

Institute of Actuaries of India

Subject CA1-I – Actuarial Risk Management

December 2018 Examination

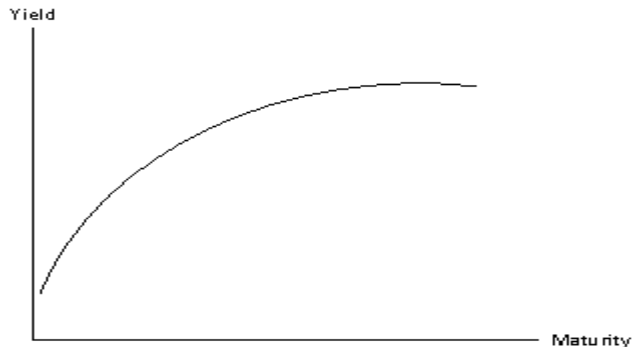
INDICATIVE SOLUTION

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:

- i) The yield curve represents the change in yield against the term to redemption. Usually it refers to the Gross Redemption Yield (GRY) on coupon paying bonds but could be any other yield as well, such as zero-coupon bond yields.

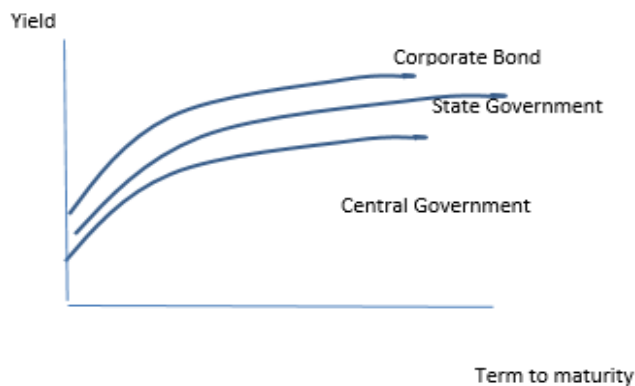


[2]

- ii) The yields of different bonds would primarily depend on the following factors:

- **Security of the bond/ Expected default:** Central Government is expected to have the highest security attached to its bonds followed by State Government and then, Corporates.
- **Marketability:** Though the marketability depends on the size of the issue as well as the tenure of the bonds, the corporate bonds are typically less marketable than the corresponding government bonds. And again, Central government bonds take the lead here.
- **Liquidity:** Central Government bonds usually enjoy the highest liquidity followed by State and Corporate bonds.

Considering these factors, the yields on Corporate bonds are expected to be highest of the three to compensate the investors for lower marketability, liquidity and security, followed by the yields on State government and then the Central government.



[4]

[6 Marks]

Solution 2:

Individual strategy will depend on individual's risk appetite, other saving for retirement, level of contribution, personal choice/preferences, Scheme restriction if any.

Ideally investment strategy should follow a "Lifestyle" approach.

This can be looked at as follows-

- Growth Phase- 10 years before retirement-
 - The aim at this point is to maximize the value of savings by investing in growth assets
 - Start with a high exposure to real assets like equity/property fund
 - A judicious mix of both could be appropriate initially.
 - The exposure to equity /property fund could start of at 100% gradually tapering off as retirement approaches
 - Since time horizon for investments is 20 years, property fund could actually yield better returns than equity
 - Likely that fund management charge for property fund could be higher.
 - Property fund could also be subject to more volatility due to lack of depth, marketability issues.
- Mid stage - 5to 10 years before retirement.
 - The aim is to start building a less risky portfolio
 - Could move his portfolio from property fund to equity fund
 - Could still continue with close to 60-80% exposure to equity/property
- Close to retirement stage 2-5 years before retirement
 - The aim is to protect from significant volatility
 - Gradually move investments to debt so that end of 5 years about 40% exposure to debt and 60% to equity
- Nearing retirement – less than 2 years
 - Aim at this point to protect the savings from volatility
 - Gradually move into Money market funds to allow it to take the savings as lump sum to purchase an annuity

[6 Marks]

Solution 3:

The fund will need to consider the following factors:

- Do they have the cash to lend?
- Size of the loan relative fund assets
- Is the loan appropriate to the fund's investment objectives?
- Here since the liabilities are inflation linked, the fund need to earn more than the government bonds but nor inflation proof
- Subject to risk appetite as mentioned in the Trust deed & Rules.

