

# **Actuarial Society of India**

Examinations

November 2006

**SA3 –General Insurance**

Indicative Solution

**Q.1.** The problem before the underwriter is to increase the insurance profits.  
 Insurance profits is Underwriting profit plus investment income. Underwriting profit is earned premium income less incurred claims less expenses.  
 The options are: increase written premiums and hence earned premium income  
 Reduce acquisition expenses  
 Reduce administrative cost  
 Reduce reinsurance cost  
 Write to a lower loss ratio the new and / or the renewal business  
 Reduce claims cost  
 Reduce the reserves /change assumption in reserve setting methodology  
 Increase the investment credit

1. Substantial growth in written premium is necessary to achieve the target, assuming that policies are uniformly written throughout the year.

Rough calculations will show that written premium need to grow by 280crores.

How far the branches and market force support this growth.

Will the new business be as profitable as the existing one?

To achieve the target premium, less profitable risks may be put on the books resulting in a higher loss ratio

Larger risks may be written but then appropriate reinsurance must be in place

Other business channels may be tried like call center, direct phone call etc.

Will the acquisition cost go up because business is through costlier channels?

In view of the large volume of business, the direct costs will go up

Large claims may result in breaching reinsurance limits and fall back on the company and the need to renegotiate the terms of the reinsurance treaty may arise

Should additional capital be injected?

2. How much the acquisition expenses can be reduced? Are the different channels / sources of business differ in the acquisition cost? If they do, then obtain more business from less costly sources.

If possible negotiate brokerage with brokers but then it is possible that they place business elsewhere.

Restructure commission say profit commission based on volumes of business.

Go for direct business with low acquisition costs. Agents and brokers may protest.

3. The admin cost has been reduced by 2%. Is there any further scope for reduction?

Can unprofitable branches be closed thus saving on expenses? What about redundancy payments and VRS payments?

1% reduction may result in saving 2crores.

How to improve productivity using modern technology and save labour costs?

Outsourcing is a possibility.

4. How well is the reinsurance used to smooth profits?

20% of 200crores is 40crores and if we assume that reinsurance recoveries is 50%, then the profits can go up by 20crores. If reinsurance is reduced by 10%, the profits will go up by 10crores.

The consequences are more volatility and possibly there is need for additional capital. The loss ratio may go up.

Again everything depends on the type of treaty and terms of the treaty. It may not be possible to change the terms immediately.

Quota share treaty may not change the volatility. XOL limits can be reduced by increasing the retention, reducing the upper limits, increasing the self insured share across the programme.

This appears to be a solution but may not be liked by the underwriter as he may prefer less volatile but more certain profits.

5. Could write to a lower loss ratio by stricter policy conditions, more selective underwriting, increasing rates.

Increasing premiums may result in loss of business

If the market cycle is hardening, it may be possible to increase rates

by being rigorous with New business/Renewals, get out of poor quality business

Statistical analysis of good and bad business will guide to target appropriate business

Writing larger volumes of business may lead to larger loss ratio

Identifying loss making branches and closing them may be a difficult decision

Exiting from some policies may mean breaking relationship as these were with the company for quite some time

6. Reduce incurred claims cost to increase profits.

Be strict in settlement of claims and settling outstanding claims for amounts lower than original estimates

This may increase claims settlement costs but compensated by lower claims

Reduce margins in reserves but this would increase taxable profits

If higher conservative reserves were set, there can be some reduction in outstanding and IBNR claim reserves.

Discounting reserves at a higher rate may be resorted to if allowed.

Tax payments are advanced. These may not add value to the company but only impact the timing of the emergence of profits.

7. Investment credit to this line of business is based on company's policy of allocating investment income.

Higher credit for this class of business can only be at the cost of other classes

It is presumed that investment income is credited on the basis of average reserves held.

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**Q2(i)** As per Insurance Act as amended, the minimum solvency margin is the highest of the following:

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 31st March 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.

(Answers based on EU/UK basis will also be accepted)

**Definition of RBC:**

Risk Based Capital is a tool to give the regulators and /or the managers of insurance companies an objective insight into the risks inherent in writing insurance business. It can be defined as an assessment of the capital required for a General Insurer by considering the Risk profile of the business written and its operations. Risk is uncertainty and can be considered as possibility that events will develop worse than planned.

