Institute of Actuaries of India

May 2010 EXAMINATION

Subject ST2 — Life Insurance

Specialist Technical

MARKING SCHEDULE

1. Solution (i)

Completeness checks

- Input to the reinsurance administration systems must be complete. This may be ensured by making sure that the input in-force policies and sum assured matches with policy administration systems or the valuation data
- Because of cessions only above a specified retention limit, it is difficult to arrive at a direct check on the completeness of output of sum assured and premiums ceded. This would invariably depend on the distribution of sum assured around the retention limits
- One check would be to sample largest sum assured policies (above a certain criterion) and see these are being reinsured in the output. This would not only provide a system check, but also make sure than the organization is not exposed because of some reinsurance administration system risk

Accuracy and consistency checks

- On the sample so chosen, random checks might be applied to get a comfort around accuracy of premium rate calculations
- Additionally, a trend check can be made on Sum ceded, premium ceded and policies ceded since last exercise and broadly reconcile with the trend of new business or lapses during the period. Obviously this would mean assuming that the sum assured distribution for new policies and lapsing policies is unchanged (else it should be a cause of further investigation)
- Premium ceded divided by sum assured ceded would give an idea of re-insurer rate that should look reasonable on its own and also be consistent (increased) compared with the last exercise considering that existing policy-holders would have aged during the period.
- Assuming similar sum assured distribution, the average sum assured ceded per policy should be consistent with the last exercise

Other checks

- Sum assured for any deaths during the period should be compared against the retention limits and ultimately reconciled with accounts data to confirm re-insurer recovery

Solution (ii):

Death benefit at risk under this product is already too low and there would not be a risk arising from claims fluctuations on account of high sum assured policies and hence risk premium constant retention method might not be suitable here

The biggest risk under this new product would be the mortality parameter risk where the company does not have an experience of catering to this segment of the population. One solution could be to use a risk premium reducing retention method of reinsurance where the company can reinsure a constant percentage (say 50%) of its death benefit at risk from the first rupee thereby reducing its mortality parameter risk

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2. Solution (i):

- Mortality risk: Since there is no explicit mortality charge under the product, there will be a death strain of 5% of the value of the fund. This will increase as the fund value goes up. Additionally as age increases through duration of the contract, the cost of this death benefit would go up as well
- High entry age combined with no medical underwriting would increase the mortality risk.
- Lapse risk: With no surrender penalty, the company will make a loss on early surrenders as initial charge is not sufficient to pay for commission and initial set-up costs.
- This structure would also encourage distributors to collude with policy holders (with the distributors offering to share part of their initial commission and the policy holders surrendering early), having adverse financial consequences for the company.

- Expense mismatch risk: All expenses paid for by fund management charges. For small policies this may not be sufficient. Also, vulnerable to adverse market movements.

Solution (ii):

- To the extent that there are equities in the fund, there is a risk that the markets may fall and the fund may be insufficient to meet the guarantee.
- This risk is exacerbated by subsequent premiums acquiring historical guarantees following fall in markets
- There is a risk that interest rates rise at maturity of the policy resulting in lower bond values, if the bonds held mature later than the maturity of the policy.
- Risk that the coupons and equity dividends may need to reinvested at a lower rate in the future.

Solution (iii):

- As the company is quite risk averse, the company should at any point of time hold at least the discounted value of the guaranteed amount at maturity in bonds. The remainder can be invested in equities. This would result in a gradually increasing debt/equity ratio going up to 100% debt at maturity.
- The guaranteed amount (watermark) may itself change quite appreciably during the course of a day due to marking to market of volatile equities (and bonds). This would necessitate frequent rebalancing of investment portfolio and introduce considerable operational risk. One way to mitigate this would be to hold buffer amount of bonds over the amounts required as per the theoretical discounting as outlined above.
- The discount rate would be based on the yield on a zero coupon bond of term equal to the outstanding term of the policy.
- The term of the bonds should be chosen to coincide with the maturity of the policies to avoid the risk of interest rate rises at maturity of the policy.
- Close ended structure would help the company to effectively target remaining duration of maturity for an entire a cohort of policies
- To mitigate the risk of reinvestment, the company should restrict the bond portfolio to zero-coupon bonds. Alternatively, the discount rate used to calculate the bond proportion could be reduced for prudence to allow for reinvestment risk.

- The company could also hold 100% of the funds in bonds to minimise the risks. But this would make the proposal uncompetitive.

