Institute of Actuaries of India

Subject CA1-I – Actuarial Risk Management

October 2015 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.

Solution 1:

- Strategic risk – the risk that the strategic benchmark does not match or performs badly relative to the value of the fund's liabilities
- Active risk – the risk taken by the individual investment managers relative to the given benchmarks or the risk that the assets the manager chooses performs poorly relative to the benchmark given to them
- Structural risk – where the aggregate of the individual investment manager benchmarks does not equal the total benchmark for the fund.

[3 Marks]

Solution 2:

i) The possible reasons could be

- Management underfunding the scheme; could be a deliberate attempt due to liquidity issue or even solvency; untimely funding when investment opportunities were insufficient.
- Experience worse than assumptions made in prior valuation such as Invest return, Salary escalation, new entrants Retirement rates, Pre and post retirement mortality rates, benefit escalation, promotion rates, withdrawal, over optimistic assumptions etc.
- Possible Error in the calculation of value of benefits / Modelling error in prior valuation/ Data error in calculations
- Change in the method of calculating assets – book value or market value
- Change in the method of calculating liabilities – traditional discounting method using return on assets or market consistent risk free rate
- There may have been changes in scheme rules/regulatory changes which have increased liability
- Inappropriate investment strategy **[3]**

ii) Deficit can be corrected by:

- An immediate lump sum contribution
- Regular contribution paid to the fund for several years to eliminate
- A reduction in the benefits payable (subject to employee acceptance, legal and regulatory constraints) **[2]**

[5 Marks]

Solution 3:

i) Assets can be valued using the following methods:

- (historical) book value
- written up or written down book value
- market value
- smoothed market value
- fair value
- discounted cashflow

- stochastic modelling
- arbitrage value. **[2]**

ii) Advantages:

- objective
- realisable value on sale (assuming the bid price is used)
- easy – doesn't require calculation
- well understood and accepted
- can be used as a comparison to other valuation methods to see whether an assetseems over or under-priced

Disadvantages:

- may not be readily obtainable (eg unquoted instruments)
- may fluctuate greatly over the short term
- may not reflect value of future proceeds
- bid / offer prices – which to use?
- difficult to ensure consistency of basis with that of the liability valuation
- value reflects the position of the marginal investor rather than your own position(eg taxation)
- may not be the realisable value on sale (eg if dealing with a large volume or anilliquid stock)
- difficult to compare year on year

[4]

iii) Investor expects a higher return from equities than from government bonds to compensate for the:

1) risk that dividends will be reduced or even not be paid
2) risk of losing all of the capital if the company is wound up
3) uncertainty of return and the volatility of the share price
4) lower marketability and higher dealing costs

[2]

[8 Marks]

Solution 4:

i) Mortality risk

- In case of assurance policies, insurer faces a risk that more policyholders die than expected during the term, in particular early deaths where the benefit may far exceed the premiums paid to date leading to a financial loss.

- In case of annuity policies, there is a risk that policyholders live longer than expected leading to more payouts than anticipated again leading to a financial loss.

In the above sentence, expected means – expected as per pricing basis or best estimate basis

[2]

ii) For Annuity holder:

- If annuity holder dies early during the term of the annuity, even before the lump-sum is recovered by way of annuity, then it would result into financial loss as there is no payment towards death.
- Since annuity is fixed, annuity holder is not protected against inflation.
- ………. Hence annuity may be insufficient to meet the needs of annuity holder
- Since the lump sum amount is locked with the insurer, then annuity holder may lose if interest rates rise as he/she would not have the option to take the amount and reinvest at better terms.
- Risk of insurer defaulting on annuity payments
- Poor customer service

For Insurance Company:

- If interest rates fall, then the insurer would be forced to pay the level of annuity committed for at the beginning. If matching fixed interest securities mature, then the risk of reinvestment at lower rates may arise. In such a scenario, insurer has to bear the loss of difference of income and annuity payable.

