benefits approach:

Regular reversionary, special and terminal bonus

Regular reversionary

A regular reversionary bonus is a reversionary bonus that is declared on a regular basis, usually each year, throughout the lifetime of a contract. Once declared it becomes attached to the basic benefits and is guaranteed and cannot be taken away.

The amount of bonus declared can be calculated in one of the below mentioned ways

- Simple – the bonus is expressed as a percentage of the basic benefit under the contract
- Compound – the bonus is expressed as a percentage of the basic benefit plus any already attaching bonus
- Super compound – the bonus is expressed in terms of two percentages; one applied to the basic benefit and a second applied to any already attaching bonuses.

Special reversionary

A company may declare part or all of a reversionary bonus as a one of special in addition to any regular reversionary bonus that it is giving.

This may be given on say re-structuring of the with profits fund or on some special occasions such as a golden jubilee celebration of a life insurance company.

Once given, these bonuses are guaranteed and cannot be taken away.

Terminal

Terminal bonus is generally payable on a claim event. For example, death and surrenders (after X no of years), maturity etc.

In theory this implies a potentially constantly changing bonus. In practice this does not happen, but even so a company will not guarantee to maintain the bonus at any particular level.

The terminal bonus to give to a particular contract may be specified in a number of different ways

- A percentage of total attaching reversionary bonus including any special reversionary bonus. This percentage may vary depending upon the duration in force and original terms of the contract
- A percentage of total claim amount before addition of terminal bonus. The percentage generally varies according to the duration in force and size of the basic sum assured.

[7]

- ii) (a) **Surplus from surrender**
Expected to be volatile and vary year on year.

Terminal bonus is the most suitable form to distribute. However, in practice some of it may be distributed as a part of regular reversionary bonus alongside terminal bonus.

- (b) **Surplus from one off events**
Non recurring form of surplus.

Special reversionary bonus is most suitable. This ensures that policyholders reasonable expectations are set to this being a one-off payment rather than an expected addition every year.

Can also be used with terminal bonus if required.

- (c) **Surplus from expenses**
Expected to contribute to surplus every year however the contribution may vary.

Best possible way to distribute this is using regular reversionary bonus as long as it is reasonably stable and predictable.

However, in practice, some amount of it might be deferred and used as a part of terminal bonus as well.

- (d) **Surplus from capital gains on equities**
Expected to be volatile and vary year on year.

A specified percentage of the realised capital gains may be distributed using terminal bonus with the remaining being included as a regular reversionary bonus.

In most countries, unrealised capital gains are not used actively for bonus declaration purposes.

[8]

- iii)
1. Various sources of profit, under with profit policies premium basis, include mortality, investment, lapse or expense experience being better than allowed for.
 2. Generally, mortality and expense sources may be much less significant than other sources, in particular when compared to the investment profit.
 3. In the long term, mortality and expense experience can be more accurately predicted than investment performance.
 4. Prediction of investment experience is also subject to the complexity and volatility associated with the underlying investments. This is also influenced by the external environment.
 5. The premium basis, thus, may be based on a more realistic estimate for mortality and expense assumptions, compared with the deliberately low investment return that companies guarantee on with-profits policies.

[3]

[18 Marks]

Solution 3:

- i) Retention limit is the maximum amount of risk retained by the cedant on any individual risk.
General factors to consider when setting retention limit include the:
- Average benefit level for the product and the expected distribution of the benefit
 - Company's insurance risk appetite
 - Level of the company's free assets and the importance attached to the stability of its free asset ratio
 - Terms on which reinsurance can be obtained and the dependence of such terms on the retention limit
 - Level of familiarity of the company with underwriting the type of business involved
 - Company's expertise in pricing such a product vis-à-vis the reinsurer's expertise
 - Any regulatory requirements with regards to minimum / maximum level of session
 - Effect on the company's regulatory capital requirements of increasing or reducing the retention limit
 - Existence of a profit-sharing arrangement in the reinsurance treaty
 - Company's retention on its other products
 - Nature of any future increases in Sum Assured

[5]

ii) **A life insurer with limited capital resources**

The need here would be to keep the retention limit low and employ a method of reinsurance which helps to reduce any new business strain.

Risk premium reinsurance on a quota share basis could be combined with a financing commission arrangement to reduce the new business strain, if such an arrangement effectively reduces capital requirements under the local regulations.

The insurer can separately enter into a financial reinsurance arrangement such as Contingent Loan to improve its capital position.

A large proprietary company which is expanding rapidly and whose free assets are declining

If effective under the local regulatory regime, it could opt for a financing reinsurance arrangement based on its large in-force portfolio.

