

# **Institute of Actuaries of India**

## **Subject SA3 – General Insurance**

**November 2010 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 to Q 1

## a) (i) Information required

The information required will include:

- Information about the two business houses such as paid up capital, nature of business, profit position for the last 3 years, organizational spread and reach and their core business. This will enable us to present our advice at the right level
- The expertise of the insurer and the modeling software available to it
- - this will affect the modeling methodology that is recommended
- The purpose of the capital modeling exercise, eg whether it is determining its regulatory capital requirement or its economic capital requirement
- this is likely to affect the recommended method and/or basis and the time horizon of the exercise
- The risk appetite of the insurer this will affect the strength of the basis recommended
- The types / range of products the insurer will sell and the locations of these risks
- The type of reinsurance arrangements that the proposed company is likely to arrange
- ... this will affect advice on how reinsurance is allowed for in the capital requirements (if at all).
- Geographical spread of business and possible exposure to CAT losses
- Financial condition of the partners and ready availability of capital at a short notice

This will affect the methods used to determine capital requirements

eg business that is exposed to catastrophe risks may require the use of catastrophe models

- the volume of business the insurer expects to sell ...
- ... this, combined with the range of products it will sell, will affect the extent to which it can allow for diversification effects ...
- The extent of any offsetting capital requirement due to the cost of financing new business volumes

## (ii) Points to be made when presenting advice

It would be necessary to point out that the capital requirement will depend on a number of aspects, including:

- the purpose of the exercise
- the available data and the depth of the granularity
- the sensitivity of the result to the different assumptions including the correlation assumptions.

In particular, it is important to communicate that there is considerable uncertainty...

... and that a range of results should be produced, based on different assumptions.

The purpose of the exercise will affect the basis used.

It may be useful to recommend a range of appropriate bases ...

... however it is important to point out that such bases may not necessarily be appropriate for other uses.

Since it is a new company, there will be limited data available.

Some data used may lack relevance. It is important to highlight this, emphasising any specific concerns over its quality and/or relevance ...

... and to point out that such issues may affect the validity of the result.

The client should be made aware of any limitations of the advice given.

Any actuarial judgement that may be needed should also be highlighted.

It is important to emphasise that the final result is highly dependent on the assumptions made.

The most significant assumptions will vary for different classes of business, however claim frequency and claim severity are likely to be among the most important ones.

Assumptions will be chosen based on the current economic, regulatory and tax environment, however it is important to point out that if these change, then the assumptions will need to be amended accordingly.

The workings would be valid for the prevalent regulatory requirements, if the statutory capital requirement is calculated. If IRDA prescribes any new capital calculation, the same may be required.

It will be necessary to point out that correlation assumptions are also important, particularly in future if the new insurer is planning to expand (either in terms of market share for existing classes of business or into new business classes).

Examples of possible correlations include:

- correlations within risk types, eg within any one class of business or between asset classes when assessing market risk
- Correlations between insurance risk and market risk.

The advice should highlight the importance of continually monitoring and updating the results.

And the need to comply with and monitor any regulation and/or guidance on setting capital requirements.

(b)

(i) Benefits of capital allocation

To ensure that sufficient loadings are included within premium rates to cover the cost of capital for each sub-portfolio and for the business as a whole.

To enable selection of the risks that best employs the capital available.

To measure and assess the performance of the company or of the sub-portfolios relative to the capital employed.

To help better management of capital planning and timing of capital injections

To compare performance, both internally (eg between classes and over time), and externally (against competitors).

To enable performance to be more accurately attributed between sub-portfolios, classes, business units or individual underwriters for the purposes of setting remuneration.

To help with strategic decision making, eg when assessing a new opportunity or examining future underwriting strategy.

To help decide appropriate compensation package for the senior management.

To meet regulatory requirements e.g analysis for FCR.

To help with reinsurance planning.

To help with investment strategy.