- The rate of return being offered compared to the return from government and corporate bonds of similar term.
- Existing capital structure of the company- debt, equity, leverage.
- Whether the debt will be secured on specific assets- secured or unsecured.
- Whether this debt will be subordinate to other debt owed by the company.
- The purpose of the loan.
- The tax treatment of the interest payments/repayment of loan.
- Any supervisory or regulatory issues (and whether this is allowed under the trust deed/rules) surrounding a loan of this nature.
- For example, is it allowed for a pension fund to lend money directly?
- Will the loan be admissible as an asset for demonstrating funding level for regulatory purposes?
- Any ethical issues in making loan?
- Marketability of the loan.
- Existing holdings of the same company in the form corporate bond, equity etc. within the fund and whether this will cause a concentration of risk.
- Whether the term of the loan matches the liabilities of the fund.
- Cost of administering the loan.
- Is it a related party transaction/ made to sponsoring employer or any of the group companies that the loan is to be made to?
- A detailed analysis of the company will need to be carried out, looking at information both in the public arena such as financial statements, to decide on the credit worthiness of the company and also:
 - Business plans
 - Management/character of the company
 - Product
 - Outlook for the sector and the market
 - Competitive position
- The fund should consider whether better terms could be obtained through negotiation.

[9 Marks]

Solution 4:

- i) To calculate the IRR will require the amount and timings of all cash flows so will need to know (or make a reasonable estimate of) the following:
- Initial cost of installation
 - Any available grants
 - taxes saved in future from government tax benefits
 - Cost of electricity bill saved by producing own electricity which will in turn depend
 - Future expected electricity usage which is a function of on climatic conditions
 - Expected inflation rate for electricity charges
 - Expected maintenance costs and timings , insurance, etc of running the turbine farm
 - Expected inflation for maintenance costs
 - Expected lifetime of the turbine

- Any residual value (could assume zero residual value) or termination cost
- Any possibility of selling any generated electricity over that needed by the farm and expected income from this. [5]

ii) Can calculate the net present value. All income and outgo will be discounted at a suitable discount rate. This rate could be cost of raising incremental capital. A positive NPV would be considered satisfactory.

Payback period could also be used. This is the length of time before the capital expended on the project is recouped from the net revenues without discounting the cash flows. This is easy to apply and easy to understand and so can be useful for an individual without a financial background.

A variation is discounted payback period. This is similar to payback period but takes account of the time value of money. This should still be relatively easy to understand and is likely to be more useful for a long term project. [4]

iii) An eco-friendly measure. This may be used when selling produce. There may be upside potential as this decision could lead to increased sales if used in marketing.

It will be necessary to decide if this is the best way of using what may be scarce funds and also if this is the best way of using the farmers' land?

Since a group of farmers are getting together, it is necessary that the capital/land each farmer is going to contribute to the project and share of power generated and revenue generated if any should be agreed in advance

There should be dispute resolving mechanism in case of any disputes between the farmers.

May wish to consider alternative renewable energy schemes like bio fuels from cost vs benefit perspective

It will be necessary to investigate the risks involved in the project and come to a view on the best course of risk mitigation, having regard to the costs involved, e.g. can estimate maintenance costs and mitigate against any unplanned increases by using a long term maintenance contract to fix the price.

Will need to consider whether planning permission is likely to be given. Are there likely to be any objections? Have any other farms been built and maintained locally? If so, do they differ in any way? [5]

[14 Marks]

Solution 5:

i) The principles of investment are that an insurance company should select investments that are appropriate to the nature, term and currency of its liabilities.

The investments should also be selected so as to maximise the overall return on the assets, where the overall return includes both income and capital.

The extent to which the company may depart from investing in appropriate investments in order to match its liabilities, depends amongst other things on the extent of the company's free assets and the company's appetite for risk.