Since it is a large company, it would not want to give away too much profits to the reinsurer by entering into a reinsurance arrangement with low retention levels. Thus, it might opt for risk premium reinsurance with high retention limits (individual surplus basis) with significant financing commission so that the company obtains the required reduction in New Business strain, without giving too much profit away to the reinsurer.

In addition, it could seek catastrophe cover in light of its declining free assets position.

A life insurance company writing predominantly unit linked business

Reinsurance could be obtained to protect the company from the mortality risk that exists on account of the guaranteed death benefit under the product.

Risk premium reinsurance is a natural choice for unit linked business as it can be administered very much like the mortality charging arrangement in place for policyholders and should be a part of the same overall administration system.

Risk premium reinsurance on a quota share basis can be used if the company is new or is in need of capital.

On the other hand, risk premium reinsurance on an individual surplus basis can be used if the company is well established and wishes to retain most of the mortality risk.

[9]

[14 Marks]

Solution 4:

i)

With Profit Annuity and Investment Strategy

Offering with profit annuities would bring an additional discretionary benefit into the product structure when compared to without profit and index linked annuities.

The guaranteed annuity rates under this product is expected to be lower with the insurer passing on the extra return earned every year via additional discretionary annuity payments.

These discretionary benefits would be in the shape of bonus payable which might vary year on year. The insurer should look at maximizing the returns on these discretionary benefits.

The company can invest in more volatile assets like equities, properties and corporate bonds to maximise returns.

However, the policyholders would have already developed some expectation of the minimum annuity rate based on the existing products.

Therefore, the company may wish to ensure that the possibility of the bonus falling below a certain level are minimized.

Thus, it would choose its investment strategy appropriately and allow for some level of smoothing of bonus rates so that annuity rates are not very volatile year on year.

The level to which the company can invest in volatile asset classes would also depend upon the level of free assets of the company and the insurers risk appetite.

[5]

ii)

Change in Investment strategy for Immediate Annuities and Index Linked Annuities

The current regulatory environment needs to be considered to find out the extent to which mismatching is allowed.

In general investment in property or equities are expected to outperform

fixed interest and index linked securities in the long run.

Some of these asset classes can also prove to be a good match for expenses which are expected to be real in nature.

Also, investment in these asset classes can also be encouraged from the point of view of diversification. However too much concentration in a particular asset class or asset category might be discouraged.

Again, if current asset classes do not match the term of the liabilities which are very long term, some investment in equities and property could be used to provide for better duration matching.

Property rental yields and dividend income can prove to be a good match for growth in expenses. However, growth in property and equity values would be volatile.

However, few other important considerations to bear in mind before altering the investment strategy are:

- Increase in capital requirement due to mismatching
- The risk of insolvency due to volatile nature of the assets while the liability outgo remains guaranteed
- Corporate bonds availability as an alternative investment category subject to credit risk and illiquidity concerns
- Credit for illiquidity premium in liability calculations if annuity liability is illiquid (can't be surrendered).

[6]

[11 Marks]

Solution 5:

i)

The charging structures for unit-linked business, i.e., any combination of:

- Policy charge or fee (taken from either the premium or the fund)
- Percentage allocation during an initial period
- A different percentage allocation after the initial period
- Bid-offer spread
- Charge for risk benefits
- Annual management charge.

[3]

ii)

- Mortality charges are usually levied monthly
- However, under the proposed structure they can only be levied when the premium is paid. Which may be in the beginning of the contract (for single premium) or at the beginning of the year.
- Monthly charges would have been fairer to the policyholder in case of termination of the policy during the year
- Also, it would be more accurately charged for the policyholders' age if charged monthly.
- Generally, there is more than one charge under the unit linked products. All these charges would need to be translated to one charge to meet the proposal.
- However, the purpose of levying more than one charge is to ensure that the insurer is in a position to match its expense needs with the inflow of charges as and when they arise.

- Initial allocation charges help cover the initial costs of selling the policy e.g. underwriting costs (a per policy cost), acquisition commission (a percentage of premium)
- By charging only as a percentage of fund, the company will bear a lot of the initial costs using its free assets
- Particularly as the initial fund value would be low
- If such charge has to be expressed as a percentage of the fund, it could be an approximation and may be levied irrespective of whether the premium is paid.
- Also, as the fund grows, the amount that may be levied may also grow, as it is expressed as a percentage of the fund. While the incurred cost would not have grown (since it was a percentage of premium).
- Similarly, some charges could be expressed in terms of premium or sum assured etc. The purpose is to meet the administrative expenses which are generally capped on per policy.
- If this is again converted to a fund based charge, the charge will continue to increase as the fund grows and may prove to be much higher for the policyholder.
- Or it may end up being insufficient at the beginning of the policy
- making the expenses even more dependant on the lapse experience
- This may create a mismatch between the timing and amount of expenses incurred and collected through charges levied.[]