(ii) Desirable characteristics of risk measures

Risk measures should, ideally:

- be easy to communicate and apply
- be observable
- be measurable
- not be prone to manipulation
- be consistent with management's perception of risk
- quantify risk in a manner that is understood by the decision maker
- be consistent with the basis used to establish the aggregate capital requirement
- result in an internally consistent allocation of diversification benefits; that is, additivity of allocations
- result in a coherent allocation.

Some potential risk measures may be as follows:

Variance

The variance is a widely-understood measure of the variability of a risk.

It is a symmetric measure of risk and so can give distorted results in cases where the risk distribution is not symmetrical or where we are only interested in one side of the loss distribution.

Variance is not a coherent risk measure.

Value at risk (VaR)

The VaR gives a point measure of the downside potential for a given risk.

$$\text{VaR}_{y\%} = m \text{ s.t. } P(X \geq m) = y$$

where:

- X is the random loss variable
- the yth percentile is the prescribed level of sufficiency, chosen to be the maximum probability at which the downside of the risk is acceptable.

VaR does not consider the overall amount of loss beyond the selected threshold.

VaR is not a coherent risk measure.

Tail VaR (T-VaR)

T-VaR describes the conditional mean of the loss distribution above a selected threshold, ie it considers the expected loss given that a worst case scenario occurs.

$$\text{T-VaR}_{y\%}(X) = E[X | X > m]$$

where  $m = \text{VaR}_{y\%}$

where:

- X is the random loss variable
- the yth percentile is the prescribed level of sufficiency.

T-VaR is a coherent risk measure.

X T-VaR

This is a variant of the T-VaR measure that considers the mean of the excess of the loss distribution above the overall mean of the distribution, given that the threshold criterion has been breached.

$$\text{XT-VaR}_{y\%}(X) = E[(X - \mu) | X \geq m] \text{ where } y\% m = \text{VaR} \text{ and } \mu = E[X]$$

where:

- X is the random loss variable
- the yth percentile is the prescribed level of sufficiency.

X T-VaR is a coherent risk measure.

Expected Policyholder Default (EPD)

This is a variant of the above measures that gives the expected loss beyond a threshold, where the level of the threshold is set to be the company's surplus capital. It is the expected value of default amounts.

$$EPD_b = \Pr(X \geq b)E[(X-b) | X \geq b]$$

where:

- X is the random loss variable
- b is the capital available.

This is therefore the chance of insolvency occurring multiplied by the expected shortfall amount.

EPD is a coherent risk measure.

(c)

The expression "solvency margin" always needs to be interpreted as defined in IRDA regulation.

There are two forms of solvency margins – Available solvency margin (ASM) and required solvency margin (RSM). The ratio of ASM to RSM is known as the solvency ratio. As per IRDA solvency regulations, insurers at all times are required to maintain solvency ratio above 1.5.

While there could be some comparison between companies based on solvency ratio, one has to be more cautious when comparing solvency margins between two companies

Comparison could validly be made between the solvency margins of two companies, but there are many factors that will distort this comparison. These factors should be taken into account where possible, ie comparison can only be made to a limited extent.

Factors to consider when comparing solvency margins

Size of margin

Larger margin  $\Rightarrow$  stronger office

Smaller margin  $\Rightarrow$  more risk.

Size of margin in relation to variation in outgo

More business (by premium income)  $\Rightarrow$  more risk (so bigger margin needed)

Often quote solvency margin as proportion of written premiums

Margin depends on classes of business (which affects the variability of outgo)

Diversification

Smaller unit size of policies  $\Rightarrow$  less risk

Fixed benefit classes  $\Rightarrow$  less risk

Greater geographical spread  $\Rightarrow$  less risk

Wider spread of business mix  $\Rightarrow$  less risk

Suitable spread of investments  $\Rightarrow$  less risk

More business usually means wider spread  $\Rightarrow$  less risk.

Valuation of liabilities

A company with a conservative basis for valuing liabilities is less risky than it would appear. Important aspects here are:

- suitable provision for IBNR
- suitable allowance for inflation of outstanding claims
- allowance for any trends in claim settlement
- extent of allowance for future investment income.

Unrealised gains

A company may have a large element of unrealised gains, with a contingent tax liability for which there is not an appropriate reserve.