OR

The company should invest so as to maximise the overall return on the assets, subject to the risk being taken on being within the financial resources available to it. [2]

ii)

- As the company wants to optimise capital usage it will have to pursue as far as possible a policy of closely matched assets and liabilities.
- Liability outgo consists of annuity payment plus expenses
- One of the type of annuities is the level annuity -liability outgo is fixed in nature followed by payout of SP less annuities paid therefore suitable matching assets would be fixed interest securities.
- Relative to a pure life annuity the duration of the liabilities is likely to be short term depending on the age and health composition of the portfolio hence, the bond durations should also be relatively short.
- The guaranteed return of the premium less annuities paid on death could be onerous. It would be necessary to project the expected timings of deaths to determine expected duration of liabilities.
- Ideally fixed interest securities should be chosen so that the expected cash flows from the bonds match those in respect of the liabilities i.e. so that a combination of coupon and redemption payments is expected to be sufficient to match the annuity payments. Bonds with a range of terms may be held to help achieve this.
- In reality it may not be possible to achieve exact cash flow matching nor it could be an optimal usage of capital matching hence the best option would be to achieve duration matching
- The currency of assets should be the same as that in which the annuities are written.
- Government bonds are recommended as they are secure and are usually liquid which would help to meet death benefit payments.
- Moreover, government securities may carry no credit risk capital charge in solvency calculations
- Some proportion may be invested in corporate bonds to increase returns/match pricing strategy but increase in required capital due to credit risk needs to be kept in mind.
- A large part of the extra return comes from accepting the liquidity risk associated with corporate bonds and this is acceptable as the immediate annuities cannot be surrendered, and so part of the liabilities is illiquid.
- high grade bonds should be invested in to optimise capital usage- a risk return trade off has to be done

- To reduce the impact of default of a corporate bond, the company should invest in a diversified portfolio of corporate bonds by companies/sector.
- The company could use credit derivatives to reduce the risk of default but this also has a cost
- The other half of the annuitant liabilities are price index-linked in nature. Index-linked bonds could be considered the best match for these liabilities if such assets are available (in the currency) and
- assuming that the same index is used for inflation-linking the assets as for the liabilities. If not, then bonds linked to a similar or correlated index may be the best match.
- There may be a lag in the index used for index-linking the bonds which could create a mismatch if the index is volatile in the short term. This needs to be managed
- There will also be an expense liability for both types of annuity. This will increase broadly in line with inflation which might be linked to a mixture of price and wage inflation so the recommended backing assets are as for the index-linked annuity.
- It is recommended that generally no equities/property are held to back the claim liabilities unless more suitable assets are not available.
- Although investing in property and equities would be expected to outperform fixed interest in the long term and in the long term provide a hedge against inflation both would be more volatile than fixed interest and so will cause a mismatch between income and outgo.
- The surplus assets (i.e. assets in excess of the liabilities) could be invested in equities and/or property to gain higher returns. However, this may not be optimal usage of capital
- The company needs to keep sufficient assets in liquid assets like cash and/or other money market instruments to meet the outgo on early deaths and any short term cash flows.
- New business premium inflow could be used to manage liquidity (to permit greater investment freedom for the remaining assets) although care would be needed as new business is not guaranteed.
- Overall, the best investment strategy might therefore be (very approximately) 50% fixed interest bonds, 50% index-linked bonds (or other strategy, if justified).
- It will be necessary to consider diversification of assets, avoiding concentration where possible and reduce a concentration risk capital charge.
- It will also be necessary to consider any regulatory restrictions e.g. restrictions on holding certain assets, levels of mismatching allowed (e.g. no currency mismatching).
- It may also be necessary to consider the risk appetite of the shareholders, if there are any.

[12]

[14 Marks]

Solution 6:

- i) The discounted dividend model derives the value of an equity shares as the discounted value of expected future dividend stream.

The general model can be expressed as-

$$V = \sum_1^{\infty} D_{(t)} v(t)$$

V is the value of the share

D(t) is the gross amount of the t th dividend payment

$v(t)$ is the discount factor between 0 and time of t th dividend payment

Simplified model is derived by assuming

- Dividends are paid annually and the next payment is due in one year's time
- That dividends grow at a constant rate g per annum
- The required rate of return i , is independent of the time at which payments are received.

