

Institute of Actuaries of India

Subject SA2 – Life Insurance

May 2010 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

Question 1

(a)

Explanation for past result:

- ? In life insurance the profits emerge over the term of the contract, and not in the first year, in accordance with sound valuation principles.
- ? Furthermore conservatism in the valuation basis for traditional business often results in a new business strain, i.e. the valuation reserve is in excess of the assets.
- ? For unit linked business, recovery of initial expenses is typically spread over a few years to make the allocation amount acceptable to clients, and this also results in new business strain.
- ? In the case of a new life insurer this is exacerbated by expenses being in excess of the assumed stable expense levels, because of set-up costs and a lack of scale.
- ? In India the high costs of distribution, due to inefficiency of most distribution channels and the demand for additional support from corporate distributors add to initial expenses, although with 90% of sales coming from our parent bank, this is unlikely to be a major factor.

Factors impacting on 2010/11 operating profit:

- ? High growth of new business will make the new business strain much larger than the profits from existing business.
- ? Expansion costs including opening of new branches and launching new channels will also tend to result in a loss.
- ? Relying primarily on the bank for distribution expansion will result in relatively low distribution costs, and hence better operating profits.
- ? The increase in scale, with more in force business, will almost certainly make the maintenance expense position better and improve the operating profit.
- ? The product mix will impact on the operating result. If we can achieve high sales of products which generate negligible new business strain or even a new business release, the prospect of making an operating profit will improve.
- ? Lower mortality than expected will result in profit, particularly from the term insurance business.
- ? Higher lapses than expected can lead to profits, but in the first few years of operations, this will mostly be locked up in the provision for revivals.
- ? Higher investment returns on the non-Par/non-UL business (including realizing profits on assets) will generate operating profits, although after just one year, it is unlikely that the assets are significant.
- ? A weakening of the valuation basis could also improve the profitability. However, at this early stage it is unlikely that we have enough mortality, lapse or expense experience to justify a change in basis.
- ? The Par business is unlikely to contribute to profits, but may help in the achievement of scale.

(b)

- ? Building tied distribution is a slow process, with high costs of first finding accommodation, recruiting management and then gradually appointing and training agents. Sales come even later.

- ? Most people who are prepared to work as agents are not prepared to work full-time on this – which makes it difficult to get good volumes of business.
- ? The sales managers job is quite frustrating and very few recruits will succeed, so a lot of effort is wasted on recruitment and training of sales managers.
- ? Given the capital restrictions imposed by the shareholders, aggressive growth of tied agency is unlikely to work.
- ? Tied agents are likely to be more difficult to control than the bank employees, so the risk of mis-selling is higher, and with it comes potential brand damage.
- ? Even when the channel is well established, it is unlikely to be as efficient as the bank channel, and may not lead to a contribution to overheads for several years.

(c)

- ? To assess the volume of business lost over a year, one usually looks at the proportion of business for which the 13th months' premium is not received.
- ? This can only be determined at least a year after date of entry, so for business written in 2009/10, you will only have an accurate picture just after the 2010/11 year is finished.
- ? At the end of the 2009/10 financial year, none of the policies in force have reached their first anniversary. This means that no annual premium cases have come up for renewal as yet, so they have not had an opportunity to lapse (unless the client requested cancellation).
- ? Similarly, for half-yearly cases, none of the business written in the second half of the financial year has had an opportunity to lapse yet.
- ? If most of the business written has monthly premiums, then the performance to date is more impressive, because there will have been more opportunities for non-payment of premiums. Vice versa if most of the business written is annual premium.
- ? If most of the business is written in the first half of the financial year, then the performance is more impressive, because there will have been more opportunities for non-payment of premiums.
- ? The high retention may be due to following good processes by the bank channel, although it is probably too early to draw this conclusion.

?

(d) 1)

- ? Tight definition of Critical Illness events will reduce the risk of misunderstandings, costly claims assessment and higher claims than expected.
- ? Limiting the number of critical illnesses covered will reduce claims, but may reduce the attractiveness of the product.
- ? Restricting the maximum cover amount will reduce the moral hazard slightly.
- ? Offering graded cover, depending on the severity of the critical illness will also reduce the risk of dubious claims.
- ? Providing for a review of rates for existing clients at regular intervals will reduce pricing risk, but may impact on sales.
- ? Tight new business underwriting, and declining or loading sub-standard lives will improve experience, but may make the product harder to sell.
- ? Financial underwriting to restrict cover to an appropriate multiple of salary will also help to reduce moral hazard.