[8]

[11 Marks]**Solution 6:****i)**

1. A passive valuation approach is one which uses a valuation methodology which is relatively insensitive to changes in market conditions and a valuation basis which is updated relatively infrequently
2. Example for passive valuation approach:
Net premium valuation approach for liabilities
Historic cost or “book value”, possibly with amortization (or “write-down”) over time.
3. An active valuation approach would be based more closely on market conditions, with the assumptions being updated on a frequent basis
4. Example for active valuation approach: Market-consistent valuation approaches for both assets and liabilities, and a risk-based capital approach to solvency capital requirements.

[8]

ii)

1. Advantages of using a passive valuation approach:
 - more straightforward to implement
 - less subjectivity is involved
 - May result in relatively stable profit emergence, when used for accounting purposes.
2. Disadvantages of using passive valuation approach:
 - May be at risk, by its very definition, of becoming out of date.
 - Relatively insensitive to changes in market conditions
 - Infrequently updated valuation basis.
 - May ignore important trends
 - May provide a false sense of security.
 - Management may fail to take appropriate actions in response to emerging problems until

1. Advantages of using an active valuation approach:
 - More informative to understand the impact of market conditions on the company
 - Enables to assess the ability of the company to meet its obligations
 - Particularly in relation to financial guarantees and options.
2. Disadvantages of using an active valuation approach:
 - More volatile.
 - Under adverse market conditions may indicate need for higher capital requirements
 - May results in systemic risk, as other insurance companies may also face similar market conditions at the same time.
 - Calculations may take longer to perform and be more costly.

Any other valid point can be awarded a mark. However, care should be taken to not award marks for the same point twice, once as an advantage for passive / active and once as a disadvantage of active / passive

[6]

[14 Marks]**Solution 7:**

- i)
- Investment risk – whether the return earned on the assets held is sufficient to provide the return guaranteed to the policyholder
 - Mortality risk – higher at the beginning of the contract, when the sum at risk is higher
 - Expense risk
 - Persistency risk

[2]

- ii)
1. Profitability
The company would want to ensure that the marginal increase in premium is sufficient to cover the cost of the increased death benefit payout.

The estimate of the increased payout will need to take into account the future expected mortality.

Which could potentially be different from past experience due to mortality improvements / change in underwriting / change in claims management practices.

2. Marketability
If an additional feature is being offered, it should increase the marketability of the product

However, it will also depend on whether increase in the sum assured every 5 years is valued by the customers, in comparison to the increase in premium

3. Competitiveness
If a similar product is offered by any of the competitors, the company would want to ensure that the additional price charges remains competitive compared to market.

Since the measure is being taken to boost the sales, it is possible that the existing product is not very competitive

In which case, even if the increment in the premium is comparable to market, it might not be sufficient to boost sales.

If a similar product is not being sold, and the existing product is already not competitive, the increase in the premium may not be viewed favourably by customers.

4. Financing requirement

The increased sum insured is likely to increase the reserving requirements significantly...

... particularly since no cap to the sum insured is mentioned

5. Risk characteristics

This change is likely to significantly increase the mortality risk faced by the company.

It might also increase the parameter and modelling risk

6. Onerousness of any guarantees

The product guaranteed an increased in the mortality benefit without any underwriting at the time of the increase.

This could pose additional risk for the company

However, active anti-selection is unlikely, since a minimum of 5 years would have passed before the sum insured doubles.

7. Sensitivity of profit

The product is likely to become very sensitive to mortality assumption, compared to previous

Since earlier the sum insured payable on maturity and on death was the same.

8. Extent of cross subsidies – unlikely to be any change in this as a result of the additional feature.

9. Administration systems

The administrative system might need modification to cope with this feature

The cost of this would also need to be recovered from the profits of the product

10. Consistency with other products

Since there is no cap to the increase in the sum insured, the maximum sum insured at the later duration may well be significantly higher than that offered under other products

Also, if this feature does not exist under any other products sold by the company, this might cause concerns

11. Regulatory requirements

The regulator may not be okay with such an open ended increase in the sum insured

Possible other valid points:

1. The reinsurer may not agree to such an open-ended increase in the sum insured

2. The company consider increasing the sum insured at a lower rate, to match the inflation instead. This might better match the needs of the customer, and also balance the risk characteristics of the product

[15]

[17 Marks]