Reinsurance

The greater the use of reinsurance, less is the risk of reinsurance recovery.

This depends on having appropriate reinsurance. For example, catastrophe cover is particularly important wherever there is the risk of an accumulation of claims from a single event, or excess of loss for unlimited liability classes.

Policy conditions and history

A company may be more exposed to risk if policies written in previous years allow an indefinite period for claiming (eg motor TP liability claims ).

Future business

The following additional aspects are all relevant in determining the likelihood of insolvency for a particular company:

- adequacy of premium rates
- suitability of rating bases (ie to discourage selection)
- stringency of underwriting
- quality of management: claims control, expense control
- quality of management: investment policy, dividend/profit retention policy
- quality of management: new business plans and growth rates.

In India we require 1.5 as solvency ratio, companies may have different capital management strategy and can keep in the range of 1.5 to 1.8 always, some companies may be always above 2. We need to understand why the margin has fallen – is the company in any acquisition / merger state stage?

One off claim events affecting only this company and not other companies

Just a fall in solvency ratio does not indicate future insolvency – as long as the solvency ratio is above 1.5. If the board of Directors are ready to infuse capital at the right time then there exists no chance of insolvency.

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Q 2.

(i) The steps involved in determining a premium are:

- Analysis of experience by collection of data and fitting a model
- Use the analysis to derive a risk premium
- Adjustments to risk premium derived to allow for likely future experience
- Derive office premiums by allowing for expenses, investment income, profit margins and one off expenses for targeted growth

Analysis of experience by collection of data and fitting a model:

Data of all policies and claims over the last 5 years to derive claim frequency and claim severity.

If experience for first two years is subject to fluctuations decision on exclusion of the first 2 years experience is required.

If the year wise experience indicates any trends, enough data to identify such trends by further sub division of data of claims by nature of claims or other features in the trends observed is required.

Since the portfolio seems to have been somewhat stable, the experience may be relevant as a starting point despite the proposals planned for high growth of business.

Data should be split by currently used main rating factors, such as geographical area, sum insured and type of construction.

Data of claims should be split by currently covered perils.



If data has been recorded, on other risk factors, such as type of cover (say, inclusion of contents cover, indexed sum insured or inclusion of public liability) or CAT proneness and also for certain perils excluded, then exposure and claim data has to be collected by such sub divisions, for studying possible impact of changes in policy conditions at a future date.

The size of the insurer and the size of the portfolio is not known, but in any event, external statistics such as data published by government, industry or other organisations on household property losses, construction/ repair costs and in particular large and CAT losses may be useful in judging whether results from analysis of internal data need adjustment for change in experience in future and allowing for any trends in claim frequencies or severities.

While fitting a claim frequency or a claim severity model type of cover would possibly the major division of data,

And consideration of number of rating/ risk factors to be included for sub division would depend on credibility of experience in relation to data size judged by number of claims available in the main cells of combinations of subdivisions

While also deciding on how data within a sub division will be grouped- for example deciding on band limits of sum insured

Also required is adjustment of data for abnormally large claims (which includes deciding on the threshold for large claim definition) and CAT events.

Checking and if necessary allowing for IBNR claim amounts is an important part of adjustment to data before fitting a model.

Since the data analysed is likely to be drawn from 3 to 5 years, claim amount data needs adjustment for money values using an appropriate index.

Use the analysis to derive a risk premium:

Appropriate best fits of models for claim frequency and claim amount may be derived after adjustments stated; it is also useful to have both a multiplicative and additive model for understanding the patterns of experience and judging the impact of correlations.

Similarly, trial and error approach may be used to find out which of the possible combinations of subdivisions of data/ risk factors gives the best fit and results.

The analysis of experience giving a set of, say, 3 or 4 “best fit” models can be used finally to derive a suitable set of premium rates and after adjustments, stated below, to derive office premium rates by discussion with marketing staff; this would apply in particular to business through the new direct helpline channel.

