Institute of Actuaries of India

Subject CA1-II – Actuarial Risk Management

May 2013 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 :

Stress testing

- Stress testing is to test the financial impact of extreme changes in the value of any parameter impacting the value of asset and/or liability
- Stress testing helps to understand the correlations and volatilities which are observed to simultaneously increase during extreme events.
- Stress Testing aims to identify weak areas by looking at effect of different combinations of correlations and volatilities.
- to gauge the impact of major market turmoil affecting all model parameters, while ensuring consistency between correlations while they are "stressed".

Scenario Analysis:

Scenario analysis helps in assessing the financial impact of group of risks.

This is used when a full mathematical model is inappropriate and involves the following steps:

- grouping of risks into broad categories
- development of adverse scenario for each risk group
- calculation of consequences of risk event occurring for each scenario
- total costs calculated are taken as the financial cost of all risks represented by the chosen scenario.

Stochastic Modelling:

- Full stochastic model is a natural extension of stress testing but can be complex and impractical in many cases.
- Under Stochastic modeling, the parameters are modeled as Variables by using probability distributions.
- Dynamic interaction between variables are also considered.
- The result will be a distribution of outcomes.
- The model is often limited by one of following approaches :eg, limit the number of variables modelled stochastically, use a deterministic.

[Total Marks – 6]

Solution 2 :

Factors to consider

- Nature term and currency of liabilities – commercial lines hence business would typically comprise commercial property, liability and business interruption covers etc.
- The liabilities are normally real in nature and can be short term (property) medium to long tailed business(liability).
- Property is a "real asset" but at the same time is ill-liquid.
- Hence the company needs available liquidity when considering investment in property

- When evaluating a specific property for investment a principal consideration is Location of the complex – prime or developing – what is the development potential of the location
- Own use - can the company use a part of the property for its own use for branches or the head office?
- Size of the investment – is it not a large investment given the size of the funds of the Company?
- Concentration Risk - is it not a large investment for the Company in a single asset
- Impact on cash flows - Whether company would have the available initial cashflows to fund the investments.
- How does investment in property match company's cash flow requirements with respect to amount and timing of the claim payments.
- Marketability - Can it be sold in parts, if required, by splitting into small pieces, to fund the large claims or to fund any other lumpsum cash flow requirements?
- Diversification of rentals - Can it be rented into small pieces or in large units to be rented so as to diversify the rental risks?
- Property Management Expertise – does the company have the expertise to maintain this property
- Impact on investment of the Management Costs – If management of the outsourced or otherwise, what would be the cost impacts on the investments returns under both circumstances?
- Uncertainties in the Cost of management - higher/ uncertainty regarding costs of managing the property
- Uncertainty/ predictability of rentals – when operational, the likelihood of the property vacancy, rent defaults etc.
- Suitability against the liabilities - Real assets, a good hedge against the inflation linked liabilities. Investment Term – a long term asset …should be suitable for long term liabilities
- Construction quality and look of the buildings
- Presence of other reputed companies in the same complex.
- Regulatory requirements- will the asset be treated as admissible for solvency purposes
- What are the alternative investment opportunities available

[Total Marks–7]

Solution 3 :

[i] Types of expenses

- direct internal expenses - claim handlers, lawyer fees, claim underwriter fees, costs of a claim management system, reinsurance management
- indirect internal expenses – cost of support departments- actuarial, finance, HR which provide support to the claims department in claims management

- those directly related to specific claims- for eg;, large claims under litigation for a long time

[ii] Medium sized company -so there could be still some volatility in claim expenses per policy as the number of claims may not have reached a stable level. Hence increase in per policy claim expenses could be due to sudden volatility in number of claims reported and settled.

Other reasons could be

- One off cost relating to purchase of new claims management system
- Increase in claim handler costs due to salary and price inflation being higher than expected or due to payment of one time retention bonus
- Legal fees higher than expected due to more claims coming up for investigation/litigation then expected
- Expense allocation method relating to allocation of indirect expenses by function/activity has changed leading to higher claim expense per policy then expected
- Fewer claims than expected hence fixed costs when allocated over fewer claims leading to higher claim expense per policy
- Regulatory changes/internal company objective changes leading to increased processing and compliance costs (for eg., regulator has mandated maximum TAT for claims, company has changed its objective on claim TAT.

