Institute of Actuaries of India

Subject CA1-I – Actuarial Risk Management

September 2017 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:

Factories are cheap and easy to build. So, an under-supply in the market can be quickly corrected. Thus, the potential for upside growth is limited.

Factories tend to become obsolete more quickly thus requiring a higher level of refurbishment expenditure compared with offices and shops.

Compared with shops and offices, the site value of factories tends to be significantly lower. So deterioration of the building leads to depreciation costs that are a high proportion of total value.

Manufacturing industry is particularly vulnerable to economic recession and bankruptcy of a tenant will result in a rent void. This applies particularly where the building is unsuitable for any other use.

The fabric of factories is more vulnerable to deterioration compared with shops and offices.

[4 Marks]

Solution 2:

i) Accuracy:

Assess accuracy of each assumption to be used

- Check and validate all the required assumptions – morbidity rate, initial expenses, renewal expenses, claims expenses, interest rate, mortality rate, withdrawals etc. Are these parameters set as agreed?
- Ensure that assumptions which are planned to be deterministic are so and those which are required to be stochastic are so.
- Ensure that certain assumptions which need to comply with supervisory requirements do so. For eg
    - Ensure that tax rates and commission rates are as per prescribed regulations.
    - Check the solvency factors used in the pricing model are as per the prescribed regulations

Validate the choice of model point and ensure that profitability is checked on all the possible model points – different ages, premium band, sum insured

- Carry out consistency checks of the results to get comfort o accuracy
    - Analyse the profitability and new business strain at different model points. They should be consistent.
    - Carry out checks to ensure correctness using existing model if available or similar models.
    - For all model points, check the consistency in profitability. Example: for same model points check the profit margin for a policy sold for different benefit bands.
- Check that the sensitivity analyses give sensible results.

- Check that model output /premium rates look sensible by "model point" e.g. higher premium rates for older lives, but need to consider that premiums for ages nearing the ceasing age would reduce (due to the potential benefit term reducing);
- higher premium rates for shorter waiting periods compared to longer waiting periods;
- higher premium rates for increasing cover compared to level cover.
- consistency In premium rates by gender across various age groups- for eg. Higher age bands female rates can be expected to lower than male rates etc

ii) Completeness:

- First check if all the cashflows are included in the pricing model – premiums, benefits, expenses, commission, reserves, solvency margin.
- Check that morbidity rates represents all the disease covered in the product.
- Have tax rates and tax cashflows Incorporated?
- reinsurance cashflows – reinsurance premium and reinsurance recoveries are modelled if the product is heavily reinsured ?
- Check the incorporation of product features like survival period, waiting period, maximum sum insured/benefit allowed etc.
- Check if the minimum and maximum term, premium, benefit limits are taken in account while selecting the model points.
- Check that premiums and sums insured increase each year in line with the relevant increase option (i.e. no increase, RPI, or fixed percentage).
- Check that no claims outgo is paid during the waiting period
- Check that expense in the model increases in line with the inflation assumption

[12 Marks]

Solution 3: i)

Risk :	**Mitigation:**
The capital cost of the project could be underestimated.	All areas of the project should be well planned and researched and costed at each stage.
The time to be operational could be underestimated.	Each part of the project should be planned to ensure the project is completed on time. Action should be taken at the first sign of overrun.
Sales are overestimated.	Market research should be carried out to determine demand for Ayurveda products and sensitivity of sales to price.
Costs of production are underestimated.	Thorough research will be needed for realistic estimate of costs. Could try to set up fixed price deals with suppliers so that they are bearing some of the risk.
There could be difficulties in getting required quality and quantity of supplies	**Diversify across suppliers , do vendor research**
You may have to replace existing profitable lines with the new lower margin ayurvedic range. This might impact profitability of	The market should be researched initially and continue to be monitored for any potential problem areas.

company overall	
Regulations relating to ayurvedic produce change. This may be very costly to comply.	Be aware of all regulations and ensure that company produces its range to the required standards always. Also research any likely changes and ensure company can meet these as soon as possible if required.
Existing and new competition	Research competitors and their distribution and marketing strategy
Inability to leverage existing distribution net work	Engage with existing distribution network and ways and means to increase their margins as well

[8]

ii) The starting point is the current cost of raising incremental capital for the company in order to carry out the project.

This is the rate of return that needs to be earned on the capital if the existing shareholders are to be no better off and no worse off.

This should be the company s normal cost of raising capital, taking this as a weighted average where the weights are based on the optimum capital structure for the company as between equity and debt. (If the company s capital structure is not currently optimum, it could be made optimum through a separate decision).

