

Institute of Actuaries of India

Subject CA1-I – 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 :

[i] An insurer participating in an industry-wide scheme has the prospect of being able to compare its own experience with that of the industry as a whole (or that part of it represented by the participating insurers) as regards both the overall level and the pattern of the experience by the categories into which the data are classified.

Any significant differences point to a need for further analysis and re-design of existing product design, underwriting policy, claims policy etc.

Since an insurer is likely to be seeking to expand by attracting business from its competitors, it may be important to have an indication of the ways in which the characteristics of the business it is seeking may differ from those of the business it already has.

[ii] The actuarial body should be careful while interpreting the industry-wide data as there is potential for distortions arising from heterogeneity.

This is because the data supplied by different insurers may not be precisely comparable because:

- insurers operate in different geographical or socio-economic sections of the market
- sales methods/distribution channels are not identical
- the insurers will have different practices, eg underwriting, claim settlement
- the details/level of detail stored by insurers in terms of policies and claims will not be standardized (for eg., some insurers may store data based on age lbd, some nbd etc.).

Other problems with using industry-wide data may be:

- the data will usually be less detailed, or less flexible, than those available internally
- external data are often much more out-of-date than internal data
- the data quality will depend on the quality of the data systems of all its contributors

If one insurer makes a mistake (eg entering a figure in millions instead of thousands) then this invalidates the whole set of data. The more insurers that contribute, the more likely that one will make a mistake.

All insurers may not contribute and hence the standard mortality may not be representative of the industry experience.

[Total Marks – 7]

Solution 2 :

[i] Stock 3: $(4,48,000 \times 200) / 1.12 = 8,00,00,000$

Stock 2: $(4,00,000 \times 189 - 0.12 \times 8,00,00,000) / 1.10 = 6,00,00,000$

Stock 1: $(3,00,000 \times 196 - 0.12 \times 8,00,00,000 - 0.10 \times 6,00,00,000) / 1.08 = 4,00,00,000$

[ii] Forward rates of each of the stocks:

One year forward rate (i_1) is such that $108 \times v_{i1} = 102.857 \Rightarrow i_1 = 5\%$

Forward rate from year 1 to year 2 (i_2) is such that $10 \times v_{i1} + 110 \times v_{i2} \times v_{i1} = 108.356 \Rightarrow i_2 = 6\%$

Forward rate from year 2 to year 3 (i_3) is such that

$12 \times v_{i1} + 12 \times v_{i2} \times v_{i1} + 112 \times v_{i3} \times v_{i2} \times v_{i1} = 116.256 \Rightarrow i_3 = 7\%$

[iii] Total Purchase Price

$= (4,00,00,000 \times 102.857) / 100 + (6,00,00,000 \times 108.356) / 100 + (8,00,00,000 \times 116.256) / 100$

$= 19,91,61,200 \sim 19,91,61,000$

Present value of the total liability outgo at market rates of interest

$= 3,00,000 \times 196 \times v_{i1} + 4,00,000 \times 189 \times v_{i2} \times v_{i1} + 4,48,000 \times 200 \times v_{i3} \times v_{i2} \times v_{i1}$

$= 19,91,61,112 \sim 19,91,61,000$

[Total Marks – 7]

Solution 3 :

[i] Experience Items

- Expenses of managing and running the scheme
- Investment return on assets backing the scheme liabilities and surplus
- Salary increases rewarded by class of employees
- Death claims intimated
- Withdrawals (includes early/ill health retirements) and withdrawal rates by duration in service
- New Entrants to the scheme
- Any bulk transfers/exits/VRS schemes
- Contributions paid

[ii] Expenses higher than expected reduces assets / funding level (and vice versa)

