

Institute of Actuaries of India

Subject CA1-I – Actuarial Risk Management

September 2016 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:

A risk is insurable if:

- the policyholder has an interest in the risk
- the risk is of a financial and reasonably quantifiable nature
- the claim amount payable is commensurate with the size of the financial loss.

The following criteria are also desirable for a risk to be insurable:

- individual risks should be independent
- the probability of the event occurring should be relatively small
- large numbers of similar risks should be pooled to reduce variance
- there should be a limit on ultimate liability undertaken
- moral hazard should be eliminated as far as possible
- there should be sufficient existing data / information in order to quantify risk.

[4 Marks]

Solution 2:

- From the point of view of insurer, mortality risk is a systematic risk. Hence its effects can only be mitigated or transferred.
- Mitigation can be achieved by charging high enough premiums for new risks, provisioning adequately for existing risks,
- Co. May do extensive initial underwriting for fresh proposals and claims underwriting.
- This might increase premiums to an uncompetitive level and result in loss of business.
- Risk transfer can be achieved by passing the risk to a reinsurance company.
- As the reinsurer will be able to diversify risks across a large portfolio, likely that reinsurance premium could be lower than the cost of the company itself putting up the capital.
- However since it is a new company, capital may be an issue.
- But reinsurance premium will be loaded for profits and expenses and company will pass on mortality profits as well to reinsurer
- Co. may diversify its mortality risk by trying to move into other markets with new products
- For eg., any form of annuity product will diversify some of the Mortality risk,
- Provided annuities are sold to a population profile that is similar to term assurance policyholders.
- i.e., for a good match /diversification it is necessary to look for products that match the age and duration of the assurance mortality risk.

[5 Marks]

Solution 3:

Possible reasons for 80-100% equity

- As per investment objective communicated to customers (for e.g. “predominant exposure to equities”).
- Hence minimum exposure pegged at 80%. Fund manager cannot go below this
- This is the mandate allowed by regulator for equity mutual funds
- To keep mandate comparable to competing funds in the market

Possible reasons that the company may be holding 0% -20% cash:

- To meet on going expenses for managing the fund
- Possibly redemptions are uncertain and hence need to hold some liquid assets
- scheme may want exposure to ill-liquid stocks which may not be easy to liquidate under redemption pressures or to meet expenses
- In order to take part in attractive investment opportunities that may arise from time to time
- When large inflow from investors in the fund and fund manager wants some flexibility to time his entry into the equity market
- Economic circumstances that could make the outlook for equity markets pessimistic thus making some exposure to cash attractive and hence to allow for such circumstances as well

[5 Marks]

Solution 4:

i)

Asset	Required Return	Expected Return
G- Bonds	Risk-free Real Yield + Expected Inflation + inflation risk premium	GRY
G Index Linked bonds	Risk free Real Yield + Expected Inflation	Real yield + expected inflation
Equity	Risk free Real Yield + Expected Inflation + equity risk premium	Dividend yield + expected dividend growth
Property	Risk free Real Yield + Expected Inflation + property risk premium	Rental yield + expected rental growth

[4]

ii)

From above

$\text{rental yield} - \text{GRY} = \text{property risk premium} - \text{inflation risk premium} - \text{expected rental growth}$

- Inflation risk premium is low due to lower uncertainty around future inflation
- Low rental growth expected due to poor economic conditions
- High risk premium for property due to Characteristics of property - To allow for risk of default, marketability, indivisibility, rental voids etc. – Given property characteristics are such that they are risky, or less marketable, requires big investment, risk of void etc., the yield on property yield can be higher than that of conventional government bonds
- Over supply of government bonds or Under supply of property or both

[3]

[7 Marks]

Solution 5:

i) Steps necessary to deal with the risks

Risk identification

The steps here will include:

- conduct a high-level preliminary analysis to confirm that the project is not such a high risk that it's not worth analyzing further
- brainstorming with experts, including senior internal staff, project experts and external people who are used to thinking in the long term
- carry out a desk-top analysis, to supplement the results of the brainstorm session, for eg
 - identifying further risks and mitigation options
 - researching similar projects
 - obtaining opinions from other experts.
- entering the information into a risk register / risk matrix.