With these assumptions the above equation simplifies to $V=D/i-g$, where D is the dividend to be paid 1 year from now [4]

ii)

- We do not know the value of i , to use in the model
- The assumption of constant required rate of return, i , over time may not be appropriate
- We do not know what "g" should be
- Constant dividend growth is not a realistic assumption
- Alternatively, use different rates of growth, a short term rate of growth for a period until it settles down to a long term average
- The results are very sensitive to absolute level $i-g$
- The equation ignores tax
- Tax payers should use net dividends received and suitable after tax rate of return, i.e,
- Use different rate of D and i . D should be annual dividend net of tax and
- i should be constant annual net rate of return required by investor
- This model assumed annual dividend payments although payments may be more frequent

[5]

iii)

- The company is young and hence the discounted dividend model may not be appropriate for determining the value of the company's shares.
- Alternative is to determine a relevant and measurable key factor of the company's business
- Key factor which could be-
 - Average order size and number of transactions
 - Site traffic
 - Conversion rate: total of visitors to site /by total no of conversions
 - Inventory levels, Stock/turnover-how much is at hand, how long it sits, how quickly it sells
 - Revenue per visit
 - Creditors/turnover which is an indicator of how much payment to suppliers is delayed
- The relationship between this factor and the market price of other quoted companies can be taken as the basis for valuation
- The problem is not many "on line" grocery companies could be listed, we can look at -
 - Other listed e commerce companies or look at valuations the ecommerce companies are getting at the time of raising fresh capital wither domestic or abroad
 - Look at 'brick and mortar' listed grocery chain
- Market share of company

- Discussion with management about aims and objectives and future plans
- The issue is any reference to companies abroad may need to be adjusted to allow for differences in market maturity, cultural differences, political and economic differences, size of companies, etc.

[6]

[15 Marks]**Solution 7:**

- i) An investment scheme, which gets closed to new money once the initial tranche of money is received and invested, is known as closed-ended fund. The only way to invest in a closed-ended fund is to buy units from an existing investor who might be willing to sell off his share.

In contrast, in an open-ended investment scheme, money continues to be invested and dis-invested on a regular basis. Investors are allowed to put in or withdraw money in an open-ended scheme even after the initial tranche is invested. [2]

- ii) Factors influencing the decision of investing in an open-ended or closed-ended fund:
1. **Regulations governing both funds:** The investors would typically be interested in what kind of assets can be held under both the schemes and whether there are any restrictions on holding a particular type of asset such as unquoted assets etc.
 2. **Level of gearing:** Different investors would get attracted by different level of gearing depending on their requirements and objectives. Hence, fund's financial leverage would influence the investors' decision.

Usually, open-ended funds cannot be geared or geared only to a limited extent.

3. **Tax rules:** In few economies, tax might be a significant deduction from the investment income and any differential in tax treatment or the tax rate between open and closed-ended schemes would incline the investors in favour of one over other.

4. **Preference for liquidity:** The marketability of the units in open-ended funds is much more than closed-ended funds, so investors looking for a relatively liquid investment are more likely to prefer open-ended funds.

5. **Volatility:** The volatility in the prices of closed-ended funds could be more volatile than the open-ended funds when compared with the volatility in the underlying value of assets. The investors looking for a stable portfolio might consider open-ended funds as a preferred choice.

6. **Choice of assets:** Closed-ended funds by virtue of being fixed in amounts and tenure are able to invest in a wider range of assets compared to open-ended funds.

7. **Other considerations:**

- Level of brokerage/fees

- Lock-in period, if any [5]

- iii) The term 'Emerging Market' refers to the developing markets which are going through the phase of rapid industrialisation and hence, the economic growth. These markets are usually classified as low or middle income as per the current level of growth, but have the potential of significant growth in the coming years.

