

Institute of Actuaries of India

Subject SA3 – General Insurance

November 2011 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

1. Pricing Large Loss Potential

Answer Outline/Expectation

- I. Expect the candidate to exhibit expertise in pricing a potential large loss. The Sarla Verma incident is merely to establish a focus.
- II. The right answer should include a clear exposition about the development of a frequency severity model to price this exposure.
- III. Data considerations must be listed for estimating both frequency and severity.
- IV. Expect the candidate to explain the potential for data verification across companies.
- V. Should be able to convert the loss cost to a rate item and enable the management to justify the loading to the regulator.
- VI. Should comment on the potential for a catastrophic loss for this kind of an exposure - a multiple fatalities accident involving a passenger carryig vehicle.

Points to be included in a typical ANSWER:

Background about a potential large loss:

- The Sarla Verma verdict has given rise to the potential for large verdicts (primarily in Motor TP death claims but may be extended to other situations) that were not priced.
- The verdict amount is much greater than for other TP claims and the frequency is much smaller as only death claims are covered. Hence, this is a typical low freq/high severity large loss.
- Currently, the case law is slowly catching up and there is a potential for an increase in freq as well as extension of the logic to other bodily injury claims.
- Given the type of claim, external assessment of claim amount, and low frequency with little or no experience of such claims in the loss history, we need to develop a freq/severity model to estimate the impact.

Data Considerations:

- Obtaining the data for estimating the impact is complex and will involve diligent effort.
- While the loss amount and loss date may not pose problems, there is little likelihood fo there being a flag that will identify Sarla Verma claims.
- A straightforward electronic sort programme is likely to be insufficient.
- Tests will have to be designed based on "cause of loss" field entries in company data sets.
- These tests will have to be designed for each company.
- Care should be taken to match the claim count with the appropriate earned exposures for appropriately defined periods -- calendar year/accident year/underwriting year etc. The same standard should be used across all companies.

Cost Estimation and Integration with existing price:

- Individual loss amounts should be converted to an ultimate estimate and trended to the appropriate expected loss date.
- A log-normal curve could provide a reasonable fit. Location could be an important predictor.
- Estimating the frequency will be trickier. "ODP" (Over-Dispersed Poisson) models may offer the best solution.
- Indicator variables may be needed to distinguish between locations as well as insurance companies.
- The arithmetic used to integrate with current premium should be defined -- either loss cost plus loss cost or premium plus premium.
- A managerial decision about expense load is needed --to soften the impact on the consumer.
- It should be noted that there can be a Catastrophic loss (essentially in the case of commercial vehicles) when there are many victims. At this point, there is probably no available data to estimate this load.

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2. Evaluating Rate Adequacy Issues

The focus of this question 'is on how pricing actuaries are able to defend their stated position with the help of numbers. Complete information is never available and actuaries have to come up with robust estimates with partial data. In such situations they have to obtain relevant data from other sources and make sure that estimates are meaningful.

Rate adequacy analysis sets the foundation for pricing action. The question examines how candidates defend two diametrically opposite positions.

2. i Marketing Perspective

Answer Outline/Expectation

- i. Expect the candidate to exhibit their ability to combine issues from loss development, underwriting profit, permissible loss ratio or similar measure, investment income, price elasticity, etc., to arrive at a solution.
- ii. The answer should relate the additional revenue, the additional expected loss, the additional expenses, the additional underwriting income and any benefit available from additional investment income.

Points to be included in a typical answer:

- Any pricing decision should be based on the expected ultimate loss ratio and not the incurred to date loss ratio.

- The actuary has to examine whether the underwriters have selected exposures in such a way (and will therefore continue to select in a similar fashion) to warrant a drastic reduction in the “age to ultimate” factor.
 - Rates can also be reduced if it is feasible to reduce the allocated expense load.
 - One can expect a reduction in allocated expenses if there is an increase in premium volume.
 - The price elasticity of the product should be included in such an evaluation.
 - The actuary should consider the potential investment income and whether the additional premium volume and the resulting additional investable funds in a long tail line lead to an increase in yield rates.
2. ii Risk Management Perspective

Answer Expectation

There are 6 major sections to this question and each section is worth 5 points -- two adjustments to losses, two adjustments to premiums, development of projected loss ratio, development of permissible loss ratio and the resulting rate indication. Numerical answers are expected for this question. These steps indicate that the candidate is able to compare/combine data from different periods of time and different sources in a systematic manner.

The candidate has to fill in reasonable numbers to the partial data provided in order to arrive at a solution. Outlandish selections will be penalized but any reasonable estimate is acceptable.

The easiest way to answer this question is to begin with the existing data table and augmenting it with necessary columns for the steps discussed below, and explaining the logic of the added columns. Unfortunately, none of the candidates adopted that approach. Hence, the solution has been provided in a descriptive manner, explaining how to calculate the rate adequacy.

