Institute of Actuaries of India

Subject CA1-II – Actuarial Risk Management

November 2012 Examinations

INDICATIVE SOLUTIONS

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.

Ans. 1) Terms for commutation

The option cost would be impacted by expected take up rate. The option will be popular (especially since there are tax advantages) unless terms offered are particularly poor.

A lump sum non-taxable benefit will be attractive to different sections of pensioners and take up rate would be impacted by-

- those in ill health would benefit from choosing to commute as much as possible of their pension.
- Since the lump sum benefit is not taxable this option will be attractive to members who are in high tax bracket
- those who are financially sophisticated and would like to use the lump sum to make better returns in another investment ,
- in general perceptions about future economic conditions

When finalizing the terms scheme has to ensure that-

- The option terms are *actuarially neutral* on a given set of assumptions, i.e. the actuary would need to set up an equation of value equating the two forms of benefit (pension and lump sum and pension only option).
    - Some items of the basis may be problematic to decide, *eg* the allowance to make for discretionary increases if the scheme has a history/provision for making discretionary increases.
    - The actuary needs to consider what type of basis to use, *eg* a basis stable over time, or a market-related basis.

- Whether the scheme sponsor wants to discourage or encourage take up of option the terms offered could reflect this.
- For example, the sponsor may wish to encourage commutation, since it reduces part of the open-ended liability of the scheme, and so transfers the risk of future adverse experience from the scheme to the member.
- Allowance should be made for the additional costs of administering the option, especially as the tax free benefit could make it attractive to cross-section of pensioners
- Administrative simplicity is an issue, for example, might use a table of smoothed commutation factors rather than strict actuarial neutrality for each individual case
- Unless there are regulatory requirements to the contrary, it would be sensible to vary the terms for commutation at least by age and by sex.
- Also, ease of communication to the members is an issue
- It may be necessary to set different terms for different categories of member. In particular, those retiring due to ill health may be allowed to commute a larger proportion of their pension for cash, subject to maximum allowed under regulation.
- Regulation may impact on the terms, for example:
    - prescribed terms or basis for calculation
    - requirement for unisex terms

- limits on amounts that can be commuted for various contingencies.

- The scheme rules may require certain terms to be applied or there may be existing industry custom and practice or competitive pressures, which influence the terms.
- Method adopted for calculating commutation factors should not be too complex so that on going review becomes expensive to do

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Ans 2) (i) factors for individual investment strategy

The main factors to be considered by an individual investor are:

- the nature of his assets and liabilities
- his cash flow requirements
- variability of market values of assets
- returns from different asset classes
- investment freedom and constraints
- practical considerations

(ii) information to be sought

Information may be sought on the following aspects when preparing an individual investment advice:

- Family information –
  - ✓ number of dependents and hence future liability
  - ✓ provision made towards house purchase, re-payment of home loans/ vehicle loans etc, children's education, marriage, long-term health care etc[1, if at least 2 are stated]
- Details of existing assets and income
  - ✓ Main source of income – from employment, property, business etc
  - ✓ Details of any fixed assets (like car, house)
  - ✓ Details of any expected future income flow- awards from Employer, bonuses, inheritance etc.
- Current investments details
  - ✓ How tax efficient are the current investments – will help in suggesting appropriate tax-efficient investments
  - ✓ Levels of diversification – if not sufficiently diversified then the proposal could suggest appropriate spreading of savings between different savings instruments, savings vehicles and asset classes
- current employment
  - ✓ this will provide information on the pattern of income – is the employment such that it is expected to produce an income stream that increases with age and experience (eg chartered accountant) or such that it produces an income stream that decreases with age (ag a movie star)

  - ✓ superannuation benefits – if there is a pension arrangement (whether this is defined benefit or defined contribution) – if these are not adequate funds may need to be set aside to build up an adequate level of pension protection
- patterns of savings –
  - ✓ eg is there a regular excess of income over expenditure?
  - ✓ If this is insufficient then it may be appropriate to hold more money in liquid funds
- What insurance cover does he/ she have – appropriate insurance cover would help in providing financial protection in the event of death/ disability, loss of property etc

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Ans. 3) (i) Overall security

The overall security of benefits is related to all of the factors that affect the uncertainty of benefits, contributions and investment returns.
The security is affected to the extent that a need for extra contributions, for whatever reason, is not met immediately.
If any of the risks do materialize, then the security of members' benefits can be preserved provided that additional contributions are available.
This assumes that the contributions required are correctly assessed. There are risks involved in the calculation of those contributions.
There may also be risks to overall security that result from errors in determining the contribution / premium requirements.
Such errors may be a result of:

- the use of an unsuitable model
- the use of unsuitable parameters
- errors in any data used to determine parameters for the models
- errors in the data relating to the beneficiaries.