(iii)

The impact on statutory valuation assumption will depend on whether the increase is due to a one-off, a capital investment or a structural change in process leading to permanent increase in costs.

One off costs/capital investment- The expenses analyzed should exclude large one-off capital costs. These one off costs/capital investment need to be amortized over the expected useful lifetime of the item purchased. The amortized cost may then simply be treated as part of the overheads.

Higher salary inflation than expected- If salary/price inflation is expected to be high in future compared to valuation assumption then a change in valuation assumption should be considered.

Higher legal fees than expected- analyze reasons for increase (is it due to increase in number of early claims or increase in large claims or any other reason) and check whether certain claim costs need to be linked to claim size and not number of claims.

Regulatory changes/internal objectives- check whether the impact on claim costs is permanent, in which case the same should be reflected in claim assumptions.

[Total Marks-9]

Solution 4 :

Advantages

• Removes the liability in respect of current pensioners and hence removes the longevity risk, the investment risk, and the expense / administration risk
• May be purchased on favourable terms if the annuity market is competitive or special tax considerations
• May reduce administration costs
• A "bundled" package of administration and actuarial service may also be offered on competitive terms
• Likely to improve the security for pensioners
• Purchasing annuities may be needed on possible wind up
• May free up investment policy for the remaining assets

Disadvantages

• The rates will include an allowance for the insurers expected profit and insurance company margins
• Terms may be uncompetitive
• The purchase of the annuity is effectively an irrevocable decision to invest in bonds at current market prices
• There may be difficulties in purchasing an annuity that precisely matches the benefit promise
• Granting discretionary pension increases will be complex
• Any potential profits from mortality, investment and expenses are passed to the insurer
• In particular members in poor health may be insured on "standard" terms
• Future increases in the cost of annuities is outside the control of the pension scheme
• and may cause a strain compared to the funding basis
• Reduces the security for remaining active and deferred members
• Possible Insurer default risk
• Reduces the total funds under investment and hence reduces investment options
• Large amounts of liquid funds will be needed at the members' retirement dates to buy annuity
• and disinvestment of assets at these retirement dates may be at an inappropriate time
• hence a constrained investment strategy may need to be followed
• there may be communication issues with retired members as the pension is paid by a third party

[Total Marks-9]

Solution 5 :

- Customer Needs – the need of the customer is to finance the inheritance tax when the insured dies. The amount of the sum received on the death should be sufficient to pay the tax. Hence a standard whole life product is required.

- Product Structure
  Premium structure- single pay, limited pay or regular pay-Will the clients have the ability to pay the premiums? For example if single premium or limited pay whole life, customers may not have the ability to pay the premiums, will the contracts offers some flexibility in premium payments?

Discretionary Benefits – should the product offer some discretionary benefits to opt by the customers e.g. bonuses.

Should the product be offered on single/joint life basis (first to die, last to die??)
Tax benefits – does the contract meet the requirements to meet the tax benefits to the customers/ insurer?

- Options - The claim amount may vary with the increase in property value and hence it is a real liability which increases with the increase in property values.

  Whether the contract permits the customers to increase or reduce the cover when needed or surrender the policy?

- Guarantees - Does the customers prefer premium rates guarantees or premiums reviewable. Should the product have any other guarantee which the customers may want or can new attractive guarantees be designed

- Competitiveness - The premium rates needs to take account competition. How competitive a product is will depend upon the type of contract and how it is sold. For example, selling through independent intermediaries tends to result in more competitive pricing than selling through an insurance company's own sales force.

- Profitability – will this product be profitable to the company. This is a long term insurance product which has long term mortality, investment and expense risks. This is more critical if the premium rates are not reviewable by the insurer.

- Statutory Requirements – does the proposed product design meet regulatory requirements pertaining to the product designing, pricing, contract wording, capital requirements, sales methods etc.
- Cross Subsidies - The insurer may allow some cross-subsidies within or across contract types. For example, a cross-subsidy would be to require larger policies to contribute more towards expenses and profits than smaller policies. Insurer need to assess/ manage the cross subsidy risks.

- Consistency with other contracts - The insurer will want to check for consistency in design and pricing with existing contracts that are being sold so that this product does not significantly cannibalize the sale of other products.
- Expertise – does the insurance company has the expertise to write long term life cover products

- Capital Resources – does the company has the capital resources to meet the new business strain and ongoing reserving and solvency requirements?

