Institute of Actuaries of India

INDICATIVE SOLUTION

November 2011 EXAMINATION

Subject ST2 — Life Insurance

1) a)

The amount of the reversionary bonus can be calculated in one of three 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 bonuses

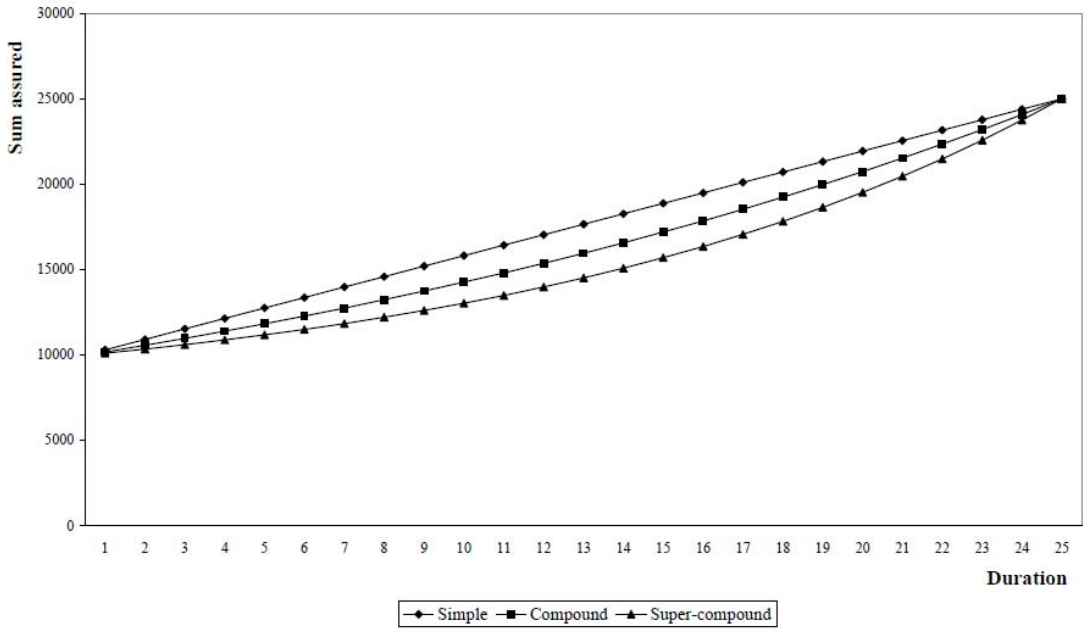
super-compound – the bonus is expressed in terms of two percentages:

one applied to the basic benefit and a second applied to any already attaching bonuses. Where this method is used the second percentage is typically higher than the first.

For a given total amount of reversionary bonus at the maturity date of an endowment assurance, the super-compound approach defers the distribution of surplus – as bonus – more than does the compound approach. The compound approach in turn defers it more than does the simple approach.

In the first few years of the contract, the initial guaranteed sum assured is much larger than the attaching bonuses. Therefore super-compound bonus methods, which give a lower percentage bonus to the initial guaranteed sum assured, produce lower amounts of bonus in the early years.

Once significant bonuses have built up under the contract (towards maturity), the higher figure on bonuses becomes more significant. The bonuses given late in the contract will be higher than under a simple or compound system, all other things being equal.



b)

The considerations in determining the type and level of bonus are as below:

Policyholder expectations

Policyholders may have expectations as regards the form of the profit distribution and the level of the bonuses or dividends given. Such expectations may be built up from:

- documentation issued by the life insurance company
  The documentation that could influence policyholders' attitudes is any marketing literature shown at the time of sale, and in particular any projections implying a specific yield on the policyholders' fund, or eventual benefit at maturity.
- the company's actual past practice

The company's past practice relates to its bonus distributions in the past few years. One consequence of this is that, on finding itself with a larger than expected surplus, a life company might not want to declare all of that surplus in one year because to do so could raise policyholder expectations that that bonus rate is typical and repeatable.