[10]

3. Solution (i):

- The amount of the reserves should be such as to ensure that all liabilities arising out of life insurance contracts can be met by the life insurance company.
- The amount of reserves should be calculated by a suitably prudent actuarial valuation of all future liabilities for all existing policies, including:
    - ♦ Guaranteed benefits, including guaranteed surrender values (the amount of the reserves for each policy should be at least as great as any surrender value guaranteed and therefore should not be negative)
    - ♦ Bonuses which have already been guaranteed, whether described as vested, declared or allotted
    - ♦ Options available to the policyholder
    - ♦ Non-unit reserves for unit-linked policies
    - ♦ Future bonuses of all kinds, taking into account the reasonable expectations of policyholders
    - ♦ Expenses, including commission
    - ♦ Taking credit for the premiums which are due to be paid under the terms of each policy
- A prudent valuation is not a "best estimate" valuation, i.e. neither too much nor too little, but should include an appropriate margin for adverse deviation of the relevant factors.
- The valuation should take account of the nature, term and method of valuation of the corresponding assets, depending on the type of policy.
- The use of appropriate approximations or generalizations should be allowed.
- The rate of interest used in the calculation of the reserves should be chosen prudently, taking into account the currency in which the policy is denominated, and having regard to the yields on the corresponding existing assets and to the yield which it is expected will be obtained on sums to be invested in the future.
- The elements of the statistical basis, that is the demographic and withdrawal assumptions, and the allowance for expenses used in the calculation of reserves, should be chosen prudently, having regard to the type of

insurance, the country where the insured people live, and the administrative costs and commission expected to be incurred.

- Where no explicit allowance is made for future bonuses, a rate of interest should be used which is lower than the rate chosen according to the above principle, by an appropriate amount.
- If a valuation method defines in advance the amount of expenses to be used in the valuation, the amount so defined should be not less than a prudent estimate of the relevant future expenses.
- The method of calculation of the reserves from year to year should be such as to recognize profit in an appropriate way over the duration of each policy and should not be subject to discontinuities arising from arbitrary changes to the valuation basis.

Solution (ii):

- Realistic reserves being negative towards start of a contract might simply imply that the contracts sold by the company are profitable. This is because future premiums would consist of loading towards
  - Initial expenses and commissions that have already been expensed out at start of the contract. These loadings when discounted by way of future premiums on a realistic basis would be released in the reserves
  - A profit loading in future premiums that gets capitalized when discounted towards start of a contract

Solution (iii):

- For existing business we are already aware of the liability and asset profile
- For pricing, liability and asset profile of new business yet to be written is relatively unknown
- Because of the known liability profile, demographic parameter risk (mortality and persistency) is lower for existing business when compared to new business
- Investment yield for current assets would be known with greater certainty. Although there might still be reinvestment risk basis future premiums, the risk is clearly lower due to existence of current asset base
- No initial expenses are involved in reserving basis whereas for pricing this is a key risk because of possibility of lower than expected sales

- Once a product is priced, an organization would not want to change the premium rates for some time to come. This might mean employing more prudent assumptions than current best estimates. (Although it can be argued that such variations are best taken care by the profit criterion)

[10]

4.

Solution (i):

- Poor persistency arises when customers do not see value in continuing payment of premiums – this typically arises when the selling is not need-based.
- Could be due to mis-selling. Typically, in developing economies, unit-linked policies are sold by the sales force as mutual fund products with an additional life cover. While insurance policies are actually long-term contracts, these may be mis-sold as single premium or short-term contracts (to compete with mutual funds).
- The sales force may not be adequately trained to sell unit-linked contracts.
- The commission structure of the sales force may not incentivize sales force to collect renewal premiums – this could occur if the company's products have high initial commission but very little renewal commission.
- Under unit-linked contracts, the customers take on the investment risk. If the customer segment to which these contracts are sold is not investment savvy, it is possible that the fund value would have fallen due to incorrect investment choices made, leading to resentment amongst the policyholders and withdrawal.
- The surrender penalties in the products may not be high enough to disincentivise customers from surrendering the policy.
- Unit-linked policies lend themselves to easy comparison with competition. If the company's fund performance is poorer relative to the rest of the market, this would lead to poor persistency.
- Any negative press about the company – poor financial position, shareholders' commitment, merger/acquisition rumours, high claim repudiation ratio, etc.
- Poor customer service due to poor quality of call centre, unsatisfactory query resolution, etc. would lead to lapses.