**Uncertainty of claim costs by line of business**

-trends in cycle (legal, technological, social economical, fiscal, political and environmental)

-Inflation and currency mismatch

-exposure to catastrophic losses, insurable interests, events (natural or economic), decisions (judicial, legislative, regulatory)

**Asset risks** due to: low income, capital values and mismatch

**Credit Risk:** fraud and poor management, broker's and agent's balances, failure of re-insurers to pay and speed up recoveries

Rapid growth- capital insufficiency

Management competence

Ownership issues: financing, related companies, regulation and accounting

**How to mitigate these risks**

Diversification by country, currency, industry, classes, assets

Appropriate reinsurance with reputed insurers

matching and hedging of assets

good management information

**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 profit

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

How to allow for re-insurer's security and reinsurance

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

Whether every risk can be measured- management risks

**Benefits of the MCR:** Simple, objective and easy to verify. Allowance is made approximately for volatile classes, reinsurance and companies with high loss ratios

**Weakness Of the MCR**

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.

MCR takes only a broad account.

Companies reserving inadequately or charging inadequate premiums, MCR falls instead of strengthening. MCR 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.

**Benefits of RBC:** RBC tries to overcome some of these issues by quantifying the risks that are being taken by the insurer. Weight is given to the riskiness of the business, credit risk and investment risk. Formula may be prescribed that the insurer has certain probability of meeting the claim

**Weakness of RBC**

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

Management risk is impossible to quantify.

More complex than MCR and more data is required.

Q.2.(ii)

$SM(n) = SM(n-1) * [1+i*(1-t)] + R(n) * (1-t) * (1-d)$  where

SM(n) is solvency margin at the end of year 'n'

't' equals rate of tax charged on gross insurance profit and investment income.

'i' equals gross interest income earned on all funds

'd' dividend on net insurance profit distributed as percentage.

'SM(n)' = k \* P(n) percentage of written premium

Solvency margin at the end of the year equals the solvency margin at the beginning of the year increased by net of tax investment income plus the post tax retained profits.

$SM(n-1) = 0.4P(n-1)$   $SM(n) = 0.4P(n)$

and  $P(n) = 1.3P(n-1)$  Substituting in the formula above, we get

$0.4 * 1.3P(n-1) = 0.4P(n-1) * [1 + 0.09 * 0.67] + R(n) * (1 - 0.33) * (1 - 0.5)$

Simplifying, we get,  $0.335R(n) = 0.4 * 0.2397 * P(n-1)$  and hence

$R(n) = 0.287P(n-1)$

$= 0.220p(n)$

The insurer's gross profits should be 22% of the premiums written in year 'n'

This will be a tall order given that the company wants to grow at the rate 30% making it to difficult to achieve the strategy in a competitive market.

He may have to whittle down the solvency margin to a lower level. One cannot maximize the market share as well as maximize profits. Rapid growth can lead to

insolvency as the company may insure many risks at inadequate premium to increase the market share. Maximizing profits would mean increasing the premium rates charged and this may affect the quality of the portfolio by driving away the good risks to competitors who may offer lower premium rates. Bad risks will remain. So some compromise is needed.

Q3. The whole question revolves around the suggestion to allocate investment income and overheads in proportion to earned premium income. Is it appropriate? Or are there any alternatives?

Assume all the investment income is related to reserves ignoring income from capital and retained profits.

Calculate insurance profit as per CFO's suggestion.

|                  | Household | Motor  | E.L.   |
|------------------|-----------|--------|--------|
| Earned premium   | 10,000    | 10,000 | 10,000 |
| -incurred claims | 7,000     | 7,500  | 9,000  |
| -expenses        | 1,500     | 600    | 500    |
| -overheads       | 2,000     | 2,000  | 2,000  |
| +investment      | 1,300     | 1,300  | 1,300  |
| Ins.Profit       | 800       | 1,200  | - 200  |

Based on the above analysis, CFO has concluded that EL may be dropped and concentrate on the other two lines.

The suggestion is not appropriate. It is better to allocate investment income based on assets backing each line of business that is to relate them to mean reserves and not earned premium income.

It may be argued that overheads may be related to contribution of each class. There can be many other arguments but definitely not according to earned premium income.

Allocation of investment income:

Should we consider the capital gains? Investment return includes investment income plus investment gains/losses. Different lines of business may have different levels of income and gains.