The cost of debt capital should be taken as the cost in real terms of new borrowing for the company, by taking an appropriate margin over the current expected total real return on index-linked bonds, having regard to the company s credit rating, and multiplying by (1t), where it is the assumed rate of corporation tax. The cost of equity capital should be taken as the current expected total real return on index-linked bonds plus a suitable margin to allow for the additional return that equity investors seek to compensate them for the risks they run.

This would generate a real discount rate, to be applied to cash flows expressed in present-day monetary values, or adjusted by the assumed future inflation rate and used with cash flows in nominal terms.

The project might be considered a slightly higher risk as this is a new area for the retailer. The project should be appraised on a slightly higher discount rate. [4]

[12 Marks]

Solution 4:

i)

- They do not have any dependant who will inherit the property after their death. Hence want to en-cash the property fully during their life time
- They do not have enough disposable income at hand and they believe that this helps augmenting their income from the purchase price received

- They are in good health and they assume that they will live longer and hence they can enjoy the benefit of both, a lump sum which can generate regular income hand and live rent free apartment.
- They believe that the property market will fall and it's good time to encash. [2]

ii) A discounted cash flow calculation could be used to determine the price to offer. Factors required for this calculation are:

- term of the lease and the ground rent, if leasehold
- current market price for the apartment
- current rental level appropriate for the apartment + expected rental growth to calculate the income forgone.
- the expected period until the apartment becomes vacant allowing for the health of Mr and Mrs X
- the expected use of the apartment post the vacancy : self-occupation or sale or rental
- the expected growth in market price over the period until the apartment becomes vacant, so as to know the value of the investment at the time of vacancy , if purpose is sale only
- the expected rental in future post vacancy if the purpose is to rent out/self-occupy the apartment
- the transaction costs, both for the current purchase and the resale, other costs e.g. insurance, maintenance etc.
- tax implications of this investment
- the rate of return required from such an investment,

The calculation could be carried out on alternative assumptions to test for sensitivity e.g. using different rates of growth in the market price, allowing for different longevity periods for both Mr and Mrs X etc.

Consideration should also be given to factors that could dramatically affect the value of the apartment e.g. the risk of development blight, changes in the taxes on property investments, the possibility of redevelopment etc. [6]

iii)

- This investment is real in nature, it is expected to be of medium to long term, does it fit with the nature of the liability profile of the bank
- the marketability of this investment could be poor, would this suit the bank needs
- there is no income for some time and instead there will be outflow of initial lump sum and , would this suit the liability profile In terms of timing
- expertise is required to price this product does the bank have the resources.
- What is the expected business volume- Is the size of the business attractive and
- is this opportunity competitive relative to alternatives available to it?
- supervisory capital requirements for this new investment – credit risk capital requirement [4]

[12 Marks]

Solution 5:

i)

- Economic growth may have slowed down and the country may be in recession. Reducing interest rates shall encourage investment spending by companies especially if there is an increase in confidence. This should lead to increased employment levels. There is likely to be a lag between the timing of the investment and any increase in growth.
- There should also be an increase in the level of consumer spending. This may be due to:
    - increased income due to a reduction in debt servicing costs
    - lower borrowing costs making borrowing more attractive
    - lower savings rate making savings less attractive
- This should provide growth in the short term but this may take time if consumer confidence is very low.
- If interest rates are reduced, international investors will be less likely to deposit money in that country. The exchange rate will therefore be likely to fall. The lower exchange rate should increase the competitiveness of exports although the costs of any imported materials used will increase which reduce the benefit. The lower exchange rate should also increase the relative competitiveness of domestically produced goods, but will increase the costs of imports which can lead to increased inflation (supply side).
- Lower real interest rates mean an increased quantity of money is demanded which is met by an increase in the money supply. This can lead to inflation. Low real interest rates can also lead to inflationary pressures by increasing demand. Inflation will need to be monitored to ensure it stays within any target range.
- Interest rates may also be reduced if the rate of inflation is lower than desired or to restore confidence in the property market.
- They may also be reduced to decrease the exchange rate.
- There may be pressure from the government to reduce rates for political reasons.
- There may be a global tendency to reduce rates and the central bank wants to keep currency/trading balance unchanged.