- ? A pre-existing clause will help to control early claims, as will a short lien period during which claims will not be accepted – up to a year.
- ? Introduction of exclusions associated with substance abuse and dangerous activities will also help control claims.
- ? Studying the experience of competitors or in similar markets will help in setting premium rates at an appropriate level.
- ? A larger margin than usual will protect against adverse experience resulting in losses, but may impact on sales.

2)

- ? Advice on which critical illnesses should be included and suggestions on grading of cover.
- ? Definition of critical illnesses and the exclusions and conditions.
- ? Underwriting guidelines at new business and claims stage.
- ? Training of staff to handle underwriting and claims.
- ? Sharing incidence rates that they feel are appropriate to the Indian market.
- ? Underwriting of difficult cases.
- ? Carrying part of the risk through a quota share treaty.
- ? Picking up large risks through a surplus treaty.

(e)

- ? Embedded Value places no value on the future steam of new business expected in future.
- ? For a young company like ours, EV will have very little meaning, as the present value of future profits from in-force business is likely to be negligible.
- ? The Embedded Value will be very sensitive to the approach taken to expenses. If future expenses are based on current volumes of in-force policies, an unduly pessimistic result will be achieved. On the other hand if in-force is assumed to increase, it will be inconsistent with placing no value on future new business.
- ? At present there will not be enough company experience to permit lapse and mortality assumptions to be derived, so in the short term we will be relying on the industry assumptions. As experience grows we can move to more accurate assumptions, but this will result in significant basis change components.
- ? Embedded Value is likely to be replaced by Market Consistent Embedded Value within the next few years, which will also introduce further changes in the value.
- ? If the value is to be quoted externally, it will require additional conservatism being built into the assumptions, so we need to be clear on the audience.
- ? In spite of all these points it is probably worth while to start measuring the EV, even though a great deal of volatility can be expected in the next few years.
- ? A better measure of the performance of an immature insurance company is the change in embedded value from year to year, although basis changes over time may create difficulties with interpretation.

(f)

- ? The main levers for improving immediate annuity rates are:
 - a. higher assumed investment returns
 - b. higher mortality
 - c. lower explicit profit margins

Expenses probably won't make much difference.

- ? In the case of investment return assumptions, it is usually possible to achieve better returns by investing in corporate bonds. However, the higher return will come with an increase in default risk. Given that the risk is carried by the shareholders in non-Par business, only part of the reward should be given to policyholders.
 - ? Without mortality experience to justify it, a change in mortality rates will be ill advised. Reducing the mortality improvement factors will need justification, and we don't have enough studies of annuitant mortality over time to justify low improvement factors. Looking at the increasing wealth of Indians, large improvements in mortality can be expected.
 - ? Lower profit margins are fine, provided that:
 - a. the cost of capital is properly covered
 - b. default risk is covered in the interest assumption
 - c. there is no residual reinvestment risk
 - ? If MCEV is adopted, discounting of future annuity payments will probably have to be done at the risk-free rate for that duration (read off the swap curve).
 - ? This will result in a liability well in excess of the assets held, which will depress MCEV. The actual profit will only emerge as the return achieved exceeds the risk-free rate.
- (g)
- ? In annuity business in general you do not know much about the health of the annuitant. For voluntary life annuities, we assume that the annuitant is in better than average health, as he will not invest the consideration unless he expects to receive income for many years.
 - ? For compulsory purchase annuities, a rational client in poor health will always choose a "return of purchase price" annuity over a life annuity, as the capital will be returned on his death.
 - ? It is possible that some wealthy clients in good health will also chose the RPP annuity, because of tax benefits (no tax on the benefit to beneficiaries).
 - ? On balance, we can assume for pricing purposes that clients selecting RPP will be in worse health than clients selecting a life annuity, so higher mortality is appropriate.
 - ? Essentially, we can expect the capital to be returned at various durations for a particular age at entry. The matching investment for a client who we think will die in t years time is a bond with term to run of t years. For a portfolio of clients, the matching investment would be a series of bonds of different durations from 1 year upwards.
 - ? However, it is unlikely that people will die as predicted, and we may find ourselves forced to reinvest maturing bonds if clients live longer than expected, or to sell bonds before maturity if clients die sooner than expected.
 - ? If we invest in less liquid bonds to improve the yield, we need to be more wary of investing long than of investing short, because the forced sale before maturity is a riskier transaction, given that it may be hard to find a buyer at a fair price.
 - ? If we invest in highly liquid bonds with a default risk, we have a similar problem if the rating deteriorates near maturity. However, the impact of a change in market yield on price is small as term to maturity reduces.
 - ? If we invest in liquid bonds with a sovereign guarantee (e.g. GOI), we should be close to a matched position.
 - ? If we select a mixed portfolio of bonds, we can take them all to the expected duration, knowing that in the event of a forced sale, the GOI is a reasonably safe disinvestment.