A lower than expected surplus in any year will tend to be met by the opposite response: over-payment of profit in that year to reflect expectations of smoothing. But it would be *against* policyholder expectations for the over-payments to persist for any length of time, as this might result in much larger bonus reductions later, or the company having to compromise its financial security.

The extent to which this is important depends on whether there is a large non-guaranteed terminal bonus that can be adjusted without notice, to bring the sum assured and reversionary bonus up to the asset share.

- the general practice in the life insurance market

  "General practice in the life insurance market" refers to the bonuses that other life companies are declaring. The company should bear in mind that policyholders expect any company's investment performance to be roughly in line with that of the market, and so expect the company's resultant bonus declarations to be similarly in line with other bonus declarations seen in the market. Similarly they will expect companies to have broadly the same split between reversionary and terminal bonus.

Failure to meet these expectations will lead to policyholder dissatisfaction and the risk of losing existing and/or new business. It may also in some countries be a ground for intervention by the insurance supervisory authority in the affairs of the company.

Business objectives of the company

A life insurance company is likely to have as one of its business objectives the aximizing n of the profit distribution to policyholders so as to improve its competitive position.

From a competitive perspective, the aim of the company will be to aximizi the eventual benefits payable to policyholders. Once a policy has been written, the only way to improve the eventual benefits to the policyholder is by aximizing the bonus distribution.

Conversely, any move of the bonus rates downwards could be expected to injure the company's competitive position and so lead to a reduction in new business. However, there may be times when the company *should* reduce bonus rates to reflect the current financial reality; and there may be times when the company *must* reduce bonus rates to ensure that it remains solvent.

In general maximizing payouts mans reducing guarantees to increase investment freedom, hence more terminal and less reversionary bonus, or super-compound rather than simple.

Margins for future adverse experience

The existence of profit distribution to policyholders means that the premium rates charged will contain implicit or explicit margins so as to generate that profit. These margins for profit could equally be looked at as margins against adverse future experience. How far they may, in practice, be viewed this way may depend on the expectations of policyholders in this respect.

For instance, suppose mortality experience on one of a company's with-profits contracts is much worse than anticipated. This could feed into the company reducing bonuses accordingly keeping in mind policyholders' reasonable expectations.

However, guarantees under all with-profits contracts mean that there is some level of adverse experience beyond which any further losses cannot be recouped.

Provision of capital

The surplus distribution system can assist the company in providing working capital. Under certain circumstances, it may be possible to defer the distribution of surplus to policyholders, and in the meantime to use that non-distributed surplus as working capital.

As mentioned above, the premium rates charged will contain margins designed to generate profit which will then be distributed to policyholders. The pace at which the profit arises and the pace at which it is distributed may or may not be the same. If part of the profit is deferred to some future date before being distributed then it may augment the company's free assets in the meantime and increase its ability to take on risk. Depending on the constitution of the company, surplus in respect of with-profits business may be available to support new business.

For example, for smaller insurance companies, the required reserves will increase in line with guaranteed benefits, so declaring a lower regular bonus now (with the aim of having a higher terminal bonus later) will lead to lower reserves and so more working capital.

However, larger with-profits insurance companies are subject to different regulatory requirements, and they have to hold a reserve broadly equal to asset share if this is higher than the "normal" reserve. In such cases, a reduction in the current bonus declaration won't have the same effect on the total reserve as that described above.

Having to hold the asset share effectively means that with-profits policies won't be a source of working capital in such companies.

Where profit is not being distributed as and when it arises, there will be years when the amount distributed exceeds the amount generated and vice versa.

However, over time it would be expected that there should be a balance between the two. Sustained over-distribution could, though, lead to an excessive drain on the free assets.

The extent to which it is possible to defer the distribution of profit depends on the form of the distribution.

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2)

a) The company has currently no or very little experience in the older customer segment.

The mortality improvements or deterioration over time may be different for different age groups.

It is possible that the customers from the proposed product can come from a different socio-economic group as compared to the existing contract.

If the company decides not to underwrite then it would make the new profile of the customers significantly different from the existing one.

By launching this product the company will probably be moving in a new market which will lead to a significant increase in the number of customers. This will possibly reduce the random fluctuation risk

The company may be exposed to anti-selection risk if the policyholders are not underwritten. However funeral plans are generally for small sums assured.