These markets offer a very high returns on investments but at the same time are very risky investments in nature and can be quite volatile as well. [2]

iv)

- Index tracking is passive management while the 2nd option is more active fund management
- Passive management will involve portfolio manager tracking the index rather than taking active decisions.
- The objective of a portfolio manager in an actively-managed fund is to beat the market,
- Fund manager must take on additional market risk to obtain the returns necessary to achieve this end.
- Index funds are also traded less frequently, which means that they incur lower expense ratios and
- are likely more tax-efficient than actively-managed funds.
- Index mutual funds are easy to understand, and as such offer a relatively safe approach to investing in broad segments of the market.

Hence while determining which option to choose-

- Where in the market spectrum the mutual fund product is to be placed.
- As a first time overseas investment for small retail customers or as sophisticated fund choice to HNI and institutional investors.
- What are competitor offerings
- To do active fund management the mutual fund needs to build in-house research, market forecasting and the experience and expertise of the portfolio manager or management team.
- The problem will be compounded since it is in emerging markets where
 - Lack of information and public disclosures, accounting differences,
 - Cultural differences, language issues
 - Level of regulatory maturity

will be different to home country

- Hence active fund management will be much more expensive relative to passive index tracking and can be justified if sufficient sales are expected
- Passive index tracking is also impacted by choice of index
 - If index is very broad based replicating the same can be administratively cumbersome
 - Overseas investments across multiple geographies is never easy
- This is first such fund for mutual fund hence initially index tracker could be preferable provided target market and fund objectives can be met

[7]

[16 Marks]

Solution 8:

- i) Aim of risk management process is to protect its stakeholders against adverse experience that could result in its not meeting its liabilities.

The key stakeholders in a health company are its shareholders and its key liabilities are policyholder benefits.

Risk management process encompasses protecting the company’s solvency and security of policyholder benefits. [3]

ii)

- Initial Underwriting
 - Medical Underwriting
 - Financial underwriting for fixed benefit products
- Claims control procedures to reduce fraudulent or excessive claims
 - Claims underwriting –checking validity of claims
 - In case of sickness claims checking for continuous validity of claims
- Management control systems
 - Data recording
 - Accounting and auditing
 - Monitoring of liabilities taken
 - Review of Options and guarantees
- Reinsurance
 - Surplus insurance for protection against one off large claims
 - Aggregate XoL to protect from aggregation of claims

[5]

iii)

<p>Regulators do not approve actuarially justified premium increases</p>	<p>Company and competitor premium rates</p> <ul style="list-style-type: none"> • Compiled information about competitors on Number of filings that are accepted without changes, accepted with changes, and withdrawn • Political/regulatory environment • Political environment – for eg., is parliament questioning raising premiums, profits of insurance companies • Political issues identified by industry association relating to industry • Regulatory news on health insurance industry, outlook • Regulatory actions –inspections reports released , penalties issued • Press releases from regulators regarding rate filing • Loss ratios – industry trends
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	<ul style="list-style-type: none"> Loss ratios- increases in trends in company vis-a-vis industry which could cause issues that increases may not be approved
Unexpected customer behaviour leading to pricing assumptions not being realized.	<p>Emerging results</p> <ul style="list-style-type: none"> Actual vs. expected for each assumption, by product and customer segment Actual vs. expected sales for each product, options and add-ons Business Mix i.e., gender, age, product choice/add-ons/options, geographic mix Monthly financial results vs. Budget Monthly trend analysis and reporting on business mix, loss ratios Sales comparison with competitors Utilization of SI experience Loss ratios trends by key business segments
Under estimation of medical inflation leading to mis-pricing	<p>Emerging experience</p> <ul style="list-style-type: none"> o Claims data reported is trending higher than Plan o Changes to mix of business – actual vs. expected, indicating some level of anti-selection o Changes in mix of services- for eg., surgical vs non-surgical and inflationary trends in both o Monthly trend reporting/analysis – frequency and severity for major reasons of claims <ul style="list-style-type: none"> o Trends in rate increases negotiated with hospitals • Competitor information <ul style="list-style-type: none"> o Market intelligence on premium rate increases gathered from sales and regulatory filings o Competitor earnings – has there been a drop and subsequent actions o Competitor pricing trends as seen in large group renewals

[12]

[20 Marks]