(ii) Sponsor covenant

The ability and the willingness of the sponsor to pay sufficient contributions to meet benefits as they fall due are known as "sponsor covenant".
This is the strength of the promise by the sponsor or provider.
It is a source of credit risk but very difficult to measure.

(iii) Introduction of disclosure regulation

- Issuing sufficient and relevant information would allow members to judge whether the Scheme was being run on a sound financial basis
- and in accordance with the trust deed and scheme rules
- and that robust administrative procedures were in place
- It may provide an early warning system to alert members to potential problems

- Members may then put pressure on the scheme sponsors, trustees or regulators to ensure that any problems are quickly rectified
- Alternatively members may choose to take a transfer value of accrued benefits if they feel that the security is inadequate

(iv) other methods to enhance security

- Require advance funding with regular solvency checks
- Insurance to guard against insolvency
- Separation of assets from sponsors' other assets
- Restrictions on types of assets held
- Trustee control of funds
- Member appointed trustees
- Authorization of individuals connected with the Pension Scheme e.g. investment managers, scheme actuary etc.
- Prescribed prudent valuation basis
- Independent trustee

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Ans.4 (i) Reasons for underwriting

The main reason of underwriting credit business (insurance cover different types of loans) is to ensure adequate risk classification i.e, lives are split into homogenous groups of-

- Uninsurable, i.e lives whose health are so seriously impaired that they would have to be declined
- Acceptable on normal terms
- Subject to special terms, i.e. to identify lives with a substandard health risk for whom special terms would need to be quoted
- Ensuring adequate classification will enable to company to charge appropriate premiums and will help prevent the risk to the company that a client selects against it (i.e. counteract anti-selection).
- The risk of anti-selection is more in term contracts which require a modest outlay for large covers.
- Financial underwriting can help avoid over-insurance. In a credit life policy, it is sometimes possible that borrowing could be substantially high compared to earning capacity of customer. Hence in such cases, either cover could be restricted or declined.
- Mortality is a critical component in pricing term contracts and the most significant contributor to overall profits.
- Underwriting enables the company to ensure mortality experienced is no worse than mortality assumed in pricing.
- Reinsurance terms available will be better than for non-underwritten business-
- if business is heavily reinsured then attractive reinsurance premium rates will also result in attractive direct premium rates to customer and hence make product more competitive.
- To enable a life insurance company to calculate the special terms a proposal should be offered if not acceptable at ordinary rates.

(ii) Options available in case higher mortality rates

The options available to a company if the underwriting process finds a client to have a higher level of risk than assumed by the company in pricing are as follows:

- Charge an additional premium for the additional risk.
- It may charge an additional premium for a limited period of time if the risk is of temporary nature.ie, people who have recently suffered from some disease and risk of relapse is higher.
- Reduce the level of life cover available for the premium payable, or impose a debt which could reduce over time
- Impose an exclusion clause, which excludes payment of the benefits that arise from a specific cause
- It could decline the application. There may be legal or regulatory constraints on declining an application or imposing special terms.
- It could defer the applications (usually only used where the illness may be of a temporary nature)
- It could offer an alternative contract where the mortality risk is lower or a shorter term contract may be offered.
- It could ignore the extra risk and offer the contract on normal terms.
- If a reinsurance company is prepared to accept the client on normal terms then the company may reinsure the proposal. (Note this is not a way of accepting substandard life risks on normal terms. It may however be useful in a situation where the direct office has very little experience or exposure to a particular risk.)

(iii) By its nature, credit life insurance requires high volumes to become profitable. The products should therefore be simple to sell and administer.

One way to make the product easy to sell is to make the underwriting process simpler.

- One of the objectives of underwriting is to reduce anti-selection risk. Since the insurance cover is only to the extent of the outstanding loan (decreasing term assurance (DTA)) insurance may be seen as only a secondary consideration the primary objective being obtaining a loan from the bank.

- For many types of loan the degree of financial scrutiny / underwriting done by the bank is often thorough enough for the insurer to afford to reduce the degree of financial underwriting for the DTA.
- The level of underwriting could also be made dependent on whether the cover is optional or compulsory for a group.
- If the cover is compulsory, the risk of anti-selection is reduced and the insurer can make the underwriting process simple

- One way to make the underwriting less cumbersome from a customer's perspective is to increase the Non-Medical limits as compared with that offered on an individual basis.
- The non-medical limits can be fixed based on the type of loans (highest for home loans, lower for other type of loans such as vehicle loans, educational loans etc). For each loan category a separate underwriting grid may be proposed
- For example, covers upto a certain level of mortgage may be obtained on the basis of a simple declaration of good health, beyond which underwriting may be on the basis of the normal long-medical questionnaire.
- The medical underwriting may be simplified to an extent, where insurer may need to call for detailed medical underwriting only for large mortgages or at older ages .
- To avoid poor lives the insurer may impose a waiting period of (say) 45 days during which only accidental deaths are covered – if such an approach is permitted by Regulations
- The insurance company could apply a 1-year suicide clause to prevent anti-selection.

