

Institute of Actuaries of India

Subject SP7 – General Insurance Reserving and Capital Modelling

November 2023 Examination

INDICATIVE SOLUTION

Introduction

The indicative solution has been written by the Examiners with the aim of helping candidates. The solutions given are only indicative. It is realized that there could be other points as valid answers and examiner have given credit for any alternative approach or interpretation which they consider to be reasonable.

Solution 1:

- i) Parametric insurance refers to type of insurance contract that insures a policyholder against the occurrence of a specific event by paying a set amount based on the magnitude of the event, as opposed to the magnitude of the losses in a traditional indemnity policy [2]
- ii) Major advantages
- The key advantages of parametric insurance are fast payouts, high flexibility and the option to provide coverage for losses that are difficult to model
 - parametric insurance solutions are designed to complement traditional insurance programs by filling the protection gaps left by indemnity insurance like deductibles, excluded perils, scarce capacity etc
 - more certainty in term of Outgo for Insurer
 - ...this reduces the claims handling costs which can be passed on in the form of lower premiums
 - the lower uncertainty led to lower capital requirement during RBC regime
 - This reduction in the cost of capital allow capital to be used for other purposes or growth in other lines
 - help in achieving diversification with relation to traditional insurance lines
 - greater flexibility in the triggers used and the payouts based on the requirement of the policyholder
 - innovative product will improve market standing increasing brand reputation and possibly attract more profitable business
 - data requirements likely to be less onerous
 - more suitable for new and emerging risks where the overall extent of risk severity and frequency is not well understood given the high uncertainty around the potential losses
 - provide immediate liquidity to the insured post disaster

Major Disadvantages

- Lack of credible and reliable data leading to difficulty in pricing and reserving
- Payout may be more or less than actual loss suffered. It is not based on Indemnity principle
- difficult for the insured to compare the policy with other traditional options

[6]

[8 Marks]**Solution 2:**

- i)
- Company is in 6th year; claims not fully run off- basic CL not suitable. Claims in first year not completely developed
 - Chain ladder using paid data may not be apt
 - Differences in claim data between file used for chain ladder and that of case estimates
 - Inflation lower than 5% in previous years from which data drawn for basic CL
 - Change in business mix: evidence in question. Private car and other (possibly commercial vehicles) give rise to higher amounts and frequency. Unadjusted Chain ladder may not be directly applicable.
 - Half-yearly reviews and improvements for case estimates reflect real picture, especially social/ legal environment better than basic CL
 - Large/ CAT claims in latest development year not fully reflected in paid claims data
 - Company's case procedure quicker in detecting new information and worsening cases?
 - Business growth cause of lower quality of business and higher average claim amount-not reflected in basic CL
 - Treatment of allocated loss different in basic CL.

- Impact of reinsurance considered in basic CL different from case estimate reserving [6]

ii)

a)

- Collect data for all the years since inception.
- Collate the data into homogeneous groups . The data should at least be split into policy groups that have different excess levels, for example level of cover or age bands.
- Adjust the data for inflation, IBNR, Changes in cover etc.
- Fit a density function to individual claim amounts. You may also fit a density function to the probability frequency but this is less crucial and it may be modelled deterministically instead.
- Check the goodness of fit and revise the parameters/ distribution function if necessary.
- The expected claim experience can be determined using simulation techniques allowing for chosen excess levels. This can be repeated for different excess levels.

[3]

b)

- There should be corresponding change in the premium rates to accompany the change in the excess level. The expected impact on profitability should be examined.
- As the premium rates are changing the loading for expenses, profit and contingencies should also be reviewed to ensure, for example, that the contribution to fixed expenses is still adequate.
- The attitude of the policy holders towards claim may change. For example, if the excess is increased then policyholder may not consider claim previously made to be large enough to bother claiming. This would also lead to lower administration expenses.
- Alternatively, policyholder may also try and inflate the claims so as not to lose out financially.
- The effect the change in excess will have on new business volumes should be considered. Will policy holders be disillusioned by any change.
- The excess of level of competitors/benchmarks should be examined.
- The change should be considered when estimating reserves
- Check that the change to administrative system and policy documents can be made.
- Reinsurance arrangement may need to be revised.

