

Institute of Actuaries of India

Subject ST7 – General Insurance: Reserving & Capital Modeling

March 2018 Examination

INDICATIVE SOLUTION

Solution 1:

- i) It is an agreement between two insurers specifying how claims costs are shared between them when vehicles insured by each of them are involved in the same accident. It specifies that each insurer meets the cost of the damage to the vehicle it has insured without any investigation or allocation of legal liability.

Type of insurance it is usually associated with – Motor Insurance

[2]

- ii) This date is used for claims made cover. It is the date after which claims must have occurred in order to be covered.

Type of insurance it is usually associated with – Liability (Casualty) Insurance

[2]

- iii) It is an Insurance cover for financial losses arising following damage where the policy will pay out to compensate the policyholder for not being able to conduct their business. eg as a result of a fire in the building.

Type of insurance it is usually associated with –Financial Loss Insurance

[2]

[6 Marks]

Solution 2:

	Rs. In Crores
Budgeted Underwriting Profit / (Loss)	(12)
Less – RI claims recovery lesser than budget (Lesser recovery hence reducing the profits)	(3)
Add- DAC at year-end higher than budget (Deferring expenses and hence increasing profits)	5
Less – AURR which was not budgeted (Additional reserve and hence reducing profits)	(2)
Add – Rectification of opening UEPR (This will lead to more premium earnings in current year and hence more profits)	8
Add – Commission paid less than budget (This will lead to more premium earnings in current year and hence more profits)	3
Add – IBNR reserve less than budget (This will lead to more premium earnings in current year and hence more profits)	2

Forecasted Underwriting Profit/(Loss) = Rs. 1 Crore UW Profit.

[3 Marks]

Solution 3:

i) a)

This risk arises due to difference in actual vs expected claim development. Possible reasons for this include:

Change in reporting and settlement patterns from expected.

Change in other trends like frequency and severity from expected.

These changes could happen due to change in regulation, legislation, economic factors like inflation and exchange rate, or other external factor.

[2.5]

b)

This risk arises due to failed or inadequate internal process, people and systems or from external events. Possible reasons include:

Administration of processes and governance of people.

Non-adherence to legislation and internal firm requirements.

Impact of significant events on the operations of the company.

Fraud, such as intentional misappropriation of funds.

Inability to implement appropriate business plan.

Errors with respect to technological aspects.

[2.5]

ii) a)

One would need to understand the effect of this judgement on all future court awards against outstanding claims and claims reported in future. The judgement may apply to few claims or all the claims.

This is likely to impact both, reserve risk and u/w risk as awards for past outstanding claims might increase. Also, liquidity risk is likely to increase as payouts might be higher and in the absence of matching assets being readily available, this could give rise to cashflow constraints.

The current distribution or Bootstrap is unlikely to have factored this event, so the current model would not have captured the effect of this court award..

Simply the mean of the distribution could have shifted if this event is not considered to be in future. However, increased volatility is likely to be considered as such judgement can't be ruled out in the future.

Capital requirements are likely to increase with increased risk for reserve, U/w and liquidity.

[6]

b)

A risk-averse company should have matching assets and liabilities and the exchange rate should have very limited impact on the capital requirement.

However, the company may also have a mismatched position due to market conditions or capital requirements. If USD assets are more than USD liabilities, overall assets of the company would reduce and vice versa.

The economic scenario generator in the capital model should have allowed for this event and capital should have been based considering this event. However, the event might be outside the risk tolerance limit (say beyond 99.5 percentile) of the company. In such a case, either the re-calibration of ESG or increase in the risk tolerance would be required.

The increase or decrease in liquidity risk would depend on whether assets are more or not. If assets are more, liquidity risk would reduce.

This dip may also impact various other asset classes in INR depending on the reason for exchange-rate drop. Thus, the market value of these assets may change (hence, the mean may change) affecting the overall market risk.

Overall, if the risk increases, capital would increase and vice versa.

[6]

[17 Marks]

Solution 4:

Various sources include:

- Difference in Business mix: One company may be writing trucks while the other may be writing buses in commercial vehicle segment.
- Customer segments: The target profile of customer may be different. Eg. High networth vs mass.
- Operating markets: The location of business may be different

- Distribution channel: Some channels perform better than others
- Classes of business underwritten including exposure to new class: How much each class contributes to the business volume
- Size of business: Larger company financials are likely to be less volatile.
- Past year movement: Reserve release or strengthening in IBNR or outstanding estimates over the past year would impact current financial loss ratios
- Current pricing: The pricing of companies is likely to be different.
- Large or cat claims: The ratios may be affected by one-off large of Cat claim.
- Impact of any latent claims: In books of certain companies, claims due to some very old exposure may have triggered.
- Reinsurance arrangement: The loss ratios would vary by different Reinsurance limits.
- Age of the business: Like in health insurance, more claims are expected after end of waiting period.