We assume the average of the technical reserves both UPR and claim reserves. (not the year end or beginning reserves). That is the assets backing those reserves.

We should remove assets that do not earn any income e.g. brokers/agents balances, computer and other furniture

Some lines of business have significant proportion of assets in agents balances

Liability profile of different lines of business is different and hence need to be allotted matching assets and hence earn different level of income. There is need to allocate more equities rather than bonds to EL than to House- hold.

Assuming on average 2 month's written premium are held with Brokers, we need to deduct this from the average technical reserves and split the investment income in proportion to the average reserves assuming they all earn same rate of return

Mean reserves:

Household =8000-2000=6000

Motor =8750-2500=6250

EL =15250-1417=13833

Investment income:

Household =897

Motor =935

EL =2068

Allocation of overheads:

It may be thought the overheads need to be met by the business as a whole and hence to be ignored at class level.

A detailed expense analysis needs to be done and then some of the overheads can be related to each class. IT as per time spent on each class of business, H.O claims and underwriting to be allocated according to time spent on each class of business and so on.

We may not allocate the overheads at all for this exercise.

|                  | Household<br>10,000 | Motor<br>10,000 | E.L.<br>10,000 |
|------------------|---------------------|-----------------|----------------|
| Earned premium   |                     |                 |                |
| -incurred claims | 7,000               | 7,500           | 9,000          |
| -expenses        | 1,500               | 600             | 500            |
|                  |                     |                 |                |
| +investment      | 897                 | 935             | 2068           |
| Ins.Profit       | 2397                | 2835            | 2568           |

This indicates that all the three lines are contributing similar amounts to overheads and profit.

Consider more details before we decide on EL

The increase in UPR suggests rapid growth in Household and Motor while the EL seems to be stagnant.

Reserve for EL has substantially increased even though this business has not shown much growth.

Can this be due to strengthening of reserves as claims manager might be aware of potential large loss e.g. Asbestosis/ industrial deafness, court judgments

Is it due to slowing down of speed of claim settlement?

The result shown above for EL is subject to greater uncertainty, in view of long tail.

Estimates need to be done for a longer time and hence may turn out to be wrong.

Latent claims need to be kept in mind.

Profitability of each class need to be established by using best estimates of claim reserves without unnecessary margins, more accurate allocation of expenses and investment income, using discounted reserves . One may consider allocation of capital and free reserves and hence the investment income on those assets to different classes

in accordance with the risk profile. Also establish trend in claims and look at the competitiveness of premium rates.

Implication of reducing 5% in premium rates and dropping of EL business:

Assumptions: volume of business remains the same initially.

Expenses also reduce by 5% as they are linked to premiums

Investment income also reduce by 5%

|                 | Household | Motor. |
|-----------------|-----------|--------|
| Earned premium  | 9500      | 9500   |
| -incurred claim | 7000      | 7500   |
| -expenses       | 1425      | 570    |
| +investment     | 852       | 888    |
| Contribution    | 1927      | 2318   |

Compare the contribution of 4245 now with earlier total of 7800. To maintain the same level of profit of 7800, we need to increase the volume of business by 84%. That is  $1.84 \times 2 \times 9500 = 34960K$ . This is a very sharp increase and requires considerable marketing effort and consequential expenses, high level of capital to maintain the solvency ratio.

The business has been expanding as mentioned earlier, Should we need to cut premium rates? Can the company cope up with the administration of such rapid expansion? What will be the reaction of the competitors to reduction in rates? Will the quality of the portfolio be affected?

Q4. Part1. This is a small company, with a low retention such that the data of 60 claims during the 5 years will be available. One should have detailed knowledge of the type of company, the quality of its underwriters and claims managers, the nature of business written and statistical evidence of past claims behaviour.

Type of company: Is it expanding all its business or only in certain areas of its business. Being small company means, it has only small share of the market and may not be able to radically change its book of business during the 5 years. If it has expanded or expanding rapidly, then past data cannot be put to effective use without making adjustments and the past claims may not be indicative of the future.

Some small companies may specialize in certain risks or in certain geographical areas in which case it will be difficult to use general market data as an alternative to company's own data. The reinsurer has to carefully isolate the sections of the general data relevant to the direct insurer's business before it can put to use the market data.