Risk analysis

The aim here is to estimate the frequency of occurrence of each risk and the financial consequences if it occurs ...

... as well considering any interdependencies between risks ...

... and the degree of controllability of each risk.

Risk mitigation

- avoid the risk, eg by redesigning the project
- reduce the risk, by reducing the frequency of occurrence or reducing the adverse consequences if a risk does occur, or both
- conduct further research to reduce the uncertainty of the risk
- evaluate each mitigation option, by analysing its effects on frequency, consequences, expected value etc
- transfer the risk, eg by subcontracting
- insure the risk
- share the risk with another party.

Finally, it is necessary to develop monitoring processes and contingency plans for managing the residual risks that are not mitigated.

[6]

ii)

a) Four major risks facing the project

(I) The railway station may cost a lot more (or less) to build than anticipated ...

... eg due to failures in the technology/engineering faults and/or the novelty of the methods and materials used.

(II) The actual number of passengers using the rail mode of travel may be very different from that anticipated leading to lesser revenues than estimated...

... eg due to poor frequency of trains or unsuitable timings or overoptimistic estimates.

(III) It may prove more difficult or costly than anticipated to raise finance for the project ...

... eg if private sector partners are difficult to find or they subsequently run into financial difficulties

(IV) It may prove costlier than anticipated to acquire the land required for building the station..

.. eg if factory owners are not readily selling the lands or are demanding very high price for the land.

[4]

(ii)

b) How each of the risks could be mitigated

- (I) The risk of possible cost overruns could be mitigated by transferring the risks to a subcontractor on a fixed price contract ...
...getting insurance for loss of revenue from delay in project completion
- (II) The risk relating to the number of passengers could be reduced by undertaking further research or a feasibility study to gain more precise estimates of the possible future passenger numbers ...
... or by allowing booking of tickets in advance for a period of 4 months or so .
- (III) It may be possible to underwrite the raising of the private sector share of the required finance.

The financial position of all private sector partners should also be assessed and monitored very carefully and the financial backers diversified.
- (IV) The risks as regards acquiring of land can again be mitigated by surveying the site very carefully beforehand and gathering relevant information about market rates, and the .

Some of the risk can be passed to the subcontractor who will carry out the clearance.

[4]

[14 Marks]

Solution 6:

- i) **Rating factor** : A factor used to determine the premium rate for a policy, which is measurable in an objective way and relates to the likelihood and/or severity of the risk. It must, therefore, be a risk factor or a proxy for a risk factor or risk factors.

(Alternative definitions : *Rating factors* are the measurable characteristics of a particular risk that will affect the size and/or likelihood of a claim. The factors used in setting premiums are known as rating factors.)

[1]

- ii) Examples of perils covered under marine insurance cover are :
- Perils of the seas (or other navigable waters)
 - Fire
 - Explosion
 - Jettison
 - Piracy etc.

[2]

- iii) Risk and Rating factors for marine hull and cargo insurance :

Risk factors :

The main risk factors for marine property are the size, type and condition of the vessel and the nature of the cargo.

Rating factors for marine property insurance are :

- the type and value of the craft
- the scope of the voyages
- the areas covered or the destination
- the number and experience of the crew
- previous claims experience.

Other rating factors might depend on the associated marine liability cover.

[2]

- iv) Business risk is specific to the business undertaken, in this case, marine insurance. These include the following :

Underwriting risk

- Potential risk of underwriting process being inadequate leading to inappropriate premiums being charged.
- The Company might have developed good data but nature of risks change over time or new risks are perceived which might be difficult to price eg., piracy developing in some part of the world, new type of cargo etc.
- If the risk classification process is inadequate, there is an anti-selection risk, *ie* the risk of applications by persons who are more prone to risks or have prior adverse claim history, being underwritten at normal premium rates.
- Company may not have skilled underwriting staff experienced in this field with sufficient knowledge of rating factors and underwriting criteria for marine insurance. Company may have to hire staff. There is a risk that the required personnel are not easily available