[10]

ii) Government bonds

- The yields on short term bonds are closely related to returns on money market instruments so a reduction in short term interest rates will almost certainly boost prices of short term bonds.
- However, investors in long bonds may interpret a cut in interest rates as a sign of monetary easing, with potentially inflationary consequences over the longer term. So, the yield on long bonds might decline by a smaller amount, or even rise.
- A lower exchange rate will affect the demand from overseas investors. It will also alter the relative attractiveness of domestic and overseas bonds for local investors. This is likely to increase the price of bonds.
- Index-linked bonds will be influenced by real interest rates. The reduction in short term interest rates may lead to an expectation of increased inflation or uncertainty over

inflation. This is likely to increase the relative attraction of these bonds and so should increase the price.

Equities

- Low real interest rates should help to stimulate economic activity, increase the level of corporate profitability, and hence raise the general level of the equity market.
- Also, the rate of return required by investors should be lower, so the present value of the future dividends will be higher.
- Any inflationary fears would tend to increase the relative level of the equity market at the expense of the bond market.
- If the exchange rate weakens, exports will become more competitive but imports will be more expensive. The effect on equity markets will depend on the proportion of profits earned abroad.
- It will also lead to improvement of any overseas earnings in domestic currency terms.

[8]

[18 Marks]

Solution 6:

i) Following are the key principles of lending that will reduce credit risk:

- The Character and ability of borrower should be satisfactory.
- There should be valid purpose for the loan.
- The amount to be borrowed should be reasonable with the purpose it is being put to.
- The borrower should have ability to repay the loan amount.

[2]

ii)

A due diligence investigation involves a thorough assessment of the "financial health" of the borrower. The purpose of due diligence process is to ensure that the borrower has capabilities and resources to repay the loan amount.

The due diligence investigation should include assessment of following areas:

- Assessment of financial position in terms of key performance ratio & trends for last few years- profitability ratios, leverage , liquidity ratio, etc
- assessment of the key management of the Company
- This is a housing mortgage company, so it is important to analyse existing customer profile --the mortgage type, type of customers, average loan amount, etc.-
- What is the trend of mortgage defaults - the company and the industry overall?
- Any risk mitigation techniques adopted by the mortgage company to reduce default risk e.g mortgage insurance etc
- Market share of Housing mortgage company and its growth over last few years, prospects for the industry overall
- Business plan- future business strategy, whether it is reasonable and can be achieved, ability of management to execute the plan,

- Reputation and popularity of the company - This can be judged through results of recent customer satisfaction surveys and external industry reports.
- Risk management process – strength of internal systems and process, strength of risk department. Are the processes and policies detailed and efficient?

[5]

iii) Risks faced by the mortgage company:

1. Customer Default risk: As the mortgage company is providing housing loan, hence there is significant risk that a customer is not able to pay due interest payments and capital repayments on time. This problem could be aggravated during economic down turn where customer defaults and weak property markets are likely to happen together.
2. Earnings risk: The risk that interest rate earning is less than expected o loans. This risk is higher if the loan is granted at fixed rate and the interest rates move up.
3. Credit risk: The risk of default of other assets / investments/by counterparty.
4. Asset Liability mismatch risk: If the assets (loan repayments) and liabilities (loans/borrowing/deposits/other
5. Liabilities taken by bank) are not matched in term, nature and currency then there is significant ALM risk.
6. Liquidity risk: Liquidity risk is the risk that the company, though solvent, does not have sufficient liquid financial resources to enable to meet obligations on time.
7. Business risk: this includes –
    - Higher fixed operational expenses then expected
    - Lower loan size amounts the expected
    - Lower business volumes than expected
    - Stiff competition
    - Poorer customer profile then expected- for eg. More exposure to High credit risk groups then expected
    - Accumulation of risk- limited diversification in customer profile- similar economic profile
    - Poor strategy or poor execution of strategy

Operational Risk: This is risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. E.g. data errors, fraud etc.

8. Legal, political and Regulatory Risk: Any changes in regulations, tax rules etc. possess risk for Mortgage Company. [8]

iv) In general

- Details of internal risk management process and governance, risk appetite and risk tolerance levels
- Details of all risks identified and risk mitigation actions in place in respect of all key risks
- Details of risks where no mitigation is in place/ limited mitigation is in place, how is capital requirement for such residual/un hedged risks quantified.
- Company's policies related to Financing, legal, insurance, technical, risk, communication, Information technology and management of conflicts of interest

Specifically

- need to study control systems and processes in the Company to manage operational risks.
- Credit risk- the control system in place for credit risk profiling of customers before offering a loan
- What are the mitigation actions taken by the Company to reduce loan defaults- In terms of business diversification- by geography and socio economic profile of customers
- Risk policy as relates to pricing - What are the criteria for offering a loan? How is the interest rate fixed, process of review? Is it fixed and variable? Basis for determining loan amour to be given as % of property value
- Key customer fraud related statistics, e.g. levels of non-disclosure/fraud statistics by customer – process I place for identification and management of such frauds
- Any pending litigations in the court, any regulatory penalties paid in the past, any tax issues etc. [5]

[20 Marks]

Solution 7:

i) The key principles of investment can be stated as:

- A provider should select investments that are appropriate to the nature, term, currency and uncertainty of the liabilities and the provider's appetite for risk
- Subject to above, the investments should also be selected to maximise the overall return on the assets, where overall return includes both income and capital.