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Ans. 5) (i) Reasons for investing in property

A life insurance company may look to property investment for the following reasons:

- To achieve greater diversification in its asset portfolio
- Property investments provide long-term real returns
- The expected returns may be higher than on index-linked government bonds though riskier as well
- Depending on the size of the company it may have sufficient free assets to be able to invest in a diverse range of assets
- Regulations may require insurance companies to invest a certain proportion in property
- There may be undervalued property currently available that is expected to provide long-term returns in excess of other asset classes
- Competitors may follow a similar investment strategy

(ii)

- Both investments offer potentially high returns with a degree of inflation protection over the long term.
- Such "real investments" are a good match for a life insurance company's real liabilities like inflation linked policy benefits and expenses
- Freeholds considered more attractive due to their– not suffering from eventual loss of capital value.
- However, leasehold is likely to offer a higher rental yield to compensate for the same
- If the leaseholds are very long term (eg 99 years or more) then there may be little difference in the investment and risk characteristics compared with freehold investments.

- Leasehold investments offer higher income and may be suitable in situations when insurance is looking for higher cash inflow.

- short leaseholds may be purchased as an alternative to fixed-interest investment.

- Leasehold investments are available in smaller units than freehold investments – eg., lease holds in one floor of an office complex

- It is possible to build a portfolio of diverse leaseholds (say an office complex, residential complex etc.) with a smaller outlay in lease hold than in free holds.

- It is also possible to build leaseholds of short and long tenure whereas freeholds are generally very long term investments

iii)

Factors to consider-

1. Choose the investment which provides-
    - Higher return after tax with a lower risk profile
    - Matches the nature and term of liabilities
    - Is in line with risk appetite of his shareholders in interest of policyholders and compliant with regulations

Option 1- Unsecured loan-

- offers a known but unsecured stream of cash flow
- potential of high return due to high risk
  The level of riskiness will depend on-
- Credit worthiness of the property developer- can the developer service and repay the debt when due?
- How strong is the balance sheet of the property developer, what are other types of debt in its books, how high is the debt to equity ratio
- Are future project projections and assumptions realistic and whether the projection been independently evaluated
- Has the property developer received advance interest/booking into the project already from interested buyers
- How does return on the loan compare with similar risky investments in the market
- What is the level of outlay and does insurance company have adequate cash to advance the loan
- What will be the % total exposure to the sector, company or group post this investment. Will it reduce diversity in the portfolio

Option 2-

- It is an investment where income is deferred and is earned only post completion of project when –
    - Post completion, the apartments can be sub-leased for rental incomes . Or
    - Can be used to house senior staff and offered as a perk which means savings in expenses
- The rental income/savings in expenses is as yet unknown and return from this investment is dependent on
    - How prime is the residential property
    - What is the expected rate of occupancy once project is completed – is it easy to find tenants or is it an attractive accommodation for staff
    - Expenses would need to be incurred based on whether it a *full repairing and insuring lease or otherwise.*
    - Ability and frequency of rent reviews and the time to the next review
        - nature of rent reviews (eg upward only)
        - probability of voids
    - dealing and maintenance expenses of managing the leasehold investments
- It is a property investment and if the company has no such investments in its portfolio offers a new avenue for diversification
- There is also risk associated whether project will be completed on time and will it up to standards

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Ans 6 (i) Swap to manage risk

- A swap is a contract between 2 parties under which they agree to exchange a series of payments according to a pre-arranged formula.
- Interest-rate swaps and currency swaps are the most common types of swap contracts in financial markers used by organizations to manage financial risks in their books
- Swaps are also used in insurance markets with insurance companies swapping packages and it is also a type of ART contract
- Financial institutions can use a swap arrangement to improve risk diversification.
- Organisations with matching, but negatively correlated risks can swap packages of risk so that each organization has a greater risk diversification, ie swaps can be set up between organizations with opposite risks.
- If organizations can’t find negatively correlated risks to swap, then swapping uncorrelated risks would provide some risk diversification.