- Marketability - Is the product design attractive to the target market and appropriate for the sales methods to be adopted by the Company

- Administrative Systems Implications – can this insurance product be serviced by the existing administrative systems? If not, what would be the implications and the costs?

[Total Marks – 10]

Solution 6 :

[i] Both the methods value the assets at market value.

All other assumptions, *eg* price inflation, salary inflation are also derived from the market.

Both approaches value liabilities using the discount rate implied by the market price of a replicating portfolio.

This is the asset mix that is the best match for the duration and risk characteristics of the liabilities.

This portfolio may be determined using an asset/liability modelling study.

Market value method (mark to market)

Under this method, the replicating portfolio consists generally of bonds – government or corporate (where the credit risk has been stripped out).

A simple approach might aim to find a single discount rate that values asset cashflows at the observed market price.

A more sophisticated approach can be taken in which the discount rate varies by term to reflect the shape of the yield curve.

Bond yields plus risk premium
This approach builds on the previous method through the introduction of a risk premium
to reflect:

- the extra return expected from the actual asset holding (*eg* if equities are held then we may expect a higher return), although the discount rate should also be adjusted to reflect any extra risk.
- a degree of actuarial judgement on the extra risk required.

[ii] Advantages of MV

- objective
- Realistic (reflects the value, if the assets were sold)
- quick/easy to obtain
- works for all traded assets
- easy to explain the other parties , (e.g. pension fund trusties, directors)
- most people feel comfortable with using market value (i.e. they are uncomfortable if a figure significantly different from MV is used)
- users of the figures can see the volatility resulting from any asset mismatching

Disadvantages of MV

- some assets may not be sufficiently traded to have a meaningful price
- Can be extremely volatile, volatility may hinder decision making
- May not be fully consistent with the method and basis used to value any liabilities.
- MV implies changing the liability valuation basis each year which makes comparison of previous years' results difficult.

[Total Marks -10]

Solution 7 :

(i)

- existing assets – level and nature of the assets- car, house other assets, ancestral property
- Existing debts and their servicing requirements – mortgage, car loan, any loan taken for marriage purposes
- Expected level and pattern of future income- income fixed/variable, expected to increase gradually or with big jumps expected,
- is spouse also working, nature of her work and income, part time/ full time, income, will she take breaks for child birth,
- Future spending covering expenses relating to medical expenses for child birth, cost of bringing up children, cost of foreign holidays expenses towards your own educational pursuits (do you/your plan to take up further studies and take a break from work)
- Nature of liabilities/ future spending – expenses likely to go up in future, higher rental, buying a car, a house –EMI, real or fixed, certain or contingent
- Duration and currency of various liabilities/ spending-
- The uncertainties in the liabilities/ future spending- since you are in an MNC, are you looking for a stint abroad for a few years or plan to take a sabbatical for acquiring higher qualification
- Expected returns from the investments and risk reward
- Risk appetite
- Rules relating to Income tax, capital gains tax and other taxes arising form investments, income, sale of assets
- Feel good factor by holding the asset for eg. stock in companies managing /producing environment products etc.
- Any personal investment restrictions (for eg., not investing in companies manufacturing weapons etc.)

- lack of freedom in selling e.g. lock in period for disinvestment
- Practical considerations in buying, managing, selling the assets

(ii)

- In the downturn of the economy, the equities are expected to under perform due to uncertainties in future corporate earnings.
- Due to earnings slowdown, the future tax collections of the government are expected to be lower. Hence, the government borrowings are expected to increase. Due to increase in expected supply of the govt bonds, there may be fear of rise in interest rates and hence the interest rate is expected to rise and the prices of the bonds are expected to reduce. Due to expected lower earnings of the corporate, there is possibility of the defaults of some corporate bonds, fears of downgrades of corporate bonds etc. These factors will make the government and corporate bonds less attractive.
- Currency is also expected to underperform due to overseas investments diverting to other countries, bad performance on account of exports etc. This will make the investment in domestic currencies less attractive compared to other currencies.
- Cash/ low risk money market instruments will be more attractive due to lower risk of erosion of market value of assets
- Overseas investments would be relatively more attractive than domestic because of likelihood of weakness of the domestic currency and underperformance of domestic equities and bonds.
- Properties – the real estate is expected to underperform due to lower demands, both for purchase and rents, from corporates and individuals.