Points to be included in a typical answer:

- In order to compile experience, losses should be developed to their ultimate value. The age of the loss (for a given exposure bucket) is known. Losses have been provided on an incurred basis by Accident Year. Since the incurred development triangle (on an Accident Year basis) is not given, the candidate has to make a reasonable assumption. The key assumption is that the “Age to Ultimate” factors decrease as the age increases. Any reasonable assumption on the actual factors with the above property is

valid for the purpose of the exam. The arithmetic operation is straightforward -- Ultimate Losses = ITD Losses X ATU factor.

- Losses should be trended from the loss date to the projected loss date during which the rates will be effective. This difference provides the time period for the trend. The trend factor should be estimated. In the absence of specific data, trend estimates from average loss cost provide a reasonable proxy. Another option will be based on “Cost of Living” kind of approaches that are also adjusted for frequency. For exam purposes, any reasonable and consistent selection of trend factor is acceptable.
 - I. For example, the average loss date for AY 2008-09/Q1 data is 15 May 2008.
 - II. Assuming that the rates will be valid from Jan1 2012 through December 31, 2012, the average loss date in the Rate adequacy measurement period is Jun 30 2012.
 - III. The trend period is the time between these two dates and is approximated as 4 years and 1.5 months.
 - IV. Given the data, the average ultimate loss actually decreases. In any long tail line, it is difficult to accept a decrease without additional info and research. For exam purposes, a 0% trend is chose. Hence, the trend factor is effectively 1 for all quarters.
- Premiums should be stated at current rate level. Candidates should exhibit their understanding of the parallelogram method in arriving at the current level factor (given the problem data) and should also comment on situations where rerating procedures have to be used.
 - I. There was a 5% rate increase on 1/4/1010 and a 3% rate decrease on 1/4/2011. The “as of” date of the data is 33/3/2011. It is easiest to handle the rate decrease outside the current level factor.
 - II. The current level factor for premium data upto 2009-10 Q4 is 1.05 (indicating the 5% increase).
 - III. A different current level factor will have to be computed for each of the 4 quarters of 2010-11. This is because earned premiums from the earlier periods will have to be adjusted for the rate increase according to their proportion in the total EP amount. Thus approximately 87.5% will be eligible in the first quarter and so on. In other words , 1.04 is a reasonable approximation (followed by 1.03, 1.02, and 1.01)
- The candidate should be able to estimate a basic premium trend factor by comparing average premiums (average premium per exposure can be calculated from the data provided). The average premium per exposure is almost flat and hence a 0% premium trend is chosen. (Any other reasonable assumption would have been acceptable). In turn, the premium trend factor is 1 for all quarters.

- The candidate should calculate the projected loss ratio from the provided data and the assumptions made. This is a straightforward multiplying, adding and dividing process. A weighted average of the quarterly loss ratios provides an estimate of the expected loss ratio during the rate adequacy evaluation period. The candidate has to provide a reasonable justification for the weights.
- The candidate should develop the permissible loss ratio, accounting for production costs, taxes, profit load, investment income, etc, taking care to explain how they have treated fixed and variable costs. Rate need is then given as $(\text{Projected loss ratio}/\text{target loss ratio})-1$ and then augmented by 3% (due to the rate decrease implemented on 1/4/2011).

Note: A clear verbal exposition of these steps or a well documented number crunching table would have obtained full marks. Unfortunately, very few candidates even got half way through these steps.

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3.

- i) As per Insurance Act , the minimum solvency margin is the highest of the following:
- Rs 50crores
 - 20%of gross written premiums
 - 30% of the incurred claims averaged over the financial year ended and the two preceding years

The figure arrived is further reduced by a factor varying for different classes.

There has been a minor amendment to this by IRDA's circular dated 31stMarch 2006.

Assets are to be valued at lower of market values and amortised costs and liabilities include UPR, URR, Outstanding claims and IBNR. IBNR is to be certified by the Appointed Actuary.

Economic Capital :

At its most basic level, Economic Capital can be defined as sufficient surplus to cover potential losses, at a given risk tolerance level, over a specified time horizon”

The word ‘economic’ indicates the fact that it measures risk in terms of economic realities rather than Regulatory or accounting rules which may have been designed to support non economic principles. This word also indicates that part of the measurement process involves converting a risk distribution into the amount of capital that is required to support the risk, in line with the insurer’s target financial strength (eg. Credit rating)”

Economic Capital Analysis enables an insurance company to strike an appropriate balance between

- Too much capital – which can lead to an excessive cost of insurance
- Not enough capital – which can lead to an unacceptable risk of insolvency

The term Economic Capital can connote either “Required Economic Capital” or “Available Economic Capital”.