[7]

[16 Marks]**Solution 3:**

i)

- Realising Fair value change account, if possible, leading to increase in investment income
- Requesting amortization from regulator of expenses
- Loss portfolio transfer or adverse development cover of loss making business
- Financial Reinsurance, if allowed
- Raising capital through Subordinated debt or any other form
- Re-pricing or stop writing loss making business
- Reducing business volumes as they can have a strain on solvency
- Requesting discounting of reserves

[4]

ii)

- Different Action will be taken by regulator depending upon if it is looking to keep company Going Concern or run-off
- Regulator may request solvency on Economic Capital/RBC to see correct position

- Regulator may look to identify the underlying reason for fall in solvency to take appropriate steps
- May seek the detailed business plan with regulator for a next few years to see when will solvency will reach back control level
- Plan should include measurable targets at each quarter to assess performance against plan
- May ask to prepare solvency position monthly rather than quarterly
- Regulator could require that an external consultant to prepare a report on the company.
- Regulator may ask the company to increase rates for loss making business
- Better matching of Asset liability for a few initial years to ensure risk relating to asset matching are reduces
- Regulator may ask promoters/shareholder to pump more capital
- However if company is not able to increase capital, more onerous requirements may be placed such as ;
- Restrictions on the amount of business the company can underwrite
- Restrictions on the classes of business the company can underwrite
- Restrictions on offering high risk features in certain types of business
- Such restrictions ensures company has sufficient capital and expertise to underwrite
- Requirement to purchase additional reinsurance
- Restrictions on the amounts of dividends the company is permitted to pay
- Restriction on the types or amounts of certain assets to demonstrate solvency
- For example, requirement on transfer investments to liquid assets to reduce the risk of failure arising from investment losses
- The use of prescribed bases to calculate premiums, asset values and liabilities to demonstrate solvency.
- Additional reporting requirements
- Rigorous monitoring from regulator to company
- Additional audit requirements
- May look for change in top Management, if needed
- Look to sale of insurer to a well-capitalised parent, if infusion of capital is inevitable and it is not available with Owners
- If failure considered inevitable, manage the orderly run-off of the insurer
- Close to new business entirely

[10]

[14 Marks]**Solution 4:****i) Assumptions:**

- The loss ratio for 2015-2017 data is appropriate for 2019-2022
- Accident years 2018 and earlier years are fully run off.
- The development of the claims has been stable in monetary terms.
- Future inflation is weighted average of the past inflation.

Method:

Reserve under BF method= $LR * EP * (1-1/UDF)$ where UDF is ultimate development factor

Estimating LR

Accident year	Ultimate Claims	Earned Premium	LR
2015	12,672	25,500	50%
2016	12,379	28,970	43%
2017	14,678	34,650	42%

The loss ratio for the year 2015 to 2017 suggests a loss ratio of 45% is appropriate. The ratio is expected on the prudent side to estimate a prudential estimate of reserves. The LR for 2018 has been ignored as an aberration to be on the prudent side.

Note: Appropriate marks were given if students calculated simple/weighted averages for 3 years/2 years/4 years as well as long as they specified and explained the mathematical method of computation for the same considering that there was some variability in the LRs and the future premiums have been increasing and as long as they erred on the side of prudence with respect to overall experience

Accident Year	0	1	2	3	4	Ultimate	Earned Premium
2015	8,789	9,645	10,066	11,892	12,672	12,672	25,500
2016	9,768	10,678	10,999	11,237	12,379	12,379	28,970
2017	9,980	10,567	12,489	13,300	14,678	14,678	34,650
2018	10,890	11,890	12,360	13,505	14,890	14,890	42,665
2019	11,999	12,764	13,876	15,890			40,905
2020	15,500	21,890	24,745				45,895
2021	18,768	19,765					51,895
2022	20,897						52,545
	0-1	1	2	3	4	5	6
DFMs	1.134256774	1.0917039	1.10091989	1.09382385	1	1	1
cdf	1.491143187	1.3146434	1.20421243	1.09382385	1	1	1
% dev	67%	76%	83%	91%	100%	100%	100%

Estimating reserves

AY	Ultimate claims	(1-1/UDF)	Reserve
2015	11,475		-
2016	13,037		-
2017	15,593	0%	-
2018	19,199	0%	-
2019	18,407	9%	1,579
2020	20,653	17%	3,502
2021	23,353	24%	5,589
2022	23,645	33%	7,788

The total reserve required is INR 18,459 crs.