The higher sales volume of this product could further accelerate this risk.

No underwriting would mean that:

- The product could be cheaper, due to no underwriting costs
- But mortality costs could be greater thus increasing the premium
- Possibly be more in line with the market for a funeral product
- No increase in number of claims as this is a whole of life product
- But would probably accelerate them
- The product would be more acceptable to the distribution channels which would mean more sales volumes.

The company would have to keep the following in mind while deciding the mortality assumptions:

- The exiting approach of deciding the mortality assumption may not be appropriate for this customer base.
- For example there will be no selection effect as the product will not be underwritten.
- In fact there may be higher claims in the initial years.
- The claim profile would be different and hence the pricing basis should capture this.
- Seek the advice of the reinsurers, as it is very likely that it will reinsure some of the new business.

b) Anti-selection is the key risk the company will be exposed to due to no underwriting

The company can propose the following actions to reduce or mitigate the risks:

- Offer a reduced death benefit in the first two policy years which would equal to the return of premiums paid.
- Impose a cap on the total sales volume from this product.
- Impose a maximum sum assured per policy
- Allow this product to be sold by a limited number of advisors who have a good track record.
- Link renewal commission to the claim experience although there will be operational challenges.
- Try negotiating with the reinsurers to pass on a substantial risk to them. This will obviously come at a price but will certainly reduce the uncertainty.

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3)

a)

The mortality experience of the company has been better than assumed in pricing over the last few years. This could be due to the stringent underwriting guidelines adopted by the company.

To analyse the impact of stringent underwriting guidelines we will need to get data of all policies which refused to accept the underwriter's decision of special terms, and which were not taken up..

The data will have to be obtained product wise, and would cover perhaps a three year period.

We assume that the cases that our underwriter imposed special terms and were not taken up would have been able to get standard rates from another company, and thus went elsewhere for insurance.

Assuming that if all these cases were accepted at standard rates the mortality experience of the lost policies would be in line with what has been assumed while pricing the product.

We would need to calculate the value of new business for all these policies.

The value of new business would be defined as the present value of future profits discounted at the risk discount rate.

To have a fair comparison we would then need to recalculate the value of all the policies that incepted in the three year period at the policy commencement date with and without allowing for the improvement in mortality rates.

The difference in the value of business with and without improvement in mortality rates will have to be compared to the value of new business of lost business due to underwriting.

However the answer is not straightforward and the following factors will have to be considered before arriving at any conclusions:

- The impact on the overall mortality experience if all policies lost were accepted at standard rates, but actually had worse than average mortality experience.
- The possibility of these policies being accepted by competition at standard rates. It is not very obvious that the prospective policyholders opted for an insurance policy from another company. Some of the policyholders who declined special terms may not have taken up the policy even if ordinary rates had bn offered.
- Therefore an assumption on the take up rate of all these policies would make sense.

b) Main requirement of an actuarial model:

- The requirements depend on the purpose for which the model would be used.
- The model must be valid and fit for purpose
- It should be rigorous
- It should be well documented.
- The model points must adequately reflect the distribution of business being modeled.
- The parameters must allow for the features of the business that could significantly affect the advice being given.
- The inputs to the parameter values should be appropriate to the business being modeled and take into account the special features of the company and the environment in which it is operating.
- The output should capable of independent verification for reasonability.
- The output should capable of being communicated to the recipients of the advice.
- The model should not be too complicated so that the results are too difficult to interpret or communicate.

- The model should not take to long or be too expensive.
- Some level of controls and consistency checking should be built into the model.

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4)

a)

The appraisal value of a proprietary life insurance company is the sum of the embedded value of the company and the value to its shareholders of the future profits they expect to receive from future new business. The latter part of the appraisal value is often referred to as the "goodwill" value of the company.