- Investment return on assets higher than expected increases assets / funding level
- Salary increases higher than expected increases liabilities/reduces funding level
- Death- provisions for benefits payable on death are made through a separate arrangement, so more deaths than assumed will reduce liabilities and increase the funding level
- Higher no of Withdrawals of employees with less than 10 years service than expected reduces liabilities so increases the funding level
- Less withdrawals than expected leading to more employees crossing the 10 years service requirement which will reduce the funding level as benefits paid out are likely to exceed expected outgo
- Impact of New entrants depends on whether contributions paid in respect of them are sufficient to cover liabilities accruing
- Bulk transfers depends on assets / liabilities transferred in or out
- Contributions higher than expected increases assets / funding level

[Total Marks – 8]

Solution 4 :**[i]**

The view of the market participants on inflation has changed substantially due to some additional information received or due to some other factors/ indicators. As a result, the expectation on the reduction in future inflation will reduce the expected yield on the bonds

The demand for the bonds in that category would have sharply increased from the investors due to some factors(eg., regulatory changes, tax changes) making bonds in this category more attractive. If demand increases, the price of the bond will also increase and hence the reduction in yield.

The liquidity of the bonds in that segment would have improved significantly leading to reduction in illiquidity risk premium and hence the increase in the price of the bond and, therefore, the reduction in the yield

During the month, the credit rating agency might have improved the credit rating of the bond issuers. Improvement in the rating over the last month has led to reduction in credit risk spread. This would have increased the bond price and, therefore, the reduction in current yield.

The income tax and/ or capital gains tax on the corporate bonds might have changed leading to higher net of tax income/ gain. This will increase the price of such bonds and hence the reduction in yield.

[ii]

The following would have been considered -

Nature term and currency of liabilities- Company has real liabilities such as future claims management expenses and future claim settlements where the settlement takes longer and the amount of the claims settlement increases with inflation. Investing in equities is considered to be a good hedge against inflation.

Level of Free assets- The company has surplus assets and it wish to take risks to enhance the investment returns from its investment portfolio

Risk vs returns- Current Equity valuations are at attractive level i.e. Investment team is expecting attractive returns from equities

Be more aggressive in pricing and improve sales performance - The insurer wishes to be more competitive in the market and it believes that by enhancing the investment performance it can compete in the market on premium rates and can improve sales performance

Level of Diversification -To gain the diversification from fixed interest assets and/ or to enhance the return on economic capital

Currency exposure will determine level of exposure to Overseas Equities or the company could also expected to gain from overseas equity due to currency gains. Overseas equities could be considered match overseas real liabilities, diversification by exposure to other markets.

Any tax incentive or tax disincentives in fixed assets

Any relative advantage for equities on the Solvency requirements e.g. Statutory Solvency margin requirements for fixed assets are higher compared to the risks or Solvency requirements for equities are lower compared to equity risks.

[Total Marks – 12]

Solution 5 :

[i] The company may provide this benefit because:

- compulsion or encouragement from the State.
 - ✓ The State may offer tax incentives to employers to encourage such benefit provision.
 - ✓ It could be a mandatory benefits that any construction company has to provide.
- a desire to look after employees and their dependents
 - ✓ financially beyond the level provided by themselves.
 - ✓ as these types of work is more accident prone.
- a desire to attract and retain the services of good quality employees.
 - ✓ providing insurance benefits that employees perceive to be attractive.
 - ✓ providing benefits that are at least in line with those offered by competing employers.
- Employees will benefit from pooled arrangement in terms of costs and better management
 - ✓ The cost may be less than if they were to purchase personal accident insurance on their own.
- To increase the company's reputation or brand value.

[ii] The key features of life insurance contracts are:

- This is a regular premium contract offering premium rate guarantees for longer term.
- There is typically only one claim in respect of 1 member (as death only occurs once)
- They are used for protection against death as a result of accident or otherwise
- Usually limited delays in reporting or settlement of claims

The key features of general insurance contracts are:

- They are usually short term *i.e.* insurance cover is typically provided for a single year or for very few years).
- Premium rates are usually guaranteed for short periods and hence can vary in future depending on group claim experience
- There can be multiple claims from a single member in case of this cover for eg., total temporary disability followed by a subsequent death claim.
- If varying benefits are provided for each contingency (*i.e.*, different for partial disability, death etc)., then claim amounts are volatile from that perspective

- There can be delays in reporting or settling the claims as there may be time period before which a disability claim is accepted to ensure claim is indeed admissible.