Solution (ii):

- Higher withdrawal rates reflect larger number of dissatisfied customers. Hence poor reputation in the market affecting ability to sell new business.
- Under unit-linked business, a significant proportion of the profits arise from difference between the fund management charge and the expenses incurred in servicing the policy. On withdrawal, cessation of future premiums diminishes the future fund size resulting in lower than expected future profits.
- The surrender penalty in unit-linked products is typically set such that all the initial expenses are recouped. To the extent the surrender penalty falls below the initial expenses, there would be a financial loss. Also, since the surrender value would be substantially below the fund value (particularly in early years), this would result in policyholder complaints and bad image for the company.
- On withdrawal, the companies usually reserve the right to clawback at least part of the initial commission paid to the sales force. However, this may not always be possible to implement (e.g. where the sales person is terminated) leading to a financial loss to the company.
- Since the company is in a start-up phase, lower levels of inforce book than expected would result in higher expense overrun than planned pushing back the company's break-even point. This is also likely to require capital injection from the shareholders longer/more than expected in the business plan.
- In life insurance companies, the senior management remuneration would be linked to movement in EV during the year. Higher withdrawals may result in lower inforce book and hence lower EV.
- To the extent that higher withdrawals are due to mis-selling, there is a risk of unfavourable reaction from the regulators, coupled with higher mis-selling compensation claims, associated legal expenses and reputational damage.
- Regulatory intervention might also imply imposition of minimum surrender value floors industry wide reducing the ability of the company to recoup its initial expenses. This would prevent the company from mitigating the immediate financial impact from surrenders

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5. Solution (i)

The interests of unit-holders not involved in a unit transaction should be unaffected by that transaction.

Solution (ii)

- The company is receiving requests for renewals and policy surrenders and cancellation at its sales offices.
- It would take some time for information and money to flow through and realized at its central processing centre.
- The lumping of batches further delays the processing and by the time the units are ready to be allocated/de-allocated, the current unit price (markets would have moved) would have moved from the price supposed to be applied for unit transactions as per regulations.
- To maintain the existing policyholder equity, the shareholders would have to fund the positive or negative difference between current NAV and mandated NAV and hence a shareholder gain or loss would occur

Solution (iii)

There would be a shareholder gain if stock markets were going down and the new units were to be allocated. Hence for renewal premium payments, there is a shareholder gain (loss) if stock markets were going down (up). Conversely for surrenders and cancellations, there would be a shareholder gain (loss) if stock markets were going up (down)

- Financial markets being volatile, the Board is worried about this variance in gain/loss account and a range of steps might be taken to overcome this situation
- Maintaining a management box by which the management would have buffer units in its account and hence would not be immediately forced to buy or sell units at the current NAV.
- Although there is still a risk that these units are held in shareholder account and hence exposed to movements in stock markets
- The company can think of introducing a distributed processing facility so as to reduce the number of days it takes for a request to get processed

- The company can beef up its technology systems so as to pass on the information of the receipt of policyholder requests to the centralized office where by the central office can act in time whilst the actual documents and money reaches later
- The company can provide electronic facilities for customers to pay their premiums and submit their requests on-line
- Any changes to the technology systems or decentralizing the processing facility needs to be considered in light of the costs involved
- There should be documented TATs (Turn around times) for operations staff to pass on this information. For a big organization, this is not an easy task to achieve and requires extensive training to be imparted to users

Solution (iv)

Reducing new business and surrenders by existing policyholders implies that the internally linked fund would have started contracting and the company would have become a net seller of units. If this is a short term phenomenon, the company might choose to leave the basis unchanged or fund the difference through the shareholder account. Else, there would be a need to convert to an expropriation basis.

In this basis, the company needs to value the underlying assets on a bid basis (i.e. the proceeds to be received from the sales of assets) rather than an offer basis
Additionally, the dealing costs or transaction cost now needs to be deducted rather than added to arrive at unit price

[12]

6. Solution (i)

- The company will have made a loss on early withdrawals where the asset share would have been negative, often substantially so. So the company feels justified in recouping some of these withdrawal losses by making profits from later withdrawals.
- There will be a significant selective withdrawal effect. The retained asset share can then go towards meeting the increased costs due to the higher average mortality of the remaining insured lives.