- In a rising interest rate environment there is risk of loss to reputation as policyholders see poor value for money and no chances of exit
- If annuity holder lives longer than expected then the annuity outgo would be higher than expected(as payouts are for longer period than expected). Any forced earlier disinvestment due to higher than expected outgo could also lead to a loss.
- Further, the company has to bear any loss in the portfolio due to difference between actual and expected parameters such as interest, mortality, expenses etc.
- Capital requirement for guaranteed annuity products could be higher than other products such as that of unit linked or participating business. Hence capital could be tied for long durations with limited rewards as annuity market is fairly competitive
- Anti selection by annuity holders
- Cost of servicing higher than anticipated (expenses etc)

[5]

[7 Marks]

Solution 5:

i) The suitability of the asset class and its mix will depend on the term chosen for the policy (planned retirement date) and the required form of benefit (annuity / cash / house).

- **Cash on deposit**: if the investor is close to retirement; cash provides a safe investment but returns are likely to be low

- **The money markets**: individual is unlikely to have access to invest in money markets and the term is too short;
- **Government bonds**: safe investment with return greater than cash and suitable terms available;
- **Corporate bonds**: less safe investment with return greater than government bonds; reflecting credit rating and hence risk; suitable terms available;
- **Fixed interest bonds**: will be suitable for the investor; government or corporate depending in investor's attitude to risk; influenced by the time to retirement
- **Index-linked bonds**: provide protection against inflation; may be suitable if investor is concerned about inflation
- **Equity**: risky assets providing high potential real returns; very suitable if there is a significant time to retirement; will depend on attitude to risk;
- **Property**: risky assets providing high potential real returns; more likely to be suitable if the investor has a significant time to retirement;
    - Access to property markets is possible directly for residential properties
    - Through collective investment schemes (to include commercial property) or property company shares
- **Futures and options**: difficult to invest in due to exchange requirements and access to markets; risky unless expertise; potentially included within pooled investments
- **Overseas investments**: similar comments to above with opportunity for diversification but there will be currency and political risks
- **Collective investment schemes** allow access to markets that the individual investor may not be able to access directly
    - Closed-ended: can benefit from gearing and changes to the discount to net asset value
    - Open-ended: will be less volatile but likely to have higher management charges

[9]

ii) The asset classes that the individual selects should reflect:

- **Age**: if the investor is young, then she can afford to take more risk with the aim of achieving higher returns
- **Risk appetite**: the assets should reflect the risk appetite of the investor
- **Tax situation**: must take account of the tax treatment of each asset.
- **Objective of the investor**: e.g. a wealthy individual who may use the endowment policy for any tax benefits may have a different asset mix to an investor who is using the endowment policy as the primary retirement savings vehicle

[2]

iii) **Advantages**

- The unit prices could be less volatile
- The fund will have a steady stream of income through coupons which will lead to a steady growth in investments.
- No risk of default

- Fund will have assets which are liquid and marketable
- Likely low investment expenses
- There is a good probability of atleast 50% of capital protection

Disadvantages

- Fund will have investors with different time horizons, from policyholders nearing retirement to young customers a long way from retirement. Inflow and outflow will need to be well matched to protect capital which is difficult considering the varying time horizons
- Capital protection is ensured if fund follows a very passive investment policy of buy and hold
- Even then, there will be no protection for customers who surrender their policy. Unit value will still fluctuate on a day to day basis.
- Will provide lower flexibility to policyholders in terms of investment in potentially high yielding assets who might see the new norms too restrictive
- The expected return over the long term may be lower due to asset class chosen
- May not provide protection against inflation as yields would be nominal
- Sudden demand for G-secs may depress yields **[5]**

[16 Marks]

Solution 6:

i)

- Being able to meet liabilities as they fall due
- Proving that it be able to do so on an ongoing basis for both on realistic and statutory basis
- Proving that it could do so on a discontinuance basis with reasonable assumptions
- Meeting the statutory requirements of investment
- Maximizing the total return of the portfolio subject to above factors

[2]

ii)

General points

- Small company - less risk appetite, less free assets, solvency considerations
- Non-participating savings portfolio – everything is guaranteed
- Both upside and down side belong to shareholders
- Shareholder risk appetite needs to be considered
- The impact on pricing rate, can it be decreased allowing for higher potential returns
- Competiveness can be increased due to increase in pricing rate which may help in improving profitability due to increased volumes and number of policies
- Or alternatively, can increase the shareholder return if pricing is unchanged given the nature of non-participating product
- Credit could be taken in setting reserving interest rate, if allowed by local regulations,, to allow for potential high returns which would lead to decrease in supervisory reserves and hence increase in profits/solvency position