[iii] Factors to discuss:

- Cost of internal administration eg., managing revised compensation package for all employees
- How should this cash benefit be determined based on likely expected cost of purchasing a stand alone insurance policy or otherwise
- What would happen if employee leaves before the end of the year, in a group contract, refund of excess premium paid can be claimed, while if paid as cash benefit has to be recovered from exiting employees
- A group policy would allow for cross subsidies among ages, allow expense savings, which will not be available when contract is purchased on an individual basis.
- Cash compensation payable would neither purchase the same level of benefits for an employee as a group contract for the same cost nor would the process of purchase be that simple (eg., underwriting may be more stringent).
- What if the cash compensation payable cumulatively comes out to be more than purchasing a group insurance policy for similar cover
- What is the Current market practice
- Employees perceptions- will cash in hand be perceived more positively than a group cover
- Value of benefits that can be purchased by employee with the cash compensation- it will vary with age, physical fitness etc. , unlike in a group policy it is possible to link the same to salary drawn, employee category etc. as group underwriting is more lenient .
- Tax implications for employees/Tax implication for employers
- How can it be ensured that employees use this cash benefit for purchasing insurance

[Total Marks – 14]

Solution 6:

[i] The two main purposes of the actuarial valuation of a benefit scheme are to:

- demonstrate the solvency (*ie* funding level) of the scheme
- determine the future contribution rate required.

[ii] Analysis of withdrawals

Group the data

.....by age, service and any appropriate member classes

Need to make sure service groups are set consistently with benefit steps

For age and service need bands/cells that are credible

i.e. may have to group in fairly wide bands or even treat as not-credible for each group compare actual withdrawals with expected number based on exposed to risk
comment on any unusual events (e.g. redundancy exercises)

[iii] Using the analysis

Could use it to determine appropriate withdrawal assumptions

...but would need to consider how credible the data is

...also whether experience of last 5 years is likely to be typical

Analysis may show whether step changes to benefit level are influencing employee behaviour

...if so, is it in the way that was intended (helping retention)?

...if not, could lead to review of benefits

...sensitivity of costs to changes in benefits (e.g. earlier vesting, uniform accrual)

Part of overall Analysis of Surplus for each valuation

Significant withdrawal profits/losses may suggest changes to assumptions/valuation method.

[iv] Internal staff responsible for administration for

- ✓ interfacing with the payroll system,
- ✓ updating the pensions scheme records,
- ✓ making benefit payments and transfer values.

Internal staff responsible for other,

- ✓ legal,
- ✓ IT,
- ✓ actuarial,
- ✓ investment

Communications provided:

- ✓ booklets,
- ✓ announcements,
- ✓ benefit statements,
- ✓ details of benefits just before retirement,
- ✓ member counseling,
- ✓ presentations to members / prospective members.

Expenses for

- ✓ trustee meetings,
- ✓ travel
- ✓ training.

External advisers,

- ✓ benefit consultants,
- ✓ legal,
- ✓ actuarial,
- ✓ auditors,

Investment managers.

External fees,

- ✓ regulator,
- ✓ government,
- ✓ levy.

IT system to link with payroll system.

And cost of upgrading for scheme improvement / legislative requirements.

Maintaining bank accounts.

Investment expenses.

[v] Reduce the cost of administration, communication, detailed correspondence with members, maintaining and updating IT systems, etc

Provide members with the necessary factual information at the minimum level required by legislation
charge members for transfer quotations

and withdraw any facility for free advice / counselling.

Reduce the number of trustees to the legal minimum.

Consider outsourcing significant elements of the scheme administration

more computerisation

Review role and scope of external parties, such as advisors, auditors

obtain market quotations for the (new) package of services required.