The term “Required Economic Capital” can be defined as the capital required to cover potential losses at a given risk tolerance level over a specified time horizon.

It needs to be noted that this capital is “required” from an economic point of view rather than from a regulatory point of view.

The term “Available Economic Capital” can be defined as the excess of the value of the insurance company’s assets over the value of its liabilities measured on a realistic or market consistent basis.

Advantages / Disadvantages of Economic capital

Advantages:

Recognizes the volatility inherent in the business

Penalize companies with inadequate reserves or which write business with inadequate rates

Recognize asset and credit risk

Disadvantage:

Definition of volatility- variation of experience of the company and the industry’s variation may differ

The period over which the volatility is to be measured

Does the same proportion of volatility to be applied to all companies

Whether every risk can be measured- management risks

Any fixed formula will be inadequate, given the number of different risks involved and the difficulty of quantifying many risks.

Advantages and disadvantages of SCR

Benefits of the Solvency Capital regime (SCR)[1] : Simple, objective and easy to verify. Allowance is made approximately for volatile classes, reinsurance and companies with high loss ratios

Weakness Of the SCR [2]

Does not fully takes into account the riskiness of the business-some have more volatile claim frequency and claim amounts

Some classes are exposed to latent claims, judicial inflation and so on.

Companies reserving inadequately or charging inadequate premiums, SCR falls instead of strengthening. SCR assumes past experience to continue in future. One bad year of claims, change in mix of business or policy conditions are not reflected and hence may lead to holding inadequate solvency margin. It does not allow for other risks like credit, inflation, latent claims, currency mismatching etc

ii) Best estimate:

The technical provisions should be equal to the sum of a best estimate and a risk margin, except in circumstances where they should be calculated as a whole. The best estimate is calculated gross, without deduction of the amounts recoverable from reinsurance contracts and special purpose vehicles.

A best estimate valuation of liabilities also requires explicit calculation of risk margin and subsequent disclosures in the financial reporting. This helps analyst and policy holders to take informed judgement on the performance of the insurance companies.

The method of best estimate + risk margin reduces the likelihood of holding inadequate claims reserves.

There are a number of reasons why insurance companies estimate technical provisions on an economic basis.

For example, it is useful for measuring profitability and supports the pricing process. It is also necessary for the production of their financial statements in accordance with accounting principles and supervisory regulations.

While accounting regulations frequently require prudence in technical provisions, both IFRS and Solvency II favour an economic view in the balance sheet.

Thus, assets and liabilities are accounted for at their current market value using prices that can be monitored or other appropriate methods.

iii) Simulation techniques

Rather than considering all possible future scenarios, we can choose a suitably large number of scenarios which are representative of all possible future ones. This approach is referred to as a "simulation technique".

Examples of simulation techniques:

a) Monte-Carlo simulations: the value of the liabilities is calculated in a large number of scenarios where one or more assumptions are changed in each scenario. By simulating the behaviour of the random variable(s) in a very large number of scenarios, the model produces a distribution of possible outcomes so that a probability weighted average can be calculated ("mean of the distribution").

b) Bootstrapping: one of the most extended uses of bootstrap within actuarial work is associated with estimation of claims provisions. Starting from a model that explains how losses are paid, it consists of resampling residuals from that model and obtaining a large sample of estimated provisions required to pay future outstanding losses.

c) Simulating losses above a certain threshold and up to a certain limit may also be used to calculate an estimated expected loss in respect of a given excess of loss programme.

d) Bayesian approaches, where explicit prior assumptions are blended with observations resulting in an estimate for the ultimate claim.

Analytical techniques

We may be able to use a valuation technique based on closed form solutions. Such techniques are referred to as analytical techniques and are based on the distribution of future cash-flows.

For the estimation of non-life best estimate liabilities that do not need simulation techniques, deterministic and analytical techniques can be more appropriate.

Examples of analytical techniques:

a) Stochastic variation in non-market assumptions (such as claim frequency).

b) Techniques which use an assumption that future claim amounts follow a given mathematical distribution (e.g. Bayesian). These techniques calculate an undiscounted probability weighted average set of cash-flows without explicitly considering each potential scenario. An example may be the Mack method, also known as the distribution free chain ladder.

Deterministic techniques

We may also be able to use a technique where the projection of the cash-flows is based on a fixed set of assumptions. The uncertainty is captured in some other way for example through the derivation of the assumptions. This is referred to below as a “deterministic approach”.

For the estimation of non-life best estimate liabilities that not need simulation techniques, deterministic and analytical techniques can be more appropriate.