(ii) (a) Example of a swap of uncorrelated risks

A reinsurer with exposure to Japanese earthquakes may swap some of this risk with a reinsurer with exposure to hurricanes in Florida.

(ii) (b) Example of a swap of negatively correlated risks

Energy companies dislike warm weather as consumers use less of their product. Conversely, household insurers dislike cold weather as it leads to insurance claims. The two organizations can however, swap their risks.

(iii) (a) methods of valuing swap

Swaps can be valued by discounting the two component cash flows. At inception the value (at market rate of interest) of a swap to both parties will be zero, ignoring the market maker's profit and expenses.

As market interest rate changes (or exchange rates, in case of currency swaps) the value of the two cash flows will alter, leading to a positive net value for one party and a negative net value to the other. Even if rates don't differ from what was expected, the value of a swap is likely to be positive for parts of its term and negative for others.

Method 1: The discount factors, and estimates of short-term rates for the floating side of the swap, are extracted from the appropriate yield curve. This is equivalent to viewing a swap as a combination of bonds.

For example, ignoring the risk if default, a party which has swapped dollar payments for sterling receipts is in an equivalent position to being long a sterling bond and short a dollar bond of the same maturity.

Method 2: An alternative way of viewing a swap contract is as a series of forward agreements. If each of these forward agreements can be valued, then so can the swap.

(iii) (b) loss to the financial institution

(iii) (b) loss to the financial institution

- At the end of year 3 the financial institution was due to receive INR 1,100,000 (=0.5 X 11% of INR 20 million) and pay INR 1,000,000 (= 0.5 X 10% of INR 20 million).
- The immediate loss is therefore INR 100,000.
- To value the remaining swap we assume that forward rates are realized.
- All forward rates are 9% per annum.
- The remaining cash flows are therefore valued on the assumption that the floating payment is 0.5 X 0.09 X 20,000,000 = INR 900,000 and

- The net payment that would be received is 1,100,000 – 850,000 = INR 200,000.
- The total cost of default is therefore the cost of foregoing the following cash flows:
  Year 3 : INR 100,000
  Year 3.5: INR 200,000
  Year 4: INR 200,000
  Year 4.5: INR 200,000
  Year 5: INR 200,000
- Discounting these cash flows to year 3 @ 4.5% per six months we obtain the cost of default as INR 817,505 (approx INR 800,000).

[14]

Ans. 7) Proposed product design

The first aspect is to define the event that would trigger the claim payment. **Definition of unemployment may be defined as under:**

- The benefit trigger unemployment must be unequivocally defined and confine the cover to involuntary unemployment.
- The definition must be analogous to the following wording: "An insured is unemployed if he or she is without gainful employment through no fault of the insured's own, which includes that it happens involuntary and not through misbehavior."

Keep Eligibility conditions as strict as possible:

- Stipulate a minimum duration of service: At inception date of the policy-
  - insurance cover or at incidence of unemployment, the insured must have been in full-time employment for at least 12 months. Full-time employment means an employment of at least 40 working hours a week
- No self-employed person should be provided this cover
- Restrict age at entry 20 – 55
- The insured must have been a permanent resident of the country in which the insurance policy is issued for at least 6 months
- The insured has to be registered at the Employment Office and has to eligible to obtain state unemployment benefits, if such benefits are provided in the country

Stipulate a maximum term of contract:

CONTRACT TERM: The maximum term of the job-loss benefit may be limited by the minimum of the policyholder's

• Term of the underlying (loan) cover (if this is issued alongside a mortgage product)
• Attained age of insured 65 years
• Retirement age

BENEFIT PAYABLE:

The benefit should neither be too attractive for insured to become less serious of getting employment nor too low for the product to be unattractive product proposition
Limit the maximum benefit to the minimum of (for example)
• 100% of monthly benefit payments on outstanding loan at inception
• 80% of insured's monthly after tax income from declared sources

INCLUDE Initial exclusion / qualifying period
This period is the time after inception of the insurance contract (acceptance of the application by the ceding company) and the earliest possible eligibility for insurance benefits:
The initial exclusion period could be equal the max (insured's period of dismissal notice; one month).

IMPOSE A Waiting period

This period is the time the insured has to wait until he or she is eligible for benefit payments after his or her dismissal, to ensure there is adequate incentive to try for a job before claiming benefit.
The minimum waiting period of say, 2month could be applied.

OTHER EXCLUSIONS
- Unemployment caused by the natural end of a fixed-term contract or retirement
- Unemployment caused by misconduct, fraud, dishonesty or any act the insured carried out (criminal activity), alcohol or drug abuse, self-mutilation
- Maternity, parental leave, interruptions of seasonal work, civil or military or any other temporary service
- Active and passive war risk, riots, civil commotion, strike
- Insured knew about imminent dismissal at application for an unemployment cover or within the initial exclusion period
- Unemployment results from an employment with husband or wife or relative in direct line or with a company controlled by husband or wife or relative in direct line.