Quality of staff of the cedant;

The reinsurer should have good knowledge of the quality of the cedant's staff in underwriting and claims settlement. This could be ascertained while negotiating the terms of the treaty with the insurer or his broker. While this may be difficult to gather this information, one may get a broad idea of how good or how successful the staff is doing their job. This gives reinsurer confidence in quoting good terms.

Type of business:

Cover is required for liability business. This is a long tailed business requiring long number of years to settle claims. The recent year's claim may not have fully developed and may consist of estimates. Further a stability clause might have been included with varying excess points which would have applied in each of the last 5 years. Past data need to be adjusted using the index. Details of claim below the excess point will be useful to get a better knowledge of the distribution of claims.

If the stability clause had not applied during the five years, then the approach will be different and a high reinsurance cover would have applied and one can get extra data required to apply necessary correction.

Statistical evidence of past claims:

There were sixty claims in the last five years. We may see an underlying claim amount distribution but the number is not large enough to confirm this distribution with available market data. We need to make an estimate the cost of the required excess by integration. In arriving at the distribution, account should be taken of any change in excess in the past or planned for the future. Adjustment has to be made for changes arising out of legal conditions.

Loading for expenses, profit and contingencies would be added to basic risk premium. There may be some pattern or consistency in the claims in each of the last five years. If there were no major change, then we may use a weighted burning cost method. Make adjustments for inflation and other secular factors. Use top slicing for a few infrequent but exceptionally large claims. Then make a loading for these exceptional large claims unless this has been built in the safety margin. Make allowance for inaccurate claim estimates and slow notification of liability claims.

Part ii:

This is a large company with very high retention. It has sufficiently large reserves to carry on its own all most of the risks. Cover is required only to restrict undue influence of its liability account caused by infrequent very large claims. May be they have another treaty with another insurer and approaching us to cover very high level of risks. But the fact that it is a large company, we assume that it needs only cover for very large risks and does not have any other treaty with other company.

Nature of the business:

We need to collect information to give us a feel for the volume and general nature of business written. We need to know the range of risks the company is running.

Statistical evidence of past claims:

Past claims data of this company alone will not be of much use in rating this type of treaty with such high excess point. The company is lucky to have only three claims in five years or the claims band covered by the treaty is subject to few claims. We need to look into other sources for more information.

Can we get more data for claims below the excess point and the exposure from which it arose. We need data on claims say over 75% below the excess point. In view of the size of these claims, many may not have been settled. If the re-insurer has similar risks in his books say from similar treaties with other insurers in the market, it may be of great help.

Another problem is random variation in occurrence of such large claims causing much variation to estimate the extreme tail of the claim amount distribution from such sparse data. Surveying market data for frequency

of events of the size of claims referred to us may be of some use.

A complex mathematical method of rating may not be useful in view relatively large fluctuations in frequency and the size of these claims.

So calculate the income required to pay the claims from several such treaties together and based on market data, use a burning cost type of method with large allowance for safety margin in addition to expense and profits.

Part iii:

Here the risk is property based and the treaty need to indemnify the cedant against aggregate claims once they have crossed a very high level.

Nature of the business written:

As we are looking at very high level of risk, the past data of this risk alone is not of much use. In order to have background knowledge, we need to have past data on the extent of property damage claims arising out of certain types of catastrophes say windstorms, earthquake, flood and explosions of plants. We need to take into account the type of construction changes in the densities of buildings. More properties are being constructed in area prone to natural catastrophe. Identify territories subject to catastrophe with reference to data published by government agencies, private research organizations and internal data. The risks are increased because of the technological progress. This leads to exposure to man made catastrophes. See what concentration of property cover is already undertaken. The ceding company needs to provide an estimate of total property sums insured for each of specified exposed high risk areas together with a note of any significant concentration of exposure in any other location.

Estimate the larger potential losses. Collect similar data on other treaties to be aware of the aggregation of risk from all inwards treaties together in each area.

What will be the cost of buying outwards aggregate excess loss cover for this type of business? This will be valuable cover and gives an idea how the market estimates the cost of such cover.

Events of this nature occasionally affect regions of heavy concentration in insured property. So we need to avoid exposure to such concentration. The result of losses need to be evened out over a longer period partly from past reserves and partly from increased premiums and reserves need to be built up for future events.

The rate will be based on crude estimate of the total amount of income required to give a net profit after outward reinsurance over long period. Adjustments need to be made to any special features of the cedant, a reasonable safety margin, expenses and commission.

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