- Alternatively, risky investment strategy could lead to higher additional reserve/capital requirement to allow risk of default and/capital value erosion
- Hence the company needs to analyse whether adopting a risky investment strategy is the optimal and best use of capital it has.
- Need to take into consideration the existing liability portfolio. i.e. size- how much of disinvestment/fresh investment required
- Should take into consideration the current timing mismatch of assets and liabilities in terms of shortfall and liquidity considerations and whether the new investment strategy could actually lead to better ALM matching
- Any regulatory constraints on investment in equity or lower rated bonds
- Any internal governing policy violation
- Costs of changing investment strategy
- Availability of suitable assets

Equity

- Could give equity exposure to relatively new upcoming industries via convertible bonds
- Type of equity to invest in - listed equities, P/E ratio, dividend cover etc

Low rated Bonds

- Currently there could be too much demand for AAA bonds reducing spreads over G sec which could make AAA safe but returns could be low
- Availability of bonds in B to AA category- could be wide spread across industries and sectors
- The low rated bonds could be having good liquidity and marketability as well
- Yields could be really attractive compared to AAA and G Sec making them an attractive buy
- Higher return and higher risk but still better than equity since earnings are known in advance
- Issue could be guaranteed by well rated parent company
- Solvency norms for Corporate bonds may be more favourable compared to equity

[10]

iii) Risk management / mitigation actions

Equities

- Cap on total fall in market value of equities beyond which the company should sell the equity portfolio
- Cap on fall in individual equity value beyond which the company should consider selling the particular equity
- Invest only in high quality equities (list, blue chip etc)
- Investing in derivatives to protect downfall from equities
- Hold a value at risk reserve based on deterministic or stochastic calculations

AA rated corporate Bond

- Try to hold till maturity if marketability is lower
- Buy credit insurance / credit default swaps
- Invest in short term corporate bonds to ensure high degree of confidence subject to Asset – Liability mismatch considerations
- Hold a default reserve based on deterministic or stochastic calculations
- Continuous monitoring of the rating of bonds and if falls below the required rating, can look to sell

[4]

[16 Marks]

Solution 7:

i)

Factors to be considered in assessing a property investment:

- price, rent and yield
- type of property (eg office, shop, factory, warehouse)
- ownership of property (eg freehold, leasehold)
- Adaptability
- quality of tenant (important when a property is "over-rented")
- age and condition of building, standard of repair and modernisation
- conditions of lease (rent review periods, date of next review)
- facilities provided
- Development potential.
- Location
- Size of property
- the number of comparable properties available to determine the rent at
- Rent review and for valuation purposes
- Lease structure **[6]**

ii)

$85{,}500\ \ddot{a}_6^{(12)} + 105{,}500 * 1.05^6 * \ddot{a}_6^{(12)} * v^6 (1 + v^6 1.05^6 + v^{12} 1.05^{12} + v^{18} 1.05^{18} + v^{24} 1.05^{24} + v^{30} 1.05^{30} + v^{36} 1.05^{36})$ @11%

⇨ 85500*4.478589+338,525.66*3.185151 = 14,61,174.70= Rs. 14.61lakhs **[4]**

iii)