[Total 11 Marks]

Solution 8 :

(i)

- Poor investment performance in respect of unit linked products may lead to higher cost of investment guarantees, higher premium lapses and/ or surrenders
- Mismatch risks – the Company has been offering investment guarantees in unit linked products. In order to manage this risk better, the company should either hedge the mismatch risk or match the assets and liabilities closely. Any mismatch may lead to significant losses and the impact on the capital position of the company.
- Pricing & underwriting standards are not adequate i.e. the Company writing new business at inappropriate price points. This is more critical for pure protection plans because a slight mispricing of the mortality/ critical illness risks may lead to product being loss making and may also require higher reserving requirements
- The critical illness claims are higher than expected due to volatility in the claims incidence rates, new diseases not anticipated earlier leading to additional losses
- Risk of anti selection against company e.g. the insured has the more information of the risks and understands better than the company and takes advantage of that.

- Critical illness incidence rates are higher than expected due to many reasons e.g. misestimating of the risks, the diagnostic advances in medical sciences lead to more and earlier detention of Critical illnesses, contract wordings are ambiguous etc.
- Inappropriate reinsurance e.g. no or little catastrophe cover
- The lapse risks i.e. the premium discontinuances or policy terminations before maturity impacting the profitability of the products and or increasing the reserve requirements for continuing customers due to higher fixed expenses per policy
- Expense and inflation risk – the risk that policy management, investment management and claims management expenses are higher than expected.
- Adverse product mix of new business or Volume of new business is higher/ lower than expected leading to lower profitability, higher capital requirements, lower return on capital etc.
- Adverse variation in average policy size and/ or adverse mix of business may lead to higher per unit costs and lower profitability
- Counterparty risk e.g. risk of failing reinsurer, party to interest rate swap etc.
- Insolvency risk – the risk that the Company's assets are lower than required by the Regulator to continue to run the business
- Concentration risk i.e. high exposure in one particular risk (mortality, particular asset/ asset class, high exposure in investment guarantees etc.)
- Competition Risk - Competitor launching a new product or new service impacting adversely the new business or the persistency
- Loose policy wording leading to payment of claims which could have been avoided
- Loose policy wording or inappropriate pricing for options to the customers might lead to higher claims costs to the Company
- Legislation, Taxation and Regulatory changes may lead to higher costs or lower benefits to the Company
- Legal risks – any legal disputes or regulatory penalties may lead to higher costs to Company
- Currency Risks – if the company has either assets or liabilities or both in other than home currencies, adverse change in the exchange rates may lead to losses to the Company.
- Lack of diversification or the business concentration risks – if the company lacks in the diversification of business e.g. writing mortality risks from geographies, investing in various assets/ asset classes may increase the diversification and reduce the concentration risks
- System Risks – the systems and controls are not effective which may lead to losses in future
- People risks - the risk of losing the key employees and the employees are not able to deliver on the key deliverables leading to losses to the Company.
- Frauds – any fraud committed whether within the company or by any other party may lead to losses to the Company.
- Reputational and branding risk to be considered.

[ii]

- Writing protection business in various geographies
- Keeping the balance between mortality benefits and critical illness benefits and risks
- Writing large number of small risks rather than writing small number of large risks
- Keeping a balance between unit linked with and without guarantees so that investment guarantee is not heavy
- Keeping a healthy balance between unit linked and pure protection business so that the business mix risk is at optimum level
- Writing the business through various channel risks so as to avoid a channel or target market concentration risk
- Investing in various currencies and in various asset classes
- Having a good diversification within each asset class to avoid concentration risk
- Set the product and pricing strategy in such a way that the overall diversification is optimum i.e. one product has opposite risks from other products(term and an annuity product).