[9]

ii)

- Legislation and prevailing accounting rules that allow or restrict discounting techniques.
- Nature of business ..Long tailed or short tailed ... investment income on long tail reserves is significant.
- The asset type in which is invested in and the asset type that the company is permitted to invest has a bearing on the discount rate to be applied.
- The extent to which the realistic picture of the financial condition of the insurer need to be shown. There is a strong argument to use discounting when preparing published accounts or account for solvency control for the purpose of rating.
- allowance for the assets not available for investment and because of the money held with intermediaries and reinsures.

- is discounting being viewed by investors as sign of weakness
- the extent discounting helps insurer solvency level and profitability by reserves reduction.
- Margin for prudenceit is prudent not to discount.

[4]

[13 Marks]**Solution 5:**

i)

- Emergency Care due to sudden illness or injury
- Due to worsening medical condition, transport to home country, or to better hospital in same country
- In case of death, repatriation of remains to home country or cost of local cremation/ burial
- PA death and disability cover, anytime during the trip outside country
- Baggage lost by Common Carrier
- Trip cancelled at beginning due to AOG, terrorism
- Legal liability to pay for third party Accidental
- Loss of Driving license, Passport & Visa
- Connecting Common Carrier is missed due to Common Carrier being late due to weather, strike or equipment failure of common carrier,
- Automatic extension up to some number of days due to unavoidable/ unforeseen circumstances
- For Hospitalization exceeding some number of days, family member visiting insured, cost of economy airfare and accommodation cost

[5]

ii) Risk 1: Anti Selection if product is not properly priced

Measures :

- Competitor Benchmarking to compare premium rates
- Rating Factors which can be used:
- Travel to Country - ASEAN, ASIA, USA and Canada etc, Age of policyholder, duration of travel ... which will help in differentiating risks
- Regular monitoring will help in doing quick course correction. Experience can be quickly available as very short duration policy
- Hire experience Underwriters for better selection of risk
- Purchase Appropriate reinsurance

Risk 2: New product so data may be not available for pricing

Measures :

- Industry data and research of foreign markets can be done to find various costs
- Flights/travel related data from travel website

Risk 3: Exhaustive coverages leading to higher premium and Lesser sale

Measures:

- Basic coverages can be compulsory and other can be provided as add-ons
- Online sale for better reach and reducing cost
- Introduction of deductibles
- Lower limit for single claim for some of high risk coverages

Risk 4: Currency risk due to exchange rate movement

Measures:

- Change in rate chart with movement in exchange rates e.g. Increase in rates by 5% for every 5% fall in currency
- Currency hedging can be explored

Risk 5 Operational Risk: Risk related to IT system and providing administrative and claim related services

Measures:

- Study of IT system of Peers before development
- Thorough UAT and making sure all rating factors are captured
- New company so in start claim related services may be outsourced to TPA
- Need to tie up with Insurance related service providers in Overseas

[8]

[13 Marks]

Solution 6:

- Company can go for Run-off Reinsurance methods such as Loss Portfolio Transfer or Adverse development covers
- Company needs to identify reasons for such an increase in reserve to decide for which methods to choose;
- Is it due to any recent court judgements
- Is it due to some claims registered now which were outside claim system
- Is it due to recent one-off exercise of visiting all claims files
- All business is mainly short term so most of the technical provisions will be of Motor TP. Therefore, TP provision amount will be exorbitant requiring significant consideration in choice of run-off method
- Most of the older years are fairly developed so not much movement in reserve is expected
- Around 85-90% of the technical provisions are in latest 5/6 years so company need to decide if it wants to Reinsure only recent years or complete Motor TP portfolio

LTP:

- Company needs to see if regulation allow for Loss Portfolio Transfer
- The company could use the LPT arrangement to transfer in view of loss making portfolio
- The company generally take LPT if it is not able to manage efficiently and resources can be better deployed elsewhere
- However, company still continues to write TP so may not completely remove TP liability from it's book
- The company will need to inform policyholders and reinsurers of this transfer
- The company need to check if it needs any court approval which is required in many foreign jurisdiction
- Claims handling functions could be removed or redeployed elsewhere
- Company/Reinsurer need to consider discounted value of Motor TP liability as right now liabilities are not discounted
- Discounted value could be value depending on rate of current portfolio yield