The starting point in valuing a life insurance company for sale or purchase will be the embedded value. However, an important element of the price is likely to be goodwill, corresponding to the estimated profits expected from future business. The sum of embedded value and goodwill is generally known as "appraisal value". The relative importance of the goodwill component is usually a function of the size of the embedded value of the

b)

If an appraisal value is being prepared as a sale value, then it is likely to be based on realistic assumptions without margins. There might even be optimistic assumptions about the volumes of future new business.

A purchase value may be based on cautious assumptions that include margins, and lower new business volumes.

As a result, the purchase value will be lower than the sale value. The final price agreed for the business will depend on the relative bargaining power of the buyer and seller.

c)

This is part of the appraisal value of a proprietary life insurance company. It represents the value of the future profit stream from the company's existing business together with the value of any net assets separately attributable to shareholders.

Embedded value is the present value of future shareholder profits in respect of the existing business of a company, including the release of shareholder-owned net assets.

It can be calculated as the sum of:

- The shareholder-owned share of net assets, where net assets are defined as the excess of assets held over those required to meet liabilities.

These assets may be valued at market value or may be discounted to reflect "lock-in", for example if they are required to be retained within the fund to cover solvency capital requirements.

These net assets may have to be invested cautiously to ensure that the solvency capital requirements are met. As a result, they will be expected to achieve a lower return than could be achieved with a less constrained investment strategy, and so they will be worth less than their market value to the shareholders.

- The present value of future shareholder profits arising on existing business.

The process of determining this amount is similar to performing a profit test, bearing in mind that some elements will not be applicable (eg new business expenses).

The future cashflows on the existing business are projected and used to estimate the future shareholder profit. These future profits are then discounted back at an appropriate rate to determine their present value.

The calculation of shareholder profits may differ for different types of business.
For example:
− Conventional without-profits business: the present value of future premiums plus investment income less claims and expenses, plus the release of solvency reserves.
− Unit-linked business: the present value of future charges (including surrender penalties) less expenses and benefits in excess of the unit fund, plus investment income earned on and the release of any non-unit reserves.
− With-profits business: the present value of future shareholder transfers, for example as generated by bonus declarations.

For without-profits business, embedded value is effectively the release of any margins within the solvency reserves relative to the assumptions used within the embedded value calculation.

It is important that the reserves used in the determination of net assets are consistent with those used in the determination of the present value of future profits.

Tax is allowed for within the calculation as appropriate.

All else being equal, increasing the discount rate increases the degree of prudence.

d)
The assumptions used in computing embedded value are:
- Economic
    - Risk discount rate
    - Fund earning rate
    - Inflation
- Demographic
    - Mortality / Morbidity
    - Persistency including surrender, part surrender, lapse and paid up and paid up surrenders
    - Expense including initial, renewal split by type such as premium related, sum assured related and per policy

e)
The calculation of embedded value for internal management accounts is likely to be carried out on a best estimate basis. Given that the purpose of calculating an embedded value is to give a more realistic value of the insurer, then a best estimate basis is likely to be used for published accounts also, although regulations may require the introduction of a more prudent basis.
The embedded value basis is likely to be more “best estimate” than the pricing basis. However the two should be looked at side by side. Any differences will immediately lead to embedded value movements on writing new business different to those implied in the pricing basis.
The expected future experience is usually taken as best estimate, unless more prudence is needed for the particular purpose for which the accounts are required (eg published).

Economic

Risk discount rate

- It is reasonable to suppose that the owners of a life insurance company decide where to invest by comparing the returns offered by different companies, relative to the risks which are run, and are able to move their capital from one company to another if they wish.
- Not all projects are equally risky. The life company should view itself as an investor like any other when it considers the riskiness of a new product, as in the long run the profits emerging from the whole company are the profits emerging from the products that it sells. A change in the mix of business, for example away from old and safe contracts towards new and innovative contracts, would change the market's evaluation of the company's riskiness.
- The following are among the features that can make a product design riskier, viewed as an investment:
    - lack of historical data
    - high guarantees
    - policyholder options
    - overhead costs
    - untested market.
- Various techniques such as Capital Asset Pricing Model (CAPM) could be used to determine the risk discount rate.