Insurance risk(*This covers pricing, Claims, expenses , reinsurance risks among others*)

Claims risk:

- There is a risk that claims are made with a greater frequency than expected or claim amounts are higher than expected due to one or more of the same reasons as above .
- Large individual claims – for example, the loss of a large ship at sea.
- There is a risk of an aggregation of claims, eg., a storm hits a harbor and many insured ships are damaged.
- There is also a risk of variable claims experience in general, since claims experience is heavily dependent upon weather
- Claims may be more volatile than expected, leading to a risk that the provisions held to back the contract are insufficient and ultimately a risk of insolvency.
- There is a risk of latent claims – i.e., claims not anticipated when the insurance was sold and hence were not reflected in the premium
- Risk of greater incidence of fraudulent claims

Expense risk: There is a risk that the administrative expenses are greater than expected due to lower volumes of business, lower renewals after one year or due to higher than expected inflation.

- There is a risk that claims handling expenses are greater than expected, *eg* due to inefficient processes or more small claims with proportionately higher expenses than expected.

Reinsurance risk:

It is likely that reinsurance will be used since the risks would be large. Business risks relating to reinsurance include:

- inadequate appreciation of the scale of the risks taken on by the insurance company and hence of its reinsurance needs
- doubts as to the availability and cost of the desired reinsurance

- reinsurance that is poor value for money
- failure to comprehend the coverage / limits of a reinsurance arrangement.

Pricing risk:

This may be due to:

- inadequate data when pricing
- Use of inappropriate/irrelevant/insufficient rating factors
- Use of incorrect data either from industry or from reinsurer

Other risks:

- loose policy wording
- bad publicity surrounding a particular product
- moral hazard
- changes in legislation.

Financing risk:

- There is a risk that this insurance represents poor value for money to the shareholders.
- Also the line of business may be loss making requiring further infusion of capital to support claims and new business

Exposure risk:

There is a risk of insufficient sales volume due to the state of the economy, competitive pressures, *ie* premiums too high, an unfavourable stage in the underwriting cycle.

Alternatively, sales volumes could be too high, leading to an unacceptable level of new business strain.

There is a risk that the mix of business is not as expected.

For example, if the pricing is such that renewals will subsidise new business, then there is a risk that not enough policies renew (*ie* that persistency is poor).

[13]

[18 Marks]

Solution 7:

i)

- Expectations theory describes the shape of the yield curve as being determined by economic factors, which drive the market's expectations for future short term interest rates.
- Liquidity preference theory: Investors require a greater return to encourage them to commit funds for a longer period so yields should be higher than expected for long-dated stocks.
- Inflation risk premium: Inflation risk is greater in the long term so yields should be higher than expected for long-dated stocks.
- Market segmentation / preferred habitat theory: Yields at each term are determined by supply and demand from investors with liabilities of that term, so yields on short and long bonds may therefore move somewhat independently.

[4]

ii) Features that influence yield differences are :

1. Supply/Demand :

The yield of any fixed interest security is a function of the price. The price will be influenced by the laws of supply and demand.

2. Marketability/Liquidity :

In general, government bonds provide the most secure and marketable fixed interest investment in a particular currency, and in developed economies they are risk free.

Corporate Bonds may have low marketability due to small issue size or because it is infrequently traded leading to high yield differential

3. Credit Risk :

Investors will require a higher yield on Corporate debt as compared to G-Sec for the higher risk involved.

The size of the yield differential depends on both the credit (default) risk and the marketability of the corporate bond issue.

A particular bond may have high credit risk: due to a low credit rating (specific risk) or due to high credit spreads in the relevant sector (systematic risk).

4. Different terms of issue:

A corporate bond or a G Sec issue may have features that make it particularly desirable/undesirable to certain classes of investor, for example a high coupon on G sec might attract institutional investors, if coupon is tax free thus increasing yield differential compared to a low coupon Corporate bond issue

5. Tax Considerations :

Investors are concerned with post-tax returns, so different tax treatment between government and corporate bonds are reflected in the yield differential.