- Asset shares are never very large on a term assurance contract, and payment of very small surrender values would not justify the cost of administering them.
- Term assurance asset shares will tend to be quite volatile (fluctuating with claims experience each year), making any fair scale of surrender values equally volatile. This could seriously upset policyholders.
- Even at later durations asset shares are not always positive – eg where the policy is loss-making.

Solution (ii)

- The premium rate would go up as a result of offering this option and hence the asset share is likely to turn positive sooner
- Selective withdrawal impact would be reduced as the remaining policyholders would have a good mix of lives with better and poorer than average mortality. This would be because certain policyholders (with poorer mortality) would continue in the plan to avail their death benefit and other policyholders (with better mortality) would continue to enjoy risk coverage and prospect of getting their money back at the end.
- Asset share would increase religiously with duration to be able to pay off the maturity benefit at the end. The amounts would also be meaningful because of higher premium rates and the need to pay off an 'endowment' at the end. For policyholders deciding to surrender their contracts before expiry, it seems fair to pay a surrender value.

Solution (iii)

Risk and factors to consider

- The terms and conditions for the exercise of the option should be designed to prevent "selection against the office", ie an excess of lives in poor health using the options to obtain large amounts of life assurance at premium rates that do not reflect their expected mortality.
- The total expected additional costs of an option depend on the health status of those who choose to exercise the option, and the proportion of lives who choose to exercise the option.
- In general, the smaller the proportions who exercise the option, the worse will be the subsequent mortality experience of those exercising the

option. If a substantial proportion exercise the option, then their subsequent mortality experience will on average be less extreme.

- So the cost of a mortality option is (roughly speaking) the product of proportion of lives exercising option X average health of lives exercising option
- If the option involves a steep increase in premiums, then the healthier lives might shop around to try to get the same cover cheaper elsewhere. This means that the company will lose out on the potential profit that these policyholders would have generated. Additionally the withdrawal by healthy lives before the option date reduces the income (extra option premiums) that we would have expected to receive from the whole risk pool. This loss of income therefore constitutes a significant risk in the management of option costs.
- Any weaknesses in original U/W might get compounded after exercise of this option
- The longer the term, the longer the policyholder will have the option, and the more likely it is that, at some time, his or her health will make the option appear worthwhile.
- Term insurance has the highest SAR and policyholders have the greatest incentive to anti-select. Hence renewal option would be more onerous as compared to conversion to an endowment plan
- If the option involves a steep increase in premiums, then the healthier lives might shop around to try to get the same cover cheaper elsewhere. This means that the company will lose out on the potential profit that these policyholders would have generated. Additionally the withdrawal by healthy lives before the option date reduces the income (extra option premiums) that we would have expected to receive from the whole risk pool. This loss of income therefore constitutes a significant risk in the management of option costs.
- A general risk of premium rates increasing to a level that the product is uncompetitive and sales not being able to cover development costs

Possible mitigants

- Restrict the number of times the policyholder gets the chance to exercise the option, eg every five years, or on every policy anniversary
- The company can also restrict the window of exercise of the option to say 5 years before maturity

- Restricting the choice of contracts available under the option or reduce the sum at risk available under the new contract.
- The encouragement given to policyholders to exercise the option. If take up of the option is low it tends to be only those who have most to gain who exercise the option. On the other hand, encouraging more of the healthy lives to exercise the option will not cause any additional expected loss, and should contribute to the company's total profit as the company will essentially be issuing lots of new policies to lots of good risks, which should be a profitable proposition.
- Publicising the option more widely can achieve greater take up by healthy lives, but care should be taken that the benefit (from future profits) is not outweighed by the risk of attracting a bigger proportion of the loss-making high risk lives from taking up the option as well.
- Take up by healthy lives can also be encourage by waiving off policy fee on renewal

Solution (iv)

- The sales volumes through this new channel would be uncertain and lower than expected sales might creating an expense risk especially recouping of development and marketing costs
- The prices on offer might be too low and could encourage lapse of term policies sold a recently and a re-entry into this product.
- There might be dissatisfaction amongst existing policyholders who have bought term policies a few years ago. One solution could be to offer conversion to this plan to all policyholders although at the cost of losing initial commission loadings on the existing plans
- Prospective policyholders might themselves or through independent intermediaries look for the best bargains and hence the product might attract most discerning of consumers. This could make the lapse assumption risk important especially when one considers that lower lapses at longer duration would lower the profitability because pure term products are naturally lapse supportive
- For the reasons as mentioned above, the underwriting needs to be stronger than otherwise to control mortality risk