[6 Marks]

Solution 5:

If the data structures of the two companies are similar, merging the data systems would be less challenging. Eg. Similarity in recording an endorsement, or how multiple claims for a single policy are treated.

However, if data structures are significantly different, choice has to be made for the selection of a particular data structure. Then all the data of one company needs to be brought into data structure of the other company. This may result in loss of consistency in data or even missing data, if not done properly.

Some of the senior staff in the company may leave after hearing the news of merger, which might create gap in terms of understanding of data if proper documentation is not available.

The activity of merging datasets may require significant amount of time. Thus, old and new systems might be run in parallel which may lead to data issues.

Not all the data fields would be present in records of both X and Y. Like, company X might not be capturing gender for motor policies. This would then require certain field values to be left blank. So any analysis using these fields might have to re-done.

The field values of the records might be different for two companies. eg. One might capture gender as Male and Female and other might capture as M & F. If not made uniform, this would make data summary/analysis difficult to perform.

Date formats need to be consistent, else there may be an issue. One company might be storing data in DDMM format while other might be storing in MMDD format.

Certain products might be closed after merger due to redundancy. Recording of future claims/endorsements still need to be made in the system. So, appropriate provision would be required for the same.

Reserving would require many products to be combined into a single line of analysis. So, appropriate mapping would be required. Also, the development pattern might get distorted if they were different for different underlying products.

If the data is not managed properly, significant issues with regards to regulatory work may appear. This may reduce efficiency, and even lower the brand image of the company. Thus the data needs to be tested thoroughly before closing the old data systems.

The opening position of new financial statements would be difficult to match against old financials of two companies as complete knowledge of various items and aggregation of those would be required.

[10 Marks]

Solution 6:

- i) Crop insurance covers the risk of loss in crop yield due to factors such as bad weather, flood, high or low temperature, poor fertility, etc.

The two common forms of crop insurance are:

1) Yield based: Here the coverage is provided based on the shortfall in yield, if any. The determination of yield is based on sample basis carried out in a farm in a particular area. So, the coverage is not purely indemnity in nature, and may result in loss or profit.

2) Weather based: Here the coverage is provided based on triggering of an insured weather event.

Weather Based Crop Insurance aims to mitigate the hardship of the insured farmers against the likelihood of financial loss on account of anticipated crop loss resulting from incidence of adverse conditions of weather parameters like rainfall, temperature, frost, humidity

[4]

ii)

It is a very short tailed class. No information is available until the crop cutting exercise is carried out. So, from the start of premium earning, it could take 6 months for claims to be reported. If the reserve valuation is in the middle of crop season, no claim information would be available.

Government intervention happens while determining the yield of the area. Based on this claims are reported in yield based insurance. The timing of this may vary over the years.

Once the crop cutting exercise is carried out, claims are reported in bulk and usually don't follow any past pattern.

Even in weather based insurance, the claim would depend on the occurrence of an insured weather event whose timing could differ from past years.

The experience is also likely to be very volatile as it depends on numerous external factors and may include catastrophic events.

[5]

iii)

The starting point is the expected loss ratio based on pricing assumptions. This would have taken into account likely soil, crop and weather conditions.

This loss ratio can be adjusted for any information obtained from the area like any peril that may affect production, satellite image etc.

Once claim notification takes place, some extrapolation may be done to arrive at the ultimate liability (like % of area whose data is available to total area etc).

Past loss ratios of the area could also be looked at after adjusting for rate change to estimate the ultimate liability.

[4]

iv)

Month	Written Premium	Earned Premium	Weight-Actual Claims	Weight-Expected Claims	Claim- Actual	Claim- Expected	Yield Claim Ratio	Expected LR	Final LR	IBNR
1	400	20	0%	100%	0	0	0%	80.0%	80.0%	16
2		20	0%	100%	0	0	0%	80.0%	80.0%	32
3		20	0%	100%	0	0	0%	80.0%	80.0%	48
4		60	0%	100%	0	0	0%	80.0%	80.0%	96
5		280	0%	100%	0	0	0%	80.0%	80.0%	320
6		0	50%	50%	150	160	75.0%	80.0%	77.5%	170
7		0	100%	0%	150	160	75.0%	80.0%	75.0%	0

Assumptions:

The claims are assumed to be reported uniformly over 2 months.