Investment manager must keep in mind the asset-liability matching requirements of the portfolio while finalising the investment strategy.

- The key Cash flows are premiums, expense outgo and benefit outgoes. Hence, these cashflows should be projected for future years to estimate the expected net cashflows inflow/outflow in each period.
- Since 85% of business is in: non-linked non-participating individual endowment business, hence liabilities are major guaranteed death benefits, surrender benefits, maturity and survival benefits.
- Any guaranteed liability outgo should matched closely as possible. Fixed interest bonds are suitable assets
- Only 5% of business is term business where death benefit is payable and guaranteed at outset. Investment in fixed interest securities are suitable to match these liabilities.
- Unit Linked liabilities: Unit linked policies provide investment linked benefits. Usually, these are normally matched by investing in the same assets as used to determine the benefits and the underlying investment objectives of the various UL funds.
- For all three lines of businesses, liabilities with respect to expense outgoes are real in nature as they are expected to inflate in future years. Real assets are suitable to back these liabilities.

- The Company's' risk appetite must be accounted for while making investment strategy for all portfolios except UL business. Example: how much exposure in equities/corporate bonds etc.
- The expected risk and returns trade off should be considered
- Similarly, tax treatment on asset proceeds and returns should be considered.
- Ensure that asset selection/exposure must be within regulatory limits
- Further, investment managers must ensure that sufficient cash and liquid assets should be available for daily business need. [8]

ii) Index linked government bonds:

- These investments provide real returns which are appropriate to the real nature of insurance liabilities (e.g. expense outgo).
- Since the benefit outgoes are guaranteed in amount, not in real terms. Hence, there is a risk that investment in too much index linked govt. Bonds will not perfect match for fixed benefit outgoes.
- In addition, a large proportion of expenses are subject to salary inflation and salary inflation tends to exceed price inflation, hence these bonds might not be adequate match for expenses.
- But Index linked govt. bonds are secure investments with minimal default risk hence might be within risk appetite of the shareholders
- Tax treatment of these bonds may be favourable than corporate bonds and /or equities hence might be attractive to march real liabilities.
- Since the liabilities are long term in nature and guaranteed in nature, hence holding 30% index linked securities may be riskier.

Corporate bonds:

- Since the benefit outgoes are guaranteed in amount, not in real terms. Hence, this investment fulfils the requirement of fixed returns with limited volatility.
- These bonds are subject to credit and default risk. Risk of down rating of issuer
- Subject to marketability risk
- Tax treatment of these bonds may be unfavourable compared to other fixed interest securities and hence should be considered.
- The Company should consider holding fixed interest govt. bonds for better diversification, lower risk but probably lower returns as well.

Cash Instruments:

- Cash instruments provide a good match to short term liabilities but usually the interest earned on cash instruments are lower than other fixed securities.
- Cash instruments also provide liquidity, enabling the insurance company to pay off unexpected claims without forced sale of assets. It's a secure investment with minimal risk of default.

- Look at the company's liability profile. If the company is growing with good cash flows from premium then 10% investments in cash seems high which will lead to lower returns. [8]

iii) Following points can be used to limit risk exposure:

- There may limit to the exposure of the Company to bonds with rating lower than A, to reduce any asset default.
- Exposure to industry should be limited e.g. investment in real estate companies should be limited to 15% of total investment.
- A requirement to match assets and liabilities by currency, so that the risk of unfavourable currency movements can be avoided
- Restriction on maximum exposure to a single counterparty/group companies to take the benefits of diversification e.g. exposure to Aditya group of companies etc.
- There must be rules on custodianship of assets e.g. the experience, amount of fund under mgt, regulatory approved etc.
- Set tolerance limits for extent of asset liability mismatch e.g. maximum 10% of assets can be mismatched in terms of duration with the liability profile
- Limit exposure to unlisted securities to ensure adequate liquidity at times of need-prescribe cash exposure.
- Risk return tolerance limits/ trade off

[6]

[22 Marks]

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