[Total 14 Marks]

Solution 9 :

(i)

- Rate of mortality of those who join the scheme and whether this is likely to change in the future or
- Be expected to be different for married/single.
- Longevity of spouses who would receive a pension.
- The proportion of members who join who have a spouse (however defined).
- The expected differential in age between the employee and the spouse.
- Level of expected anti-selection if offered as an optional benefit to members
- The rate of interest or investment return that should be assumed.
- The rate of salary increase and the relative difference between salary and price inflation, interest rate assumption and inflation etc
- Expense and/or administration costs of managing this new benefit

[ii] Who should be covered / possible restrictions, e.g:

- Spouses
- Partners: opposite sex, same sex
- Should Children be covered if, yes age limits,
- Should other family members be covered e.g. those financially dependent.

Benefits

- Integration with state benefits
- Level of benefits on death pre-retirement
- or death post-retirement
- or on other events / circumstances.
- Consistency with benefit basis for members
- e.g. should benefit be fixed or if salary / service related etc.

- How payable: cash, pension, or both.
- Would members appreciate the benefit
- Any reduction for large age disparity between member and dependant.
- Whether benefits cease on remarriage.
- Option to exchange member's pension for dependants' pension • or vice versa.
- How to deal with any selection issues, eg if member in poor health.

Admin issues
- Nomination / expression of wish forms
- regular communication with members to ensure these are kept up to date.
- Methodology for determining who to pay benefits to
- dealing with disputes between different beneficiaries.
- Record keeping
- Consider requesting evidence of health for new scheme members.

Costs
- Likely level of costs and future trends in the cost.
- Split of costs : company / member.

Insurance
- Consider availability of insurance to (re)insure benefits
- especially any large risks
- and so as to get a free cover limit.

Other
- What equivalent benefits competitors are providing.
- Legislative requirements
- e.g. maximum level of dependants' benefits
- or a requirement that benefits can only be provided in certain circumstances,

[iii] The scheme is likely to experience higher than average mortality given the industry the members are employed in.

Hence there is likely to be a greater number of deaths and a relatively higher impact on the scheme.

The scheme is, however, large and mature so the membership and hence experience should be relatively stable.

However there may be some key members with large death benefits so it may be possible to insure some or all of the benefits of key individuals to reduce the overall risk profile.

How generous are the death benefits i.e. is the liability large relative to the size of the scheme.

Need to consider the impact of any expectation of improved longevity.

Insurers are likely to charge an occupational rating which might make the premiums expensive.

The cost of the insurance over the long term is likely to be similar to the actual claims experience plus the life office expenses, profit and contingency margin.

Hence in the long run self insurance should prove more cost effective

Insuring the benefit will however result in a more even cashflow as there is a greater predictability in the cost of the death benefits.

Experience rating / profit sharing arrangements may be possible to smooth cashflow and still retain any potential profits.

Self insuring all the benefits carries a catastrophe risk which might impair the security of the members other benefits.

Alternatively it is possible to buy catastrophe cover e.g. stop loss insurance to reduce the risk profile. Need to consider any one event claim limits.

Consider legislation / rules on level of insurance

The spouses' pension is likely to be a significant total liability. However the payments would be paid over the lifetime of the spouse so the effect of the scheme s cash flow is less of a problem than the lump sum death benefit.

For the older lives (where most claims are expected) the reserve held is likely to exceed the amount of the death claim.

Need to consider the free cover limits and evidence of health criteria.

Insurance arrangements need to be regularly reviewed to ensure they remain competitive.

Consider appetite of company to risk

Consider funding position of the scheme.

[iv] Clearly each of the companies could have used different assumptions in order to price the business (on the assumption that these are not prescribed by legislation).

This could be because they were simply taking a more optimistic or pessimistic view of the likely outcome or on the investment return were assuming investments in more or less conservative investment media.

This could be justified, for example, by a company which had a significant level of free assets or surplus or simply that it was looking to undercut rivals, or the implied profit margin could be different (e.g. If one was looking to loss lead in order to gain market share.

The quotations could be on a first year basis versus a term period (i.e. anticipating an increase or decrease in cost over future years which is spread).

The quotation could be contingent upon more strict criteria such as requiring a medical if salaries are greater than a set amount or in the event of death excluding certain specifics, or only for spouse at date of enrolment rather than subsequent re-marriages.

Given them the wrong data or they have valued the wrong benefits.

A company may have been able to re-insure some of the catastrophe exposure (i.e. cover in respect of particularly high levels of salary or for particularly large number of deaths associated with a single event) and have passed this on.

Overall costs could be lower.

[Total Marks-24]

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