Equal weight of actual and expected Loss Ratio is applied in calculation for 6th month.

The IBNR is based on expected Loss Ratio method.

[6]

v) Various uses include:

- Showcasing reserve adequacy and the risk involved– So that uncertainty is clear to the management.
- This can be used to determine capital for crop insurance line of business – A distribution (continuous or discrete) can be assumed along these scenarios to estimate the capital at a certain confidence level.
- These results can be used for
 - Understanding the company’s reinsurance needs.
 - Discussions with the regulator on company’s performance, etc.

[3]

[22 Marks]

Solution 7:

i) Various entity segments involved in dealing of crypto-currencies are -

- i. Crypto –currency mining firms - These will be small or medium sized firms with several employees (programmers) & clients for whom they mine currency. They would typically hold assets in form of office premises, specialized machines for mining and crypto-currency in digital wallets.
- ii. Individuals and firms trading in crypto-currencies for value appreciation - These will be high net worth individuals or mid sized firms with some employees (trading operators). They would typically hold assets in form of office premises and crypto-currency in digital wallets.
- iii. Crypto-currency trading online platforms/exchanges - These will typically be large corporate firms with many employees (maintaining the exchange platforms) and a large client base who transact on the platform. They would typically hold assets in form of office premises, servers which host the trading platforms and crypto-currency in digital wallets.

Insurance needs for each segment

- i. Needs specific to Crypto-currency mining firms
 - Errors & Omissions Liability for indemnifying any financial loss (inability to provide mined currency) caused by the mining firm to their clients due to performance failures and negligence in services.
 - Environmental liability for damage to property as a result of unintentional pollution for which the insured is deemed responsible. Mining of crypto-currencies can lead to consumption of lot of energy which may lead to some unwanted pollution.
 - Machinery Breakdown for physical damage to the specialized machines used for mining - repair and/or replacement of damaged parts by fire, explosion, impact damage, flooding, water damage etc. and Machinery Loss of Profits (MLOP) to cover potential loss of earnings over the period of breakdown of mining machinery

- Third Party Liability cover to compensate third parties engaged in the mining process for bodily injury, death or disability
- ii. Needs specific to Individuals investors and firms trading in crypto-currencies for value appreciation
 - Personal liability/third party liability cover for any financial losses caused due to error in transactions done by the investors/trading firms
 - Cyber insurance for loss of currencies stored in digital wallets due to identity theft / unauthorized access by third party to their digital wallets.
- iii. Needs specific to Crypto-currency trading online platforms/exchanges
 - Errors & Omissions policy for financial loss to third parties (crypto-currency investors) caused due to technical errors in the trading platform and/or functionality failure.
 - Cyber insurance for activity of hackers which could result in leakage of customer sensitive information present on currency exchanges
 - Machinery breakdown for physical damage to servers which host the trading platform - repair and/or replacement of damaged parts by fire, explosion, impact damage, flooding, water damage etc and Electrical failure due to any cause like short circuit or volatility in electric current requiring repair or replacement of parts
 - Business interruption for downtime of online platforms /exchanges due to damage/electric failure or any other reason

Common insurance needs –

- Employers' liability –against compensation payable to employees for losses that they suffer as a result of negligence of the employer
- Public Liability resulting from injury to third parties or damage to third party property associated with the firm for visitors on premises
- Building & Contents cover for damage to premises, furniture & fixtures etc. where business is conducted
- Business interruption cover (or Loss of Profit) for inability to use business premises following damage
- Cyber theft insurance for digital theft of crypto-currency stored in a digital wallet due to activity of hackers
- Loss of crypto-currency stored in a digital wallet due to technical errors or any other reason like fraudulent exchanges etc
- Fidelity guarantee cover for financial losses caused by dishonest actions of its employees -such as theft of mined currency or any other theft/embezzlement or fraud
- Exchange rate insurance to protect against the volatility in the exchange rates of the crypto-currencies

- Credit insurance cover against the risk that debtors will not pay their obligations after transaction of the crypto-currency with other investors