6. Low expected future economic prospects might drive investors away from Corp bond and towards G Secs. Increasing yield differential , or, high corporate growth prospects of issuing company, may make corporate bond more attractive leading to low yield differentials.

[4]

iii)

Common points to consider- applicable to both GI and Life companies

Attractiveness of the Yield

- Spread on the bond compared to other corporate bonds of same rating and duration
- Spread compared to government allowing for risk of default and marketability

Tax considerations

- Compared to other asset classes
- Compared to other corporate bonds
- There may be special relaxations like tax concessions etc for investments in certain sectors like infrastructure and CSR activities. Hence the insurer may invest in such corporate bonds

Marketability and liquidity (might be more desirable for GI companies)

- Compared to other asset classes

Security

- Rating of bond
- Whether secured or unsecured
- General economic environment and market of cement industries and its future outlook.
- Credit worthiness: Financials of the company itself like P/E ratio, past dividends, any defaults in past, any regulatory or other penalties or sanctions, management team of the company, listed or not listed etc.
- Options available with the bond - Or may have embedded option such as, convertible loan stock
- Diversification – against other investments such as government bonds, or equities or property

- Investment policy – does the company's investment policy have restriction on investment in corporate bonds, or restriction of investment in cement industry or this company in particular, or does it require some minimum criteria to be met before investing in corporate bonds such as minimum rating etc.

Term of liabilities

- Motor mostly short term except for motor third party. Property is also generally short term business
- annuity is generally a long term liability hence the tenure of the bond might not be suitable but
- Very likely that long dated bonds are not available
- For both companies the bond may be attractive for investing assets backing free shareholder funds where the intent might be to maximize returns subject to acceptable risk

Nature of liabilities

- Fixed or inflation linked. E.g. for life, a good match for fixed monetary liabilities, if annuity is fixed it might be suitable
- If the life insurer is mature and therefore has a substantial portfolio of annuities in payment (as against substantial in-deferment annuities) then liabilities will increasingly be well matched by fixed-interest bonds but the 5 year term may be short. Need to look at duration of liabilities
- For general insurer, suitable as liabilities as most liabilities except for motor 3rd part liability are short term and could be taken to be fixed in nature
- Peer pressure - Other insurers/competitors buying it

[10]

iv)

- Depends on level of free assets available with life and general companies. Over and above regulatory solvency position
- For GI company, depends on level of volatility the business is exposed to ; especially if business is geographically concentrated (motor and property business), exposed to catastrophe, natural disaster and has limited reinsurance etc. this could easily wipe away the free surplus in no time. Hence may think twice before too big an exposure to the Corporate bond.
- Quantity of purchase involved. So if the company does not intend to buy too huge amount of the issue, then it may not have material impact of the solvency.
- For a life company, it also depends on which product the asset is marked to. For example if the bond is purchased for annuities which do not vary with an index (like index for fixed interest securities) then purchasing the bond might be worth the 10% fall in admissibility. It increases matching of liabilities and hence might actually reduce reserves or margins required in reserving. Hence net impact could be limited
- The return on the bond might be worth taking the hit on admissibility for both companies.

[4]

[22 Marks]

Solution 8:

i)

- Revisit the definition of profitability
 - Need to understand how profitability is defined. Is it based on accounting P&L or claims ratio or combined ratio or some other parameter.
 - Further, does it allow for cost of capital. Is it looked on basis of s/h IRR or NPV at RDR
- See if excess reserves/IBNR is kept or basis/methodology of reserves