Fund earning rate

- The value assigned to this parameter will be affected by:
    - the significance of the assumption for the profitability of the contract, which will depend on the level of reserves built up and the investment guarantees given
    - the extent of the investment guarantee given under the contract – this will affect the types of assets in which the premiums from the contract will be invested
    - the extent of any reinvestment risk and the extent to which this can be reduced by a suitable choice of assets – the less important the reinvestment risk the less account needs to be taken of future investment yields
    - the intended investment mix for the contract, as affected by the above, the current return on the investments within that mix and, where appropriate, the likely future return.

Inflation

- The following may be considered when setting the value of the inflation parameter:
    - current rates of inflation, both for prices and earnings
    - expected future rates of inflation
    - the differential between the return on government fixed-interest securities and on government index-linked securities, where such exist
    - recent actual experience of life insurance company or industry.

Demographic

Mortality / Morbidity

- The main demographic assumption that is used to price a life insurance contract relates to mortality rates. The values assigned to these rates should reflect the expected future experience of the lives who will take out the contract being priced. These values will usually be based on an adjustment to mortality rates from a standard table.

- If the company has adequate data, the adjustment would be derived by analyzing the company's own experience for the type of contract concerned. Alternatively, the experience of a similar class of business could be used as a substitute.
- The data would relate to an appropriate period of years, such that the volume of data is adequate, but excessive heterogeneity due to trends over time is not introduced.
- The analysis would divide the data into relevant homogeneous groups, subject to adequate levels of data being retained within each cell.
- If the company has insufficient data to produce reliable results, or has no appropriate data at all, industry sources or life reinsurance companies date would be used instead.
- If the adjusted rates are to apply to a class of lives which is expected to have a different experience from that to which the analysed data relate, then further adjustments may need to be made. This situation could arise due to a change in target market, distribution channel, or the basis of underwriting and accepting lives.
- 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.
- It should also be noted that the rates are more important if the premiums are guaranteed (non-reviewable).

Persistency including surrender, part surrender, lapse and paid up and paid up surrenders

- The withdrawal assumptions should reflect the expected future experience in respect of the contracts that will be taken out.
- They will be based on an analysis of the company's recent experience. Ideally, this should relate to the contract being priced, but if no such experience exists or the available data are inadequate, then the experience under any similar contracts would be analysed.
- If the company does not itself have adequate data, there may be industry wide experience that it could use.
- The results of such analyses should be assessed to see if they have been affected by special factors such as an adverse economic situation in the country.
- If the rates are to apply to a class of lives that is expected to have a different experience from that to which the analysed data relates, then adjustments may need to be made. This situation could arise due to a change in the benefits being offered or target market or distribution channel.
- Expense including initial, renewal split by type such as premium related, sum assured related and per policy
- The parameter values for expenses should reflect the expected expenses to be incurred in processing and subsequently administering the business to be written under the product being priced.
- The values will be determined after analysing the company's recent experience for the type of business concerned. The result of this analysis will be a division of the expenses by function, as appropriate, and possibly by whether the level of expense is expected to be proportional to the level of premium or benefit, or can be expressed as an amount per contract.
- If the company has insufficient recent experience to provide meaningful results, or suitable recent experience is not available, the parameter values may be based on a similar type of business and, if this is not available or not reliable, on any industry data or data from a life reinsurance company.

f)
A company may analyse the change in embedded value over a year to understand the implications of various management actions on the value.

The sort of information that it will give is:
- The value of new business written, normally by product
  This can help the management understand the value added through specific products or product lines.
- The amount of any expense profit or loss
  This can help the business understand if levels of expenses are commensurate with what is assumed in the reporting of value
- The amount of any mortality profit or loss
  This can help the management to understand effectiveness of underwriting and other risk selection mechanisms
- The amount of any withdrawal profit or loss
  This can help the management assess appropriateness of sales practices as well as to evaluate the effectiveness of any initiatives to improve persistency
- The impact of free assets on embedded value growth
  Is spare capital being used efficiently, or is it just sitting around earning market yields and hence reducing the overall return achieved by the company)
- The impact of supervisory minimum solvency margin requirements on the rate of return achieved

In addition to providing management information on how actions are reflected in value, it also gives management a validation of assumptions used. It is common to use the same assumptions for embedded value work as for pricing (other than the risk discount rate which is often set higher for pricing to take account of the extra risks involved in acquiring business). It is crucial that the assumptions used in product pricing be valid, and their continuing validity can be monitored by the analysis of embedded value movement.