[10]

ii) Risks & Uncertainties associated with Profitability are:-

- Since crypto-currencies are a very recent phenomenon, there may not be good awareness of insurance products which cater to these specific risks. Due to this the projections of business volumes will be highly uncertain to achieve.
- Higher digital thefts and hacking incidents may have lead to higher demand for the product, however this could subside as such incidents reduce in occurrence.
- Number of competitors offering such insurance products will also make the business volumes more uncertain.
- Volatility in the crypto-currency market provides even more uncertainty, as the price of crypto-currencies are subject to dramatic increases/decreases in very short periods of time—meaning an expensive policy signed one year ago would cover significantly less than it would have now.
- The insurer will have little experience in knowing what underwriting and rating factors to ask for and use (and to what extent), which may leave it open to undesirable risks and anti-selection.
- Reinsurance may not be available or may not be offered at a suitable price (eg liability cover may be scarce or expensive).
- This would also have impact on the claims severity as well since the value of crypto-currency would have changed from the one on basis of which premium was charged.
- Type of distribution chosen for the product will make an impact on the business volumes – brokers/ aggregators/ online or direct distribution model
- Claims frequency, severity and development may be expected to vary by distribution channel
- The amount and timing of an individual claim is always going to be uncertain
- Claim frequency may be subject to random fluctuations and may also change over time
- Changes over time may be due to a changing attitude of policyholders to claiming. This change in attitude could lead to a spiral effect. If an individual manages to make a successful, but unusual claim then due to the publicity that this is likely to attract, other policyholders in the same position are also likely to claim.
- The interpretation of policy wordings can also affect claim frequency.
- Accumulations of risk may occur from a single hacking event affecting multiple firms and/or a widespread virus attack affecting multiple firms

- Demand Surge - Following a major hacking/virus attack, there will be increased demand for goods and services which may be far greater than originally anticipated.
- There are uncertainties in delays between the date of the claim event, the date of reporting the claim and the final settlement of the claim.
- In addition, the date of the claim event itself may be uncertain.
- The delay between the claim event and reporting of the claim will depend on the type of claim and the speed at which policyholders report potential claims.
- The delay between the claim being reported and settled will also vary by type of claim.
- Large claims are likely to suffer the longest settlement delays, especially in liability classes where the claims may need to be settled by the courts.
- Claims development patterns can be expected to change over time. This may be due to a number of factors.
- Specific influences on expense uncertainty stem from uncertainty over commission and other sales-related expenses, eg for existing and new distribution channels and uncertainty arising from changes in operations, eg new markets and off-shoring.
- General economic conditions will have an effect on expenses.
- Also the general economic cycle is difficult to predict and has a significant effect on investment markets, most notably on investment returns.
- Investment return can sometimes be an important source of income, especially for long-tailed classes of business like liability.
- With capital markets becoming increasingly complex, there is now a much wider range of investments in which the insurer may choose to invest. Some of these investments may be less certain than more traditional asset classes. Crypto-currencies itself can be an asset class in which the insurer can invest for hedging purposes.
- From time to time, governments may vary the level of tax, which will have an effect on the insurer's post-tax profits.
- Many types of incidents giving rise to claims are influenced by economic conditions like inflation, unemployment, economic growth etc. whose changes are difficult to predict as regards both timing and extent. There is therefore continuing uncertainty as to the number and cost of the claims that will occur when conditions change.
- The rates of crimes such as theft and arson have shown considerable variation from year to year and from country to country.
- Current position of this product in the insurance cycle will affect profitability. Insurance cycle is the observed tendency of insurance prices and hence profitability to vary in a cyclical fashion over a period of several years. It can be very difficult to predict, as the frequency and amplitude of the cycle can change every time the market turns

- Impact of regulations on crypto-currencies will also lead to factors for uncertainty in the profitability.

[10]

iii) Innovative Insurance Company Limited can enter into following Reinsurance programs to optimize its risk-

- Quota share –It is proportional reinsurance whereby the premiums and claims for all risks covered by the treaty are split in a fixed proportion. Since Innovative Insurance Company Limited is venturing into new and unusual risks, it will be able to get technical assistance in terms of underwriting/pricing the risks from the reinsurers who might have prior expertise in similar risks.
- Surplus – It is proportional treaty reinsurance whereby the proportion of risk covered varies from risk to risk depending on the size and type of risk. As an alternative to Quota share above, Innovative Insurance Company can opt for Surplus if it wants to fine tune its risk retention by each policy and still avail technical assistance of reinsurers.
- Excess of Loss - The reinsurer covers the risk (or a proportion of it) between defined layers, the limits of which are often indexed for inflation (using a stability clause). This will help Innovative Insurance Company limited to avoid single large losses and to smooth its results.
 - Risk Excess of Loss - this relates to individual losses.
 - Aggregate Excess of Loss - this relates to cumulative losses, where the aggregation may be by event, by peril or by class.
 - Catastrophe Excess of Loss- this is a form of aggregate XL covering severe losses within the hours clause that result from a specified event such as an hacking event or virus attack
- Stop-loss - Stop loss is a specific type of aggregate XL, which covers against very bad experience across a whole account over a defined time period. The limits are usually defined as loss ratios (i.e. as percentages of premiums). Since it is a new and unusual risk, this will be preferred over any other excess of loss arrangement.