Adjustments to risk premium derived to allow for likely future experience:

The risk premium derived needs adjustment for the following:

- Trends in claim frequency, split by nature of loss/ peril
- Inflation of claim amounts again split by nature of loss/ peril
- New business characteristics expected, due to growth and introduction of new distribution channel
- If necessary by allowing for a sensitivity analysis for impact on size of sum insured and claim experience
- Changes in policy conditions, policy excesses or other policy features
- In particular, the impact of introducing a loyalty bonus will need careful analysis by examining a number of scenarios
- Allowing for different levels of persistency
- As well as different mix of rating factor groups of policyholder populations becoming eligible for loyalty bonus at different rates
- Possible effects of dilution in underwriting standards generally associated with growth
- Cost of reinsurance considering the size of the company
- and any possible changes in reinsurance arrangements, particularly for the new distribution channel

Derive office premiums by allowing for expenses, investment income, profit margins and one off expenses for targeted growth:

- analysis of expenses in the past would indicate the starting point for adding per policy loadings
- allowing for future estimated inflation
- and variable costs, including commission,

- which may not apply for rates for the new distribution channel
- adjustment required separately for-
  - assessment of development cost for additional infrastructure for growth of business, say, including new offices/ sales outlets
  - and set up costs of a call centre for the new distribution channel
  - allowing in both cases for expected business volumes from each source
  - also allowing for response rates and conversion rates
  - and to spread development costs over a period of years, taking a view on persistency of policies
  - impact on per policy costs by a changed and somewhat uncertain mix of policyholder populations at different levels of loyalty bonus
- further adjustments for-
  - investment income
  - profit margins and or expected return on capital
  - considering required solvency margin on the portfolio
  - competitiveness of premium rates in different segments of the portfolio
  - and other contingencies

(ii) Issues to be considered are:

Growth of business-

- This arises from 2 sources- higher persistency of existing business and new business and higher market share due to the attraction of the loyalty bonus
- Policyholders who feel that existing premiums are only modestly on the higher side may be motivated to continue with the company and eventually reach the 75% limit specified

- Both these would help substantially in reducing the fixed costs
- And also perhaps help in cross sales of other products such as PA and motor
- And eventually help company realise its objectives on profit and return on capital
- If other companies do not have such bonus, the product may help the company as one with a product distinct to itself
- and minimise/ eliminate problems of price competitiveness in the short term
- and in the long term reach an optimum level of premium rates
- although company has to face the risk of competitors copying and improving upon such loyalty bonus
- Company may consider charging different rates between existing policyholders and new policyholders under the new product
- particularly, if the existing product is seen as offering cheap minimum cover
- and definitely a different rate for the policyholders coming through the new distribution channel, who may have different claim experience profile
- and different expense factors

Company has to consider whether the 3% rate of loyalty bonus and the maximum level of 75% are realistic enough to attract existing and new policyholder..

And assuming that the rate is a compound rate, whether the implied period (say 10 years) over which policyholders would reach the maximum level is a fair balance between company's requirements on persistency and policyholders' expectations..

And in such an event or in an event when competitors introduce similar schemes need for improving the bonus rates with impact on premium volumes..

Thus in the long run premiums might rise..

Although some offset may be expected by higher average sums insured..

and movement of portfolio towards higher premium covers..

(iii)

The issues for consideration are:

- Loyalty bonus appeals universally to all current and prospective policyholders,
- Whereas, a NCB appeals to only those who expect to have a good claims record
- Theoretically, loyalty bonus is aimed at improving persistency and hence reduce fixed costs of expenses
- Whereas, NCB assumes past claim experience is a good guide to future claim experience
- In household domestic insurance, policyholders may have only limited influence on claim experience and
- If at all it is so in the contents section of the policy covers and
- hence, NCB may not be an effective means of either rating or retention
- although, NCB may discourage small claims and so lead to savings in claim costs
- if however, other companies have an NCB system, this company may have to eventually introduce the same
- much will depend on which of the two systems are more acceptable in the market
- and the levels of bonus rates under each system, which might be seen as reasonable by policyholders
- and also help the company achieve its goals on growth and profitability over the short and long terms

**[38]**

**[Total Marks 100]**

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