[35]

5)

a) The regulator would feel the need to impose a cap on charges on unit linked products because of the following factors:

- The sales of unit linked products could be cannibalizing the mutual funds business. The mutual fund regulators may have approached the life insurance regulators and expressed their concerns on the high commissions paid on unit linked products which become an obvious choice of the distributor.
- There may not be any regulation available on the maximum permissible charges on unit linked products and the regulators would feel the need to introduce it to bring discipline in the industry.
- The media may have campaigned against the high charges on unit linked products which the customers may not be aware of.
- There may have been a court ruling in favor of some existing customers who may not have understood the charges on unit linked products.

- There may have been an increase in cases where polices are cancelled in the cooling period because of high charges in unit linked products.
- There may be a perception in the market that the insurance companies are making abnormal profits in unit linked products.
- The life insurance companies may be over promoting unit linked products and the regulator may feel the need to de-risk the industry and bring back the balance on traditional products.

b)
The major components of an asset share are:

- Premium
- Investment income
- Realized capital gains/ losses
- Unrealized capital gains/losses
- A share in the profits from without profits business sold by the with profit fund.
- Initial commission
- Renewal commission
- Expenses setting up with acquiring and setting up new policies
- Ongoing administration expenses
- Investment expenses
- Cost of any death benefits
- Cost of any further benefits under the policy
- Surrender profit or losses
- Charges of any options or guarantees
- Contribution to the transfer of profits to the shareholders
- Cost of capital to the contract whilst asset share is negative
- Contribution to free assets to support a smoothing policy.

c) Major differences between asset share and an account statement of a unit linked policy.

- The basic difference is that while unit account statements are transparent to the policyholder, the asset share calculation is not shared with them.
- The charges in a unit account statement are known to the policyholders and the insurance companies may have to obtain regulators approval before increasing them. The actual expenses and policyholder benefits paid will get deducted from the asset share. Therefore the policyholder participates in the profit of the company.
- The investment return allotted to the asset share is based on pooling concept whereas the NAV on unit linked products is marked to market.
- The unit account statement will not participate in the profit or loss of other without profit business unlike asset share calculation.

d) It is unlikely that different returns will be allocated to each individual policy. In fact this would go against the pooled nature of with profit business.

Key will be to decide the asset mix appropriate for the class of business.

First, consider whether the overall asset mix of the fund is appropriate for the products. If not, actual assets held will be hypothecated to the separate classes of business written by the company. This will give the actual assets for the products we are considering.

Next it will be necessary to decide how these assets are hypothecated between different subsets of same type of products, like endowments. The same asset mix can be used for all the endowments.

For example, it may be reasonable to allow for some matching of assets and liabilities. So more of the fixed assets could be allocated to the policies very close to maturity. Similarly, shorter dated fixed interest assets would be allocated to these policies. Alternatively, there may be a large element of terminal bonus so that policies close to maturity have a high proportion of real assets.

This will lead to grouping of the policies into reasonably homogenous groups, but practical consideration will dictate the number of these groups.

Again, for practical reasons, this is likely to be simplified to an asset mix that varies as the policy ages.

The asset mix may be influenced by the information provided to the policyholder.

The historic year on year returns for each asset class would then be applied to these asset shares in each year of the policy. As investment expenses are usually expressed as a percentage of funds under management, it is common for this to be netted off against yield.

The tax impact could be based on the actual tax paid. Or it could be based on notional tax rates applying each year. The latter approach would require an assumption about turnover rates of assets so that an estimate of the tax on unrealized gains is made.

Further practical issues would be:

- One off jumps in asset values (for example the sale of a large property)
- Uneven flows of premium over the year where returns are not even over the year
- Data quality issues and timeliness of receiving data
- Deciding how frequently to carry out the calculations.

[22]

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