- ? However, caution may make a company reluctant to invest in corporate bonds of long duration, because over time the default risk will increase. Therefore, it is better to use corporate bonds of shorter durations than expected, mixed with illiquid bonds of the expected duration and GOI's of slightly longer durations than expected.

[50]

Question 2

(a) 1)

- ? The asset share can be a fundamental tool for assessing the sustainability and equity of a bonus declaration.
 - ? To inform terminal bonus rates
 - ? Divide book into cells that, by practice, enjoy the same terminal bonus rates
 - ? For each cell, examine policies that are about to mature in coming year. Compare ratio of guaranteed benefits to asset share
 - ? Ensure that spread of ratios within each cell is acceptably narrow, so that cross-subsidies are not excessive, but are in line with PRE.
 - ? Terminal bonus rate will be set to disburse desired percentage of asset share in each cell.
- 2)
 - ? To inform supportability of proposed bonus rates
 - ? Consider target level of terminal bonus, expressed as percentage of asset share at maturity
 - ? Consider whether the target level of terminal bonus for the whole portfolio would allow sufficient scope at maturity for equitable treatment of policyholders. So even if the TB cushion for the whole portfolio appears adequate, there may be cells where it is small or even negative. This would suggest that the reversionary bonus rates are too high for these cells.
 - ? Compare this target percentage of asset shares with bonus reserve valuations
 - ? Consider past practice in relation to anticipation of future risk premiums, and whether such risk premiums in investment returns should be anticipated and distributed by reversionary bonus. Set BRV basis accordingly.
 - ? Calculate reversionary bonus rate that equates BRV to target percentage of asset shares
 - ? (.5)(4)A
 - ? Test reversionary bonus rates for resilience. If BRV is recalculated at lower interest rate, is there sufficient scope to reduce bonus rates accordingly or would capital be required to support guarantees? If the latter, what consider what charge should be made for such capital support.
 - ? Decide hypothecation of assets between participating and non-participating business, and among different pricing series of participating policies, if appropriate, having regard to PRE.
 - ? Profits from non-profit surplus emerging
 - ? which may be measured statutory or realistic bases, for the purpose of distribution to with profits policyholders as bonus, and the concomitant shareholder transfer to the 90:10 gate