Simplify the investment strategy, e.g. by investing in tracker funds.

Close the scheme to new members,

so avoiding the need to provide information to new employees.

consider email correspondence with members

[Total Marks – 15]

Solution 7:

[i] The reasons why life insurance companies need capital are to:

- fund the strain from writing new business ...
- which may be particularly important in an environment where regulatory reserving requirements may be stringent and
- the level of retained earnings in the participating fund may be limited and hence capital may be required for smoothing bonus payouts in years in which the earnings are lower;
- attract new business as financial strength may be significant in determining new business levels (if considered important by potential customers and their advisers).
- increase free reserve which will enable the company to invest more freely (in the pursuit of higher expected returns for its policyholders and shareholders.
- provide the capital required to achieve its strategic aims, eg develop a direct sales force, undertake other major new ventures, acquire another company.
- provide the capital required to fund development costs such as computer hardware and software, product development etc.
- smooth reported policyholder bonuses and reported profits.
- improve the solvency position (especially in a time of increasingly stringent supervisory solvency requirements).
- increasing risk retention and reducing reinsurance requirements;
- cover the risks the company is exposed, such as
 - ✓ policy guarantees eg guaranteed surrender values, guaranteed annuity conversion options,
 - ✓ catastrophic risks,

(ii) Parties to consider

Shareholders- There may be rules that state that the shareholders are entitled to a fixed proportion of the bonuses awarded to policyholders. Hence any deferral of surplus distribution will impact shareholder profits as well.

With-profit policyholders – Company's past bonus policy and benefit illustrations would have created Policyholder reasonable expectation. Hence any decision leading to a deferral of distribution of surplus can be expected to cause some dis-satisfaction and could lead to higher surrenders.

Potential policyholders – The new bonus policy should be attractive to potential policyholders so that the company can secure adequate volumes of business in the future.

Distribution channel and brokers- The new bonus policy need to be competitive/attractive and easily communicable to new customers.

Board of directors – The board of directors need to ensure that policyholders' expectations are met and and the same time the policyholder security is not threatened. Hence they would be concerned about how the change in bonus policy could be communicated to existing policyholders and justified to the regulators.

Competitors – The new bonus distribution policy should not be too far out of line with competition.

Regulators – The level of discretionary benefits awarded should fulfill any regulatory requirements and any requirements specified in the policy literature.

Reinsurers – If the contracts have been reinsured, the reinsurers should be consulted to ensure that existing reinsurance arrangements will still be valid.

Marketing and Sales department– The expectations of the marketing department on an appropriate level of reversionary and terminal bonuses bearing in mind current and future potential policyholders' needs and competitors' bonus policy.

Administrators / IT – The new bonus policy must be able to be administered on the systems.

[iii]

Deferring surplus distribution is an important source of capital for a company if its options to raise capital are limited.

as in many jurisdictions, surplus in the participating fund can be used to meet required capital (Solvency margin).

While considering the extent of deferral the company needs to consider:

- How long and how much should be deferred- the more the company defers, greater will be the improvement in its solvency position.
- Should the change in bonus rates be gradual or abrupt;
- Changes required in existing investment policy to make it in line with new bonus policy, for eg., increasing exposure to real assets;
- Should and how much terminal bonus for early claims be set (deaths and surrenders)

How to manage existing policyholder expectations, how to communicate the changes in bonus policy and reduce customer dis-satisfaction;

Policyholder's reasonable expectations may also in some countries be grounds for intervention by the regulatory authority in the affairs of the company. How should regulatory requirements be managed.

[Total Marks – 17]

Solution 8 :

[i] An insurance company is insolvent if it is unable to meet its liabilities as they fall due or if it does not have assets in excess of the value of the liabilities.