- Revisit reserving assumptions and methodology and see if the profitability is getting dipped due to excessive prudence in reserves or some error in calculation
- The impact of this is better reporting of results and release of capital
- Revise premium rates upwards
 - This may lead to loss in new business, which further depends on competition
 - Need to take views of marketing and distribution channels regarding any increase in premium rates
 - May lead to lower persistency on renewal
- Revisit volumes and mix
 - Check if it is due to very low volumes being written leading to not able to recoup fixed expenses
 - Check if there is a shift more towards loss making mix
 - Is there any particular age group where loss is more? Try to restrict age if higher is giving more claims than expected
- Change in target market, distribution channel and geographies
 - What is the target market? What is the average case size? Can revisit to sell more affluent class or can move towards rural markets depending upon pricing
 - Is there any particular distribution channel which is bringing loss making business; revisit the channel or stop sales through that channel
 - Is there any particular geographies where claims experience is worse. Stop sourcing through those areas
- Frauds / anti-selection
 - Check the list of all hospitals from where claims are made. Are there any particular hospitals which tend to inflate bills. Are there any fraudulent cases happening in such hospitals where hospital is also involved. Remove/blacklist or debar such hospitals
- Policy wordings/Product design
 - Is there any anti-selection due to policy wordings?
 - Revisit definitions. See if some policy wordings are loose and open to interpretation
 - Revisit/ change exclusions, waiting period etc. such as exclusion of pre-existing disease etc.
 - Capped amounts of benefits such as room rent or cap on doctor fees etc or cap on amount paid on any particular illness
 - Reduce/remove no claims discount
 - Introduce/increase co-payment
 - Check if there is any moral hazard due to policy design. Such as including knee replacement surgery with loose wording or dental checkup etc
- Does the premium rate allow for medical inflation appropriately or has medical inflation been higher than assumed
- Stricter underwriting
 - Revisit the underwriting rules. Start doing sample checks through independent personnel

- Revisit proposal form and check for declarations/questions asked. If needed, change or increase them
- Claims underwriting - Introduce investigation into early claims or high claim size
- Revisit/reduce expenses
- Revisit distribution channel used
- Check for persistency/renewals
- Revisit commission paid, initial and renewal
- Revisit investment strategy

Impact

Wherever there is impact of change in premium rates, or any other kind of restriction on age or geographies or tighter underwriting etc., this shall either lead to lower sales volumes or lower renewals or higher expenses or a combination of these.

Hence, needs to be discussed with marketing and sales persons. The cost versus benefit analysis needs to be done before implementing any change.

Similarly, competition practice or market practice needs to be looked at

Any change in investment strategy need to be looked from risk appetite, investment policy and regulatory point of view.

Also, need to look into regulatory position of changing any benefit or design or wordings

[15]

ii)

How to use existing indemnity data

- Need to consider the disease/illness covered in critical illness and whether the indemnity data covers details of reasons for hospitalization, with appropriate and adequate classification of underlying condition, for eg., CI definitions are specific and require specific diagnostic tests and hence generic recording for cause of hospitalization might not be enough.
- The terms and conditions of CI product versus that under indemnity product such as exclusions, waiting period etc. may be different and hence data may not be appropriate without some adjustment
- Need to allow for differences in underwriting and claims practices between the 2 products
- Need to allow for medical advancements in future etc. for detecting critical illness new types of diagnostic tests or increase in awareness which could leads to change in CI incidence rates, which might not be reflected in past indemnity data.
- Also, need to allow for any change in target market, distribution channel etc. to be used in critical illness product compared to that of existing indemnity product data
- CI policy may not pay claims in case of death of policyholder within a definitive time period (for eg., 30 days) of being diagnosed with a CI. The indemnity data may not have such details

[5]

iii)

Issues to be considered

- Is the product expected to be profitable enough after offering 10% discount.

- This should be looked at in conjunction with the saving of acquisition costs. Are there any saving in acquisition costs given we already have details of customer and customer database and they may be loyal customers of the company
- Further, will there be nil or lower commission involved in such cases
- Expected higher volume and mix by offering discount, does it compensate for the discount
- Further, to whom should the product be offered among existing customer. If someone already had claimed for hospitalization of critical illness should we offer to them as well.
- Will there be any further/fresh underwriting involved – medical or declarations or should the existing data be used
- Will there be any anti selection involved if offered all existing customers and/or no medical underwriting involved
- Regulatory challenge – will it be allowed by regulator to have differential pricing for new and existing customer
- Is it the best way for increasing sales or any alternative has been looked into for eg., looking at new marketing initiatives, which could give better results.

[5]

[25 Marks]