- ? Expenses incurred in acquiring and maintaining with profits business need to be analysed to the level of unit costs
 - ? Company practice in allocation of expenses between estate and asset shares should be investigated
 - ? Should also consider whether past practice in this regard should be continued, in particular whether it meets PRE
 - ? Lapse, surrender and paid-up experience should be analysed
 - ? in order to estimate surplus arising from these sources
 - ? in order to distribute this surplus among continuing policyholders if in line with PRE
 - ? which may be added to asset shares as an explicit cash flow or as an adjustment to historical investment returns
 - ? Historical smoothing profits and losses to the extent these are recycled to continuing policyholders rather than to the estate
 - ? Cost of historical shareholder transfers arising from shareholders' share of surplus
 - ? to the extent it is in accordance with PRE to charge this to the asset shares
 - ? should be calculated on historical valuation bases, with cost spread over participating business at the time of transfer
 - ? Statutory reserves
 - ? To ensure that sufficient surplus exists to meet the cost of the proposed bonus.
 - ? Relationship of guaranteed benefits to asset share
 - ? for each bonus or pricing series compare cohort by cohort
 - ? to ensure equity between cohorts. For example, if the ratio of asset share to present value of guaranteed benefits varies significantly, it would indicate that the some subsets of policies are benefiting from a higher rate of accretion of guarantee than others. Any implicit cross-subsidy should be considered in declaring bonus rates.
 - ? Analysis of surplus
 - ? to assess how surpluses arising from different sources may best be distributed, in particular to assess the split between reversionary and terminal bonuses
 - ? the reconciliation of the closing surplus to the opening is also a useful check on the calculations
 - ? Past policyholder communications and bonuses declared
 - ? Ensure any changes in rates are in accordance with PRE regarding smoothing of bonus rates from one year to the next
 - ? Smoothing considerations may differ between reversionary and terminal bonus. So for example, reversionary bonus rate movements may be capped at some absolute level, whereas terminal bonus rates may be smoothed so as to prevent volatility in claim values.
 - ? Investigate competitors' bonus rates
 - ? Bonuses affect company's marketing position
 - ? Any difference in trend of bonus rates between companies should be sought to be understood.
- (b) 1)
- ? Intrinsic value may be reflected by a deterministic model
 - ? Could use a stochastic model to reflect time value of guarantees
 - ? Develop a stochastic model of asset behaviour
 - ? Run the model to generate several thousand simulations

- ? The number of simulations should be such as to reduce the sample error to a negligible amount
 - ? In each simulation, project the liabilities.
 - ? The projected bonus rates, asset allocations and asset hypothecations should all be simulation specific so as to reflect the company's intended management actions.
 - ? May also allow for dynamic policyholder behaviour so that withdrawals are related to the moneyness of the guarantee, i.e. when the guarantee appears valuable, because it is close to or in the money, one might expect higher policyholder persistency
 - ? Calculate the average shortfall. Discount at some risk discount rate. The result would be the cost of guarantees.
 - ? The choice of risk discount rate is problematic but of vital importance
 - ? May choose a discount rate based on risk free plus some risk margin. But risk margin is hard to set objectively
 - ? The management actions may be hard to predict and model, particularly in the extreme scenarios, where extreme actions may be taken.
 - ? But the cost of guarantees will be dependent largely on the extreme adverse scenarios since it is in these scenarios that the guarantees would bite
 - ? The future bonus rates in particular will depend on a projecting statutory solvency at each future time in each scenario. This will require intensive computer usage.
 - ? Future management actions may also include a charge on the asset shares in respect of cost of capital. This would require the capital requirements, possibly generated by resilience analysis, to be projected at future dates in each simulation.
 - ? A charge on the asset shares can be an inefficient action since it increases the intrinsic value of the guarantee
 - ? Given the difficulties of projecting management actions in extreme situations, those scenarios that give rise to costs should be investigated individually, so that the modeled management actions may be validated.
 - ? To render the calculations tractable, it may be necessary to work with grouped model points.
 - ? The grouping should be such as to accurately reflect in particular the moneyness, i.e. the relationship between the (discounted) guarantee and the assets held against the policy liability, and term outstanding of the policies
- 2)
- ? The statutory reserve will make a prudent assumption regarding lapses. A realistic assumption is required in this context.
 - ? The difference will result in a discount to the liability
 - ? On surrender, the SV is payable. The difference between the reserve held and the SV will result in a release of surplus since the reserve must at least equal the surrender value.
 - ? The realistic balance sheet will require an estimate of future policyholder decrements and also of the company's policy on surrender values.
 - ? The realistic balance sheet will project such releases and take their present value.
 - ? Similarly, on lapse and paid-up, the release of surplus (or deficit) as compared with the statutory liability will be projected in the realistic balance sheet.
 - ? This present value may be offset against the statutory liability
 - ? PRE in respect of the surpluses arising from policyholder decrements should also be allowed for in the balance sheet. In particular, if it is expected that these surpluses should

be distributed to continuing participating policyholders, a corresponding liability should be set up.

- ? This liability will affect the cost of guarantees since it will be added to asset shares and would also be reflected in future bonus rates.
- ? In practice, any such second order effect would be unlikely to be sufficiently material as to merit detailed modeling.

[50]

[Total Mark 100]