[6]

iv) The primary objective with the investment strategy of the assets that support the liabilities should be to maximize the return. This is subject to:

- The nature, term & currency of the existing liabilities – special consideration should be given to the exchange rate of the crypto-currencies which tend to be very volatile.
- To hedge this partially, Innovative Insurance Company may invest selectively in a new asset-class of crypto-currencies as per its exposure.
- The property damage claims will be more nominal in nature and short tailed whereas the liability claims will be linked to inflation and will be longer tailed.

- Level of uncertainty of existing liability – Since the liabilities are very uncertain, appropriate liquid assets need to be invested in.
- Size of assets, in relation to the current liabilities- the larger the quantity of free assets, the more that the company has freedom to invest widely
- Expected long-term return from various asset classes
- Expected volatility within the various asset classes
- Existing asset portfolio
- Non-investible funds – not all of the assets will be available for investment, eg moneys held by brokers, policyholders or reinsurers.
- Economic outlook and its likely impact on security and return on investments eg future inflation affects the return on index-linked bonds
- Risk appetite.
- Tax treatment of different investments and the tax position of the general insurer (consider relative tax treatment of income vs capital gains)
- Statutory, legal, ethical or voluntary restrictions on how the insurer may invest
- Rating agency constraints on capital required to maintain the insurer's desired rating, and therefore a better image and better terms for raising future capital
- Competition – strategy followed by other funds, it is unwise to follow a strategy very different from other insurers selling similar business in case there is a failure of this strategy and the insurer is the only one suffering losses
- Regulatory constraints
- Company-specific investment objectives (eg ethical investment).

[4]

v)

Ways of regulating the product to maintain confidence in market despite volatility in crypto-currency prices

- Restrictions on underwriting
 - Restriction on volume of business that can be written/retained by an insurance company based on its past expertise/reinsurance support.
 - Limits on contract terms and premium rates that can be charged. For example- fixed sum insured for crypto-currencies can be prescribed in the policy irrespective of its actual market price.

- Restrictions on information that may be used in underwriting and premium rating, eg restrictions on rating factors used, or on the ability to decline cover. This is for ethical / anti-discrimination reasons.
- Requirements to file / publish premium rates before they can be used. This prevents under cutting which might lead to solvency strain for the insurer
- Capital requirements
 - The requirement to maintain a minimum level of solvency based on inherent risk of business. This will lead the insurance companies to adopt better risk management practices for this product to ensure lower capital requirement.
 - The requirement to deposit assets to back claims reserves. – This ensures the company has sufficient funds to pay claims.
 - Requirement to hold a claims equalisation reserve (if allowed).
- Investment requirements
 - Restrictions on the type or amount of certain assets allowed to demonstrate solvency – This is to prevent high-risk assets from backing liabilities or to encourage diversification.
 - Restrictions on the currency and duration of assets allowed for demonstrating solvency (or mismatching reserves) – This ensures that assets match liabilities by term and currency so that short term changes in exchange rates will not have an impact on solvency margins.
- Reporting requirements
 - Disclosure / transparency of reporting requirements, eg a requirement to provide detailed reports and accounts at prescribed intervals – This helps regulators, investors, capital providers and policyholders assess the soundness of the company.
 - Restrictions on the discounting of liabilities and discount rates that can be used. – This ensures consistency and that reserves are sufficient.
 - Requirements for general insurance companies to be audited. This gives regulators and investors' confidence in the company and prevents fraud.
- Authorisation requirements
 - Licensing agents to sell insurance and requirements on the method of sale. – This ensures that a company has the necessary expertise and that the insured is well informed.
 - Requirements for management to be fit and proper, eg restrictions preventing specific individuals from holding key roles in companies. – This promotes confidence in the industry and helps prevent fraud.

- Other requirements to protect policyholders
 - Legislation to protect policyholders should general insurance companies fail – This protects policyholders and maintains faith in the insurance market.
 - The requirement to pay levies to consumer protection bodies – This protects policyholders and maintains faith in insurance market.
 - A cooling off/free-look period, eg fourteen day cancellation rules on policies issued. This protects policyholders and promotes confidence in the industry.
 - Advertising restrictions.
 - Regulations with respect to treating customers fairly. – This protects policyholders and promotes confidence in the industry.

[6]

[36 Marks]