- The company will probably prefer to continue with the existing factory unless the price being offered by the developer is significantly above both the market price of the factory and the costs of uprooting and rebuilding the manufacturing unit elsewhere.
- It is also possible that the company has provided housing facilities to its work force in the vicinity. In that case, the new location should also be easily accessible to them
- The company may prefer to sell the factory if it has plans of expansion and there is no room in the current location for building more units to aid in expansion.
- The “market price” of the factory could be estimated by looking at what other similar properties have been sold for in recent times. This information however may not always be available, either due to the reason that no similar factories were sold or because such information is not in public domain.
- If the cement company is need of fresh finance, it could obtain this by selling the property to an investor and then leasing it back. This would avoid the need for purchasing elsewhere and relocating.
- The price offered must reflect:
    - the location, in particular transport links and proximity to workforce, customers and suppliers
    - the age and condition of the building
    - whether it can be adapted to other uses
    - the number of comparable facilities
    - the lease structure
    - the size of the factory
- The price offered would also have to be greater than the costs of relocating.
- These would include:
    - the costs of laying-off local staff and re-hiring new staff in a new location
    - the cost of searching for a new suitable location which has all the necessary features of transport and communication links.
- Is there any tax incentive announced by the government in new area considered for relocation
- Would there be a loss of production in the time of shifting premises?
- Other implications such as capital gains tax would also need to be considered.
- As well as considering the price offered, there will be non-financial factors that must be considered.
- These include:
    - Does the company have an agreement with the local authority that restricts it from selling its plant to the developer?
    - Are there any local restriction on use of land
- Will public opinion swing against the company if it sells a site to developers, particularly if redundancies are involved in the local market?

[8]
[18 Marks]

Solution 8:

i)

Characteristics of well run projects are:

- a clear definition of the aim of the project which reflects the needs of the customer
- full planning
- thorough risk analysis
- monitoring of development
- measurement of performance and quality standards
- thorough testing at all stages
- care in managing different strands of the project to ensure that there are no unnecessary delays in one part of the project which depends on the outcome of another (critical path analysis)
- to move along at the appropriate pace so that the right things are done at the right time
- stable but challenging relationships with suppliers of external components of the project
- a supportive environment
- excellent communications between those involved
- positive conflict management, which uses conflict as a source of ideas and a tool for development
- a schedule of what needs to be considered at each milestone review point.

[3]

ii)

Stakeholders	Needs
Company P/Board of directors	• Co. P should get a fair amount for the portfolio being sold • Repatriation of money to home country should be enabled without hassles • Existing staff need to be redeployed elsewhere within the company if Co.Q is not taking them over. Else they may need to be retrenched on reasonable terms • Similarly all other third party contracts (such as IT, policy servicing and so on), intermediaries, legal consultants, tax consultants, contract employees etc need to be terminated on fair terms • The entire project needs to be executed in a timely and cost effective manner • All necessary regulatory approvals need to be received on time
Company Q/Board of directors	• The price paid for the portfolio should be fair and equitable and should be related to the profitability of the portfolio • The nature of policies being bought should be capable of being mapped into its existing software, else there would

	be a need to buy new software and hence may incur more cost than expected • The demographic experience of the portfolio should not be more adverse than that of its existing business. • The entire project needs to be executed in a timely and cost effective manner • All necessary regulatory approvals need to be received on time
Policyholders of Co. P in the home country & of overseas country and policyholders of Co. Q.	Policyholders of overseas branch • Policyholders' Benefits needs to be preserved after sale to Co. Q. • System of transition needs to be smooth and policy servicing should not be affected due to the sale • Level of benefits such as bonus should be as per policyholders' reasonable expectations and should not be impacted by sale both • Co. Q should be financially sound in order to meet the policy liabilities as and when they fall due • There should not be undue admin charges imposed on any policyholder because of the sale of the portfolio • There needs to be Equity between different policyholders (par non-par, linked/non-linked, group/individual, different generations of policyholders) post the saletoCompany Q • Policyholders should not be disadvantaged due to cost of acquiring new loss making company which impacts investment freedom, future bonuses and price of products. • Situation pre and post acquisition should be maintained. • There needs to be transparency in the deal and policyholders should be aware of the proceedings Company P –Home policyholders • Company P is getting rid of a loss making entity hence home policyholders would benefit from improved capital position
Employees of both companies	• The employees of Co. P need to have their jobs protected as well as their wages/benefits • Promotion prospects of should not be hampered due to the sale • Retrenchment if any should be on fair terms • Redundant employees if any may need to seek fresh jobs