- There will still be significant Motor TP policies in its “premium receive in Advance” as 3/5 years policies are given to new vehicles
- Buy in of Reinsurer is required
- Significant release in capital can happen
- There can be Tax implications for Insurer
- GST on premium may nullify any benefit in Capital

ADC

- The company could purchase an ADC on a few accident years or it’s complete Motor TP business
- The company has a choice of attachment point for the ADC depending on risk appetite and cost
- The company could keep some share in the ADC to keep the cost down
- The company could decide to keep or pass on the claims handling function, depending upon the arrangement with the reinsurer
- Company can benefit favourable reserve movements if it thinks reserve are prudent
- Investment income will be with company which can be significant
- No court approval required
- Keep an interest in the performance of the business and maintain data
- Claims would usually still be handled by Company B and hence there are the associated expenses

[15 Marks]

Solution 7:

i)

- Capital will be needed to cover:
- Legal and regulatory costs- to hire legal and regulatory experts to navigate the licensing and compliance processes, which may involve fees and ongoing compliance costs
- Market Entry Costs: market research, establishing relationships with brokers, and adapting to local regulations.
- Compliance and Risk Management Systems: includes software, training, and ongoing monitoring costs.
- Professional Services: costs to engage consultants, auditors, and advisors to help set up your company, ensure compliance, and manage risks.
- Insurance and Risk Management: to purchase insurance coverage to protect against potential losses and liabilities. This can be a significant upfront cost.
- Depend on the business plan of the Company- specific capital requirements will depend on regulatory guidelines and the risks you plan to underwrite.
- Office Space, technology, equipment and Infrastructure- cost will vary based on the location and size of your company.
- Staffing: Hiring skilled professionals in the reinsurance industry, such as underwriters, actuaries, claims adjusters, and administrative staff, is essential. Salaries, benefits, and recruitment costs are part of this expense.
- Technology and Software: Reinsurance operations rely heavily on technology and software for data analysis, risk modelling, and policy administration.
- Marketing and Business Development
- Reserving and Capital Adequacy: capital for potential claims and meet capital adequacy requirements.
- Reinsurance Treaties: reinsurance premiums if plan to reinsure own risks
- Operating Expenses: Regular operating expenses, such as utilities, insurance, and employee salaries, will also be incurred.

ii)

- Estimate the inflows and outflows that will be incurred based on the specifics of the reinsurance company and its business plan. It will be necessary to create model points that represent the mix of employer's liability and professional indemnity business the Company intends to sell.
- Cashflow model will be needed which projects the cashflows into the future. Cashflows will include premiums, claims, expenses, investment return, reinsurance premiums and recoveries and tax.
- Model must allow for any required solvency margin.
- Cashflows should be discounted back at apt risk discount rate in order to determine the reserves that are needed.

Basis should be chosen that will be fit for the purpose:

- If the company is calculating economic capital, a realistic basis might be apt
- If the company is calculating regulatory capital, then a prudent or cautious basis may be more apt- in this case the basis may be prescribed.

It will be necessary to decide:

- Variables that will be modelled deterministically and the ones which will be modelled stochastically
- Time horizon over which to model the cashflows- this should be the lifetime of the business being modelled
- The degree of accuracy required and so the number of simulations required- a minimum of 50,000 simulations would generally be considered apt.
- Correlations between different variables should also be allowed for
- Model should ensure consistency between various assumptions
- Allowance should be made according to the structure, terms and conditions of the products- employer's liability and professional indemnity
- Future tax position should also be considered
- Scenario and sensitivity testing should be carries out on different assumptions.
- Output from model will be the amount that needs to be held as reserves plus any required solvency margin. This will be scaled up to reflect the volume of the business the company expects to sell
- The initial capital required to set up the company will be added to give the total capital required to set up the new reinsurance company.

[9]

iii) Let capital required for EI =x

Capital for PI=3/2x

.3*x=12%*1000

x=400 crores

So the Capital Required for EL is 400 Crores

Capital for PI= 3/2*400=600 crores

So the capital Required for PI is 600 Crores

Total Capita = Capital for EL + Capital for PI

Total Capital= 600+400=1000 crores

$$\text{ROC} = 30\% * (1000) = 300$$

$$\text{Profit on PI} = 300 - 120 = 180 \text{ crores}$$

[5]

[21 Marks]