Deterministic techniques will be more appropriate in circumstances such as:

a) Where an alternative technique may require the calibration of parameters for which only inadequate data is available.

b) Where the nature of the liability is complex but the complexity does not materially affect the result or the complexity cannot be captured better by other techniques.

c) Where the nature of the liability is sufficiently simple or for other reasons the nature is such that cash-flow projections based on best estimate assumptions result in a best estimate liability.

Examples of deterministic techniques:

a) Actuarial methods such as Chain ladder, Bornhuetter-Ferguson, average cost per claim method, etc...

b) Stress and scenario testing; for example, adjusting data for inflation and allowing inflation to vary, thus producing sensitivities around this parameter.

c) Influential observations or outliers have been allowed for appropriately, for example via case by case reserving.

d) Systematic as well as other random features are being captured through sensitivity testing, diagnostics or other techniques (this could be stochastic).

e) Where a calculation relies on assumptions of an even spread of risk over the policy year and this is not the case (e.g. seasonality such as due to weather or hurricane season) the proportions should be adjusted.

f) The use of relevant assumptions or other external/portfolio specific data as an input to the calculation when there is lack of data or as a benchmark for comparison.

Combination of techniques

We can use a combination of above techniques

iv) Other issues to consider

The most important issues that influence the development of claims are the time horizon (tail), inflation, currency

effects, legislative changes in the line of business (e.g. workers' compensation) and cultural changes.

(e.g. attitude towards litigation).

These are factors outside a company which affect the timing and size of claims. However, it is also important to understand the internal procedures in claims departments:

- How are individual technical provisions set?
- How long does it take to set the technical provision after the reporting of a claim?
- When are technical provisions changed?
- When and why do claims departments review technical provisions?
- Have there been any changes in claims settlement practices?

The (individual) technical provisions are set by the claims department on the basis of subjective appraisals.

However, using incurred claims, i.e. the total amount of claims (instead of paid claims only), to produce an IBNR projection, might provide a more reliable estimation of the technical provisions required.

In addition to the procedures explained above, in Economic capital calculations the technical provisions need to be adjusted for the time value of money, i.e. the present value must be calculated. This adds a new factor to the equation which requires expertise and a good data base.

v) Formula based Economic capital calculation may not give the real capital requirement since individual companies experience will not be factored in the calculations. This may result in a modified SCR calculations. This could be misleading.

One way to solve the problem is to develop internal capital model by each general insurance company. Some companies may not have sufficient data to apply a full scale internal capital model.

Some companies may not have sufficient internal expertise to calculate the required estimates. External expertise may be expensive to engage or unavailable.

Additional costs to companies in doing the calculations. These additional costs would need to feed into premium rates with potential impact on level of sales.

Significant increase in capital requirement can be difficult to explain to shareholders and/or other stakeholders.

Some exposures are particularly difficult to estimate economic capital requirement for, an example being latent claims.

There are many approaches to calculating Economic capital. Different methods can produce very different results. Different methods are appropriate for different types of risks.

Naive application of methods can provide misleading results.

From a regulatory perspective, it may not be possible to determine whether companies' estimates really do represent the true capital requirement.

Increased regulatory costs will feed back to general insurance companies.

It can be difficult to compare results between insurers, e.g. if company A has a lower capital than company B, it will be unclear whether this reflects the riskiness of the liabilities, method selection or a difference in judgement?

Such uncertainty may undermine confidence in the insurance industry.

The assessment of diversification between classes of business is one of the more difficult areas.

It is difficult to estimate correlations between lines of business based on observed experience.

It is often necessary to use general reasoning to estimate correlations.

Regulators may not have the necessary level of expertise and resources to review the economic capital calculations estimated by general insurance companies.

The calculations used to produce the economic capital requirement may be difficult to explain to management.

Other stakeholders may also be confused, e.g. policyholders, investment analysts.

There may be a false confidence held by stakeholders.

General insurance companies would be concerned that the new regulations result in a less favourable tax treatment.

vi) Issues to be considered by the regulator

- a. Availability of expertise in the industry to calculate economic capital.
- b. Availability of expertise in the regulators office to check the EC calculations
- c. Impact study of the Economic circular issued by the regulator on various general insurance companies
- d. Further calibration of the formula and the parameters to ensure any bias is removed
- e. Effect of switch from SCR to EC on capital adequacy of the general insurance companies; increased demand for capital may seem very unreasonable, less requirement of capital may weaken the underlying robustness of the general insurance company
- f. How the analysts and merger and acquisitions would view this switch
- g. Whether the switch to EC from SCR be one time or the GI companies should consider the max of the two till the time the EC calculation is stabilised. This may defeat the purpose of EC
- h. What the regulators in other countries have done
- i. Views of different industrial bodies
- j. Parliamentary clearance
- k. Transition period of two years where both numbers are reported by capital allocated by SCR. Gradual transition will help solve the above problems and will not create a shock to the system.

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