Regulators/Government of both countries	• The sale should comply with the regulations of both countries.
Tax Authorities of both countries	• Should be tax compliant in both countries • Repatriation of money issues needs to be considered
Shareholders of both companies	Shareholders of company Q • would be concerned about the value from acquiring a loss making company • Will be concerned on value from purchase of a loss making company and feasibility of any turn around plan CO Q has • that their future level of dividends should not fall • Shareholders of company P would be concerned that they should receive a fair consideration amount for the portfolio of business being sold • Currency risk at the time of repatriation of funds.
Reinsurers if any	• Existing Reinsurers of Co. P would be concerned about the loss of business
Agents and sales force of both companies	• As it is not a closed business, there would be distribution channels. They may expect that their future share of commission on existing business be preserved • How will the relationship with CO Q be in future
	[13]

iii) The key aspects that **Co.Q** has to consider while developing the project written strategy document are:

1. Objectives – Identification. Achievement, standards, financial and economic

The primary objective of the project, is to complete the purchase in a timely and cost effective manner without any undue disturbances to the existing policyholders and other stakeholders and to ensure a smooth transition of systems, data, policy servicing, financials and other material information from one insurer to another. The financial and economic objectives of the project also need to be identified and spelt out in the written strategy document.

How the objectives will be met and acceptable quality standards

To meet the objectives there may have to be timelines and measurable targets, such as dates for achieving each milestone of the project eg., independent assessment of the

profitability of portfolio, finalizing the consideration amount, testing indigenous IT compatibility, seeking regulatory approvals, communications to policyholders and so on.

2. The role of the project sponsor and any third parties

Co. Q is the project sponsor, and hence its role will need to be defined explicitly. Obviously Co. P will also have a keen interest in the completion of the project and hence the roles of both companies would have to be agreed upon at the outset. Co. Q's role would be ensure smooth progress of the project from end to end.

The project of purchase of insurance portfolio is a not so common one and requires specialist interventions at various levels. Co. Q may need to work with consultants, field experts or other third parties during the process. The role of each one of them has to be clearly defined in the written strategy document.

3. Policies :– Financing, - Legal, - Insurance / Re-insurance, - Technical, - Risk, Communications, - Information technology, - Conflicts of interest

The various policies that need to be in place are:

- Financing policy – *to deal with means of financing the purchase and other terms and conditions*
- Legal policy – *to deal with any possible litigations, compliance with local laws*
- Insurance/Reinsurance policy – *regarding insurance against third party risks; reinsurance of portfolio being purchased*
- IT Policy - *The use of information technology will be important for the smooth administration of the portfolio take over. Hence the IT policy would need to cover extensively such details as to how the portfolio would be merged with existing database of Co. Q and what would be the role of IT consultants at each stage.*
- Risk Management policy including prescriptions for change management - *Consider analysis of all risks to the objective and options for mitigation. Might include risk of adverse publicity / loss of reputation; Policy for conflict of interest may also be framed at this stage if any external consultant is also linked to other insurers or other agencies that may give rise to a possible conflict of interest; there may be common stakeholders who may face a possible conflict.*
- External communications policy - *is critical to the success of the project with clear channels of communications to policyholders and other third parties. The nature of sale and its implications to policyholders should be clearly spelt out in the communications policy*.
- Technical policy – *Might cover actuarial aspects of valuation of the business*
- The policy for dealing with legal issues – *Agreement between the two companies will need to be carefully worded to avoid disputes. It will be necessary to ensure that the criteria are clear and cover all required areas, such as policy data, financial data, investment data, method of transfer of data, employee issues, third party issues, etc. Consideration will also need to be given to any other legal risks, for example confidentiality or non-disclosure requirements during adjudication.*

4. **Expected cost of the project** **-** *Total cost of procuring the business, cost of setting up the data in the IT system, synergy with existing business, ongoing expenses and administration etc*

5. **Schedule - Key milestones for project review & Breakdown of the work to be completed**

The timescales for the phases of the project – agreement between two companies, regulatory approvals, sync of IT systems, policy data transfer, other data transfer such as product details, past financials, past regulatory returns, stipulated deadlines etc. – should be established. Key milestones should be in place to review the project – for example, monitoring entries to ensure the competition is set to achieve the objective.

6. **A breakdown of the work to be completed**

A structured breakdown of the work to be completed under the project should also be established, involving assessment of feasibility, competition, financing if any, technical consultation if any, administration and media/communications.

[11]

[27 Marks]

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