- [ii] The regulator not so worried as insurance companies rarely become insolvent because:
- Insurance companies are normally subject to a requirement by the regulator to maintain a specified level of solvency capital.
 - The required solvency capital is normally is on top of prudent reserves.
 - There are also regular reporting requirements (*eg* quarterly supervisory solvency valuations and submission of returns) that enable the regulator to monitor the financial position of companies.
 - Solvency norms are designed to enable the regulator to be in a position to intervene in the running of a company before it reaches a position of technical insolvency, *ie* of being unable to meet its liabilities as they fall due.

If the insurer's financial position is showing deteriorating trends (*eg* solvency ratio is falling quarter on quarter), then the regulator may require the company to:

- close to new business, or
- establish a recovery plan (with implementation monitored closely by the regulator).

It will also be important to project the insurer's solvency position into the future using either a stochastic model or a deterministic model with scenario testing. The result of the same may also required to be submitted to the regulator along with annual actuarial valuation.

[iii] Solvency is measured by comparing the value of assets to the value of liabilities.

The risk of insolvency can be reduced by implementing systems that:

- maximise the value of assets, and
- minimise the value of liabilities, and
- give stability to the relative value of assets to liabilities.

Increase the value of assets

This can be achieved by:

- choosing an optimal investment strategy that maximizes return, subject to an acceptable degree of risk
- holding assets that have maximum value in the solvency test (for example hold only those assets that are admissible)
- raising fresh capital, *eg* through a rights issue or a capital injection from a parent company.

Reduce the value of liabilities

The insurer will want to look at its exposure to unusual and significant claim events that could jeopardise its solvency.

For example, large individual claims (*eg* an explosion at a factory) or accumulations of risk (*eg* flooding over an area of the country).

As a result it may implement some or all of the following:

- write less business in those classes where experience is very uncertain (*eg* some commercial property cover) and hence particularly conservative reserves have to be held
- restrict exposure to certain perils, through exclusions or upper limit on payouts
- purchase appropriate types and levels of reinsurance cover, *eg* individual excess of loss to protect against large individual losses.

The value of liabilities can also be reduced by using a weaker basis for valuing liabilities ...
... but the basis should not be weakened to the extent that it is imprudent.

The value of liabilities could be reduced through tighter operational risk management, for example more stringent:

- underwriting
- fraud management.

Stability of assets against liabilities

The investment policy should aim to match assets and liabilities by nature, term, currency and predictability so as to give stability to the solvency level.

Suitability of pricing basis

The suitability of the pricing basis should be monitored to ensure it is appropriate for the risks being written, *ie* appropriate risk classification being used, and the business is not loss making.

[iv] The “other option” is to merge its operations/being acquired by a company prepared to take over the business.

The acquiring company would take over this business after doing an appropriate cost/benefit analysis-covering:

- the location of the operation and possible diversification of risks
- any integration of the systems platform
- relocation of staff or whether there an adequate labour force available
- the effect on unit costs.

[v] In case of insolvency, SFI would be used mainly to pay two broad categories of policyholder liability outstanding-outstanding claims not yet settled and unexpired periods of risk.

This fund will be created via levies on the insurance industry. i.e. require deposits to be held in an insolvency fund which can then be used in the event of insolvency.

This looks unfair on those policyholders who are more astute and companies which are better run.

The insolvent insurer will have contributed the least in part to the outstanding liability.

How much could be the levies? The regulator may not have any data supporting to this to find the appropriate charges.

In what frequency the levies would be charged?

Who will manage the fund and what could be the appropriate investment strategy of the fund under SFI.

Require to consider the expense of running the fund to be managed. The data management and information keeping would be big task.

The conflict and confidentiality would matter depending on how the SFI would be managed.

What would be tax implication of the levies paid to SFI.

This may be difficult to estimate what could be appropriate level of fund is required to be held. Will the levies will be varied if the fund is huge and no insurers become insolvent.

On the other side, if an insurer becomes insolvent, still not sufficient to pay all the claims, what actions to take.

Should the remaining insurers which are solvent required to pay the shortfall if any, which is again unfair.

[Total Marks – 20]