Premium Reviewability
No guarantees should be offered on the premium rates (since this is the first time that such a product is being considered) at least not for a long period(guarantee could be for 1-2 years utmost) .

The experience on Job-loss products can be very unpredictable. Hence, It may be important to include a premium adjustment clause in the contract that would allow the insurer to review rates once the claims ratio on a policy exceeds, say 120%.

[15]

Ans 8. (i)

Rating factors for pricing-

:

- location of policyholder (eg postal code)
- use of car -business, leisure or sporting activities
- make and model of vehicle
- Sex of the main driver
- Age of main driver
- number of years driving license held
- where the car is parked overnight – in a garage, on the roadside
- security devices installed in the car
- Past claims history say for last 3 years
- whether or not the main driver has any driving convictions
- the extent of any modification to the engine or body

(ii)

- The company expects savings in claims costs and claim and administration expenses by ensuring cars are always repaired in company approved garages.
- Savings in claims costs due to –
    - Claims costs less likely to be inflated
    - Less chances of fraudulent claim due to reduced risk of collusion between garage owners and policyholders
    - Quick turn around time on repairs – so if, policy terms provide replacement vehicle during time when car is in garage, faster TAT would ensure savings in claim costs
    - Quality of work – reduced chance of going for repeat complaints
    - Can expect only genuine replacement parts will be used and hence reduced chances of subsequent claims
    - Can bargain with garage owners on competitive repair costs due to expected volumes.
- Savings in expenses
    - Use of approved garage owners- company can reduce use of surveyors/loss assessors when determining extent of damage
    - A stream lined process for claim intimation, assessment and reporting can be set up which will lead to savings in claim management costs
    - An agreement can be arrived with garage owners on time lines for claim estimation and reporting. This will reduce efforts required to wards setting up claim estimates
    - Garage might provide facilities like towing of damaged vehicle at limited additional costs, which could result in cost savings
    - Can set up system of paying direct payment to garage owners (cash less service to customers) which reduce claims management costs

(iii)

- Unearned premium reserve
- Additional unexpired risk reserve
- Provisions relating to reported but not settled claims
- Incurred but not reported
- Incurred but not enough reported reserve
- Claim equalization reserve
- Catastrophe reserve
- A claims handling expense reserve
- Reserves for re-opened claims

Ans 8 iv)

Loss ratios could have worsened due to

Change in company's internal policies/premiums charged

- Due to fall in premium per unit exposure during the last few years. This could be due to company charging less premium per unit to be competitive in the market
- The company's premium in high risk segments are attractive compared to market and hence there is anti-selection happening
- Due to change in underwriting policy- more lenient than before, leading to poorer selection and pricing of risks
- Balance of portfolio has changed during the investigation period- for eg., portfolio has a greater share of a specific segment (more younger drivers than before) which are known to have comparatively high loss ratios
- Claims settlement/underwriting standards have changed for eg., more lenient than before, less scrutiny than before

Loss ratios can deteriorate due to increase in claim frequency or claim severity which can be due to-

Change in law leading to increase in claim frequency/severity

- Change in general laws – no longer mandatory to wear seat-belts hence impact of accidents higher than before –claim severity/claim frequency
- Courts have increased awards at a rate much higher than expected in premiums-claim severity
- There is increase in period of limitation I,e, earlier third party claims had to be intimated before expiry of a definite period. Now either the period has been increased or made unlimited- claim frequency
- The laws have laid down new norms for minimum compensation, which were not there before- claim severity

Change in consumer behaviors

- Greater awareness of their rights and hence increase in claims frequency

- More litigious than before leading to more court cases and higher amounts of claims- claim severity
- More fraudulent claims than before and going undetected

Corrective measures-

Before any action is taken it is necessary to analyse reasons for increase in loss ratio and take corrective action-

- Improve selection of new risks at issuance
- If premiums are low compared to market increase premium per unit exposure but this will impact new business and renewals
- Increase premiums for selective segments which are the main reason for increased loss ratio
- Change distribution focus to more profitable segments – by changing reward programs
- Educate customers on risk management practices- wearing seat belts, speed limits etc.
- If changing customer behaviors is impacting claim severity adversely and is expected to be permanent then premiums have to be increased
- Improve claims management practices – more scrutiny of claims than before to establish genuineness of claims
- Increase/Introduce claim deductibles/excess to reduce small claims

[17]

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