- Competition would invariably catch up in future if this turns out to be a success. This could trigger a price war
- Bypassing the agents might upset the distribution force and may lead to agent attrition. Company would need to manage the expectations carefully

[17]

7. Solution (i)

- Appraisal value is the sum of the embedded value and the value of future new business, also called "goodwill".
- Embedded value, in turn, is the sum of the present value of the inforce book (PVIF) and the net assets of the company.
- Net assets of the company will be based on the figures shown in the balance sheet of the company
- PVIF of the existing business would need to be calculated separately for the two lines of business (UL and Term Assurance)
- The data for calculating PVIF could be either the policy level data or a appropriate set of model points.
- A set of assumptions need to be determined on a realistic basis for future investment returns, initial/maintenance expenses, mortality, withdrawals and tax. A risk discount rate that reflects the shareholder's required rate of return needs to be determined.
- Assumptions should be based on an analysis of the company's own experience adjusted suitably for known future variations. However, since the company's experience is not mature, may need to rely on external consultant's advice and/or industry-wide data.
- Since the appraisal value is prepared to arrive at a sale price, the assumptions would be without any margins for prudence

- Net cashflows are projected till maturity and discounted back at RDR to arrive at the PVIF.
- To calculate the "goodwill", need to project future sales volumes separately for different channels and products.
- This would be based on company's signed business plan, which in turn should be based on expected industry growth in this market
- Value of future new business could be determined using cashflow projections as for PVIF calculations
- Alternatively, a simple multiple of the value of last 12 month's new business could be used
- Since it is still young, the company is likely to have an expense overrun and the appraisal value should be reduced to allow for this.

Solution (ii)

- Since the company is only three years old, the "goodwill" element is likely to be a significant item of the appraisal value.
- The bank would need to ensure that the future sales volumes are realistic taking account of the expected industry growth and the capabilities of the direct sales force and other distribution partners
- The assumptions underlying the calculations of the sale value are likely to be aggressive with no margins.
- The bank would particularly look at the margins included in RDR since the company is quite young. The bank may also look to use a higher RDR for future new business to reflect the additional uncertainty.
- The assumptions underlying the future expense overrun would have a significant impact on the appraisal value – in particular, the bank would need to check if the projected operating expenses are reasonable

- Need to check if due allowance is made for worsening profit margins in future from increased competition and adverse regulations
- Whether appropriate allowance is made for tax and other liabilities, e.g. misselling compensation.

Solution (iii):

- Distributor vs a shareholder – impact on financials. Being a distributor would improve bank's P&L through commission earnings without taking on any risk associated with owning an insurance arm. Being a shareholder, on the other hand, may weaken the company's P&L through capital outgo to fund the NB strain (since the company is young and is unlikely to have broken even) but could potentially improve the assets through EV.
- What's the goodwill multiple implied in the appraisal value and how does it compare to other similar transactions in the market
- Reputation/brand of the JV in the market
- Strength and reputation of the foreign partner
- Management control – what level of control would the bank have in the JV
- Products of the company – can the bank be able to sell those products and any potential conflict of interest with the bank's own products
- Risks with the existing products – guarantees, options
- Systems and processes
- Any litigation/fines?
- Cross-sale opportunities to sell bank products to insurance customers
- Cultural fit; employee engagement/satisfaction

- If the company has branches in places where bank also has its own branches, there would be some scope for synergies
- Are there any other buying opportunities available or likely to come up shortly?
- Why is the shareholder selling the company?
- Cost/benefits of purchasing a company compared to starting their own
- How to fund the purchase?

Solution (iv):

- UL: For UL business, difference between the FMC and the expenses is the most significant contributor to future profits.
- With the drop in the earned rate, the future FMC would be lower while the expenses would remain unchanged. This would reduce the projected future profits arising from this line of business.
- However, the RDR drops by a greater percentage point, which would increase the PV of future profits.
- In short, since the gap between the projected earned rate and RDR has decreased from 6% to 0%, the PV of UL business could increase substantially
- Term Assurance: For a term assurance business, mortality profits are the single most contributor to future profits
- The fall in the earned rate makes no material change to the future profits
- While the fall in the RDR of 9% would have a substantial positive impact of the PV of future profits from this business

[24]
[Total